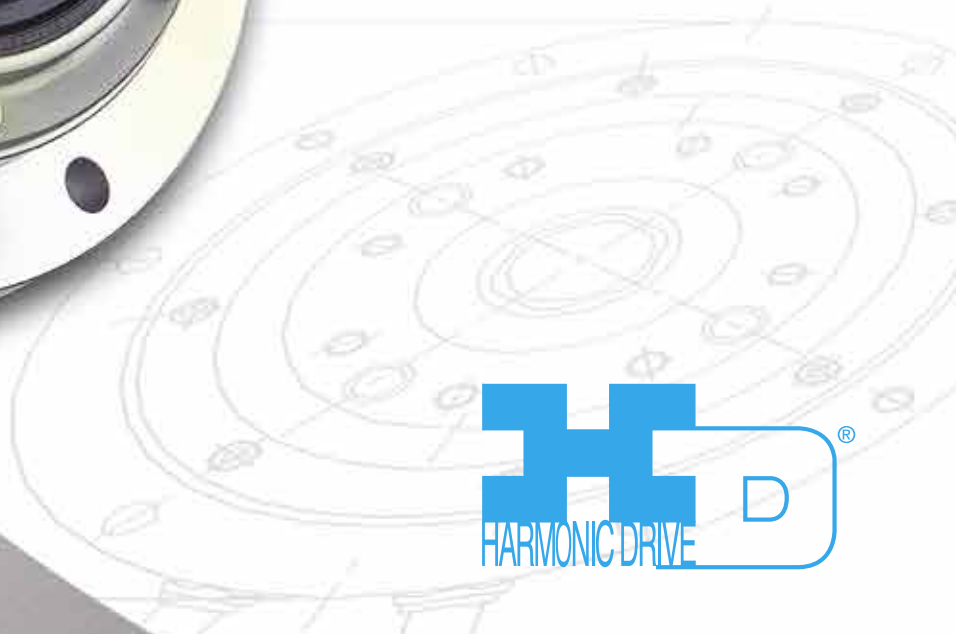


# Harmonic Drive LLC

Precision Actuators • Gearheads • Gearing Components



Total  
Motion  
Control

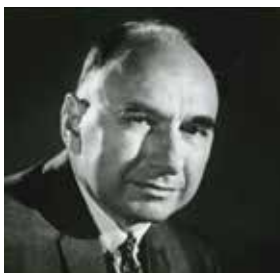


## Excellent Technology for Evolving Industries

Harmonic Drive LLC engineers and manufactures precision servo actuators, gearheads and gear component sets. We work closely with companies of all sizes to understand their application requirements and provide a standard or custom-engineered solution to enable the success of their design project. Our mission is to provide motion control solutions that give our customers a competitive advantage.

With over 50 years of experience, our expert engineering and production teams develop enabling technologies and products to meet the needs of an evolving motion-control market. We are very proud of our outstanding company history.

Our high-precision, zero-backlash Harmonic Drive® actuators and gears have, and continue to play critical roles in robotics, spaceflight applications, semiconductor manufacturing equipment, factory automation equipment, medical diagnostics, and surgical robotics.



C. Walt Musser  
Patented Strain Wave Gearing  
in 1955

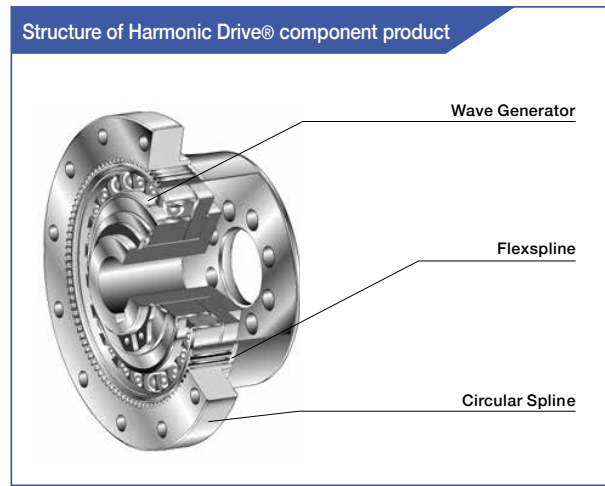
# Harmonic Drive® High-Precision Strain Wave Gearing

## Features

- Zero backlash
- High positioning accuracy
- High repeatability
- Compactness
- Light weight
- High reduction ratio
- High torque capacity
- High efficiency
- Quiet operation

## Structure

Utilizing a unique operating principle, the gear consists of only 3 basic parts (Wave Generator, Flexspline, and Circular Spline). It provides excellent features not found in other speed reducers.



### Wave Generator

The Wave Generator is a thin raced ball bearing fitted onto an elliptical hub. This serves as a high efficiency torque converter and is generally mounted onto the input or motor shaft.

### Flexspline

The Flexspline is a non-rigid, thin cylindrical cup with external teeth on the open end of the cup. The Flexspline fits over the Wave Generator and takes on its elliptical shape. The Flexspline is generally used as the output of the gear.

### Circular Spline

The Circular Spline is a rigid ring with internal teeth. It engages the teeth of the Flexspline across the major axis of the Wave Generator ellipse. The Circular Spline has two more teeth than the Flexspline and is generally mounted onto a housing.

## Operating Principle

The Flexspline is slightly smaller in diameter than the Circular Spline and usually has two fewer teeth than the Circular Spline. The elliptical shape of the Wave Generator causes the teeth of the Flexspline to engage the Circular Spline at two opposite regions across the major axis of the ellipse.

As the Wave Generator rotates the teeth of the Flexspline engage with the Circular Spline at the major axis. For every 180 degree clockwise movement of the Wave Generator the Flexspline rotates counter-clockwise by one tooth in relation to the Circular Spline.

One Turn of Wave Generator

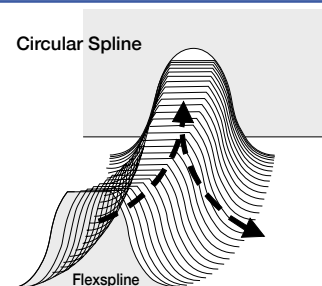
Each complete clockwise rotation of the Wave Generator results in the Flexspline moving counter-clockwise by two teeth from its original position relative to the Circular Spline.

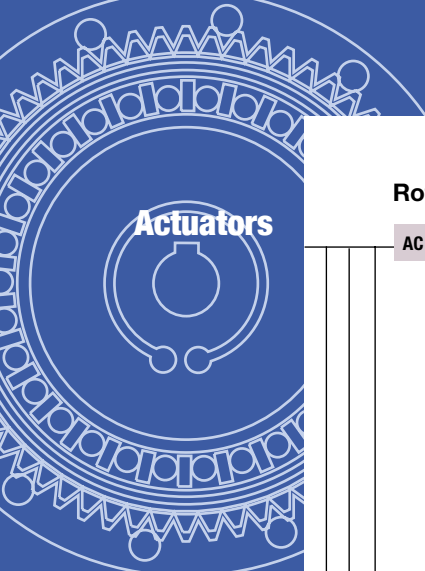
## Tooth engagement

The strain wave gear has a unique tooth engagement which results in a zero-backlash gear mesh that provides high positional accuracy and high torque with a compact form factor.

The Harmonic Drive® strain wave gear utilizes a unique gear tooth profile for optimized tooth engagement. Unlike an involute tooth profile, which is used in conventional gears, this optimized tooth profile ("S tooth") enables about 30% of the total number of teeth to be engaged at the same time. This technological innovation results in high torque, high torsional stiffness, long life and smooth rotation.

The "S" tooth profile eliminates stress concentration by widening the tooth root and providing a large tooth root radius. This figure shows the progression of the Flexspline tooth engagement as it meshes with the teeth of the fixed Circular Spline.





# Actuators

## Rotary Actuators

|                    |                                    |               | Peak Torque (Nm) | Maximum Speed (rpm) |
|--------------------|------------------------------------|---------------|------------------|---------------------|
| AC Servomotors     | Miniature Flat Hollow Shaft        | FHA-Cmini     | 1.8~28           | 60~200              |
|                    | Flat Hollow Shaft                  | FHA-C         | 39~820           | 22~96               |
|                    | Flat Hollow Shaft                  | FHA-C PR      | 39~820           | 22~96               |
|                    | Flat Hollow Shaft                  | FHA-C H       | 39~820           | 22~96               |
|                    | Hollow Shaft                       | SHA-CG        | 23~3419          | 25 ~120             |
|                    | Flat Hollow Shaft                  | SHA-SG        | 73~3419          | 17~118              |
|                    | Ultra-flat                         | FLA           | 1.8 ~ 34         | 50~500              |
|                    | Ultra Compact Cylinder             | RSF Supermini | 0.13~1.4         | 100~333             |
|                    | Compact Cylinder                   | RSF mini      | 1.8~28           | 60~200              |
|                    | Compact Cylinder                   | RSF           | 34~330           | 45~90               |
| Compact Cylinder   | RKF                                | 56~330        | 45~90            |                     |
| DC Servomotors     | Compact Cylinder                   | RH mini       | 0.39~20          | 50~180              |
| Direct Drive Motor | Ultra Precision Direct Drive Motor | KDU           | 7.0~15.0         | 160~180             |
| Hollow Shaft Motor | Ultra Precision Hollow Shaft       | HMA           | 1.8~33           | 3000~6000           |

## Linear Actuators

|                 |                          |        | Maximum Driving Force (N) | Maximum Speed (mm/s) | Stroke (mm) |
|-----------------|--------------------------|--------|---------------------------|----------------------|-------------|
| AC Servomotor   | High-Force Positioning   | LBC    | 6000~12000                | 10~20                | 50          |
| DC Servomotors  | Low-Force Positioning    | LA     | 49                        | 0.9                  | 10~30       |
|                 | Medium-Force Positioning | LAH-46 | 392                       | 3.7                  | 10~30       |
| Stepping Motors | High-Force Positioning   | LAH-80 | 3000                      | 3000                 | 0.9~10      |

## Other Actuators

|                          |                              |     | Moment of Inertia (g.cm <sup>2</sup> ) | Torque Constant (N·m/A(rms)) |
|--------------------------|------------------------------|-----|----------------------------------------|------------------------------|
| Optical Galvano Scanners | High Accuracy, High Response | LSA | 1.9~8.5                                | 0.0082~0.05                  |

## Sensors

|                        |               |
|------------------------|---------------|
| Super-Compact Encoders | Micro Encoder |
|------------------------|---------------|

## Servo Drivers

|                        |                              |                 | Pulse Position Command | Analog Speed Command | Mono-shaft Control (Command) | Interface to Absolute Encoder | Interface to Incremental Encoder |
|------------------------|------------------------------|-----------------|------------------------|----------------------|------------------------------|-------------------------------|----------------------------------|
| DC Digital Servo Drive | Multiple Operating Modes     | DCJ Series      | •                      | •                    | •                            | –                             | •                                |
|                        | Multiple Operating Modes     | DDP Series      | •                      | •                    | •                            | –                             | •                                |
|                        | Multiple Operating Modes     | DEP Series      | –                      | •                    | •                            | •                             | •                                |
| AC Digital Servo Drive | Multiple Communication Modes | RTL Series      | •                      | •                    | •                            | –                             | •                                |
|                        | Multiple Operating Modes     | REL Series      | •                      | •                    | •                            | •                             | •                                |
| For AC Servomotors     | Position and Speed Control   | HA-680 Series   | •                      | •                    | –                            | –                             | •                                |
|                        | Field Boss                   | HA-800 Series   | •                      | –                    | –                            | •                             | •                                |
|                        | Field Boss                   | HA-680CL Series | •                      | –                    | –                            | –                             | •                                |
|                        | Field Boss                   | HA-680ML Series | •                      | •                    | –                            | –                             | •                                |
| For Direct Drive Motor | Position Control Only        | HA-770 Series   | •                      | –                    | –                            | –                             | •                                |

The combinations with actuator and driver may not comply with foreign safety standards. Please contact our sales office.



FHA-C mini (Page 8)



FHA-C (Page 9)



FHA-C PR (Page 10)



FHA-C H (Page 12)



SHA-CG (Page 14)



SHA-SG (Page 16)



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RSF Supermini (Page 20)



RSF Mini (Page 21)



RSF (Page 22)



RKF (Page 23)



RH Mini Series  
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HMA Motor (Page 26)



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LAH-80 (Page 29)



LSA (Page 30)

Custom actuators also available. Contact us to find out more about our engineering design services.



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DDP  
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DCJ  
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RTL/REL  
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HA-800  
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HA-680ML  
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HA-680CL  
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Field Boss Options



# Speed Reducers

## Harmonic Drive® Precision Product

### Component

#### Component Gear Sets

Consisting of three basic components: flexspline, circular spline and wave generator; component gear sets offer ultimate design flexibility and can be tightly integrated in equipment sub-structures.

| Component | Cup      | Standard    | CSF | Peak Torque (Nm) | Reduction Ratio |
|-----------|----------|-------------|-----|------------------|-----------------|
| Component | Cup      | Standard    | CSF | 1.8~9200         | 30:1~160:1      |
|           |          | High-Torque | CSG | 23~3400          | 50:1~160:1      |
|           |          | Ultra-Flat  | CSD | 12~820           | 50:1~120:1      |
| Component | Pancake  | Standard    | FB  | 7.8~330          | 50:1~160:1      |
|           |          | High-Torque | FR  | 9.8~4000         | 50:1~320:1      |
| Component | Silk Hat | Standard    | SHF | 9.0~1800         | 30:1~160:1      |
|           |          | High-Torque | SHG | 23~3400          | 50:1~160:1      |

### Gear Unit

#### Gear Unit

Housed component gearing combined with precision cross roller output bearing & flange. Very compact, robust and easy to use gearhead solution.

| Gear Unit | Cup      | Standard                               | CSF-2UH    | Peak Torque (Nm) | Reduction Ratio |
|-----------|----------|----------------------------------------|------------|------------------|-----------------|
| Gear Unit | Cup      | Standard                               | CSF-2UH    | 9.0~2600         | 30:1~160:1      |
|           |          | Standard, Lightweight                  | CSF-2UH-LW | 9.0~2600         | 30:1~160:1      |
|           |          | High-Torque                            | CSG-2UH    | 23~3400          | 50:1~160:1      |
|           |          | High-Torque, Lightweight               | CSG-2UH-LW | 23~3400          | 50:1~160:1      |
|           |          | High-Torque, Full Unit                 | CSG-2UK    | 127~3400         | 50:1~160:1      |
|           |          | Ultra-Flat                             | CSD-2UH    | 12~823           | 50:1~120:1      |
|           |          | Ultra-Flat                             | CSD-2UF    | 12~453           | 50:1~120:1      |
|           |          | Compact Mini                           | CSF-2XH    | 0.5~28           | 30:1~100:1      |
|           |          | Compact Mini, Double Shaft             | CSF-1U     | 0.13~28          | 30:1~100:1      |
|           |          | Mini, Ultra-Flat                       | CSF-2UP    | 1.8~28           | 30:1~100:1      |
| Gear Unit | Silk Hat | Hollow Shaft                           | SHF-2UH    | 8.3~1800         | 30:1~160:1      |
|           |          | Hollow Shaft, Lightweight              | SHF-2UH-LW | 9.0~1800         | 30:1~160:1      |
|           |          | High-Torque, Hollow Shaft              | SHG-2UH    | 23~3400          | 50:1~160:1      |
|           |          | High-Torque, Hollow Shaft, Lightweight | SHG-2UH-LW | 23~3400          | 50:1~160:1      |
|           |          | Input Shaft                            | SHF-2UJ    | 9.0~1800         | 30:1~160:1      |
|           |          | High-Torque, Input Shaft               | SHG-2UJ    | 23~3400          | 50:1~160:1      |
|           |          | Ultra-Flat, Hollow Shaft, Lightweight  | SHD-2UH-LW | 12~450           | 50:1~120:1      |

### Simplicity Gear Unit

#### Simplicity Gear Unit

Non-housed component gearing combined with a precision cross roller output bearing. Similar to Gear Units (above), without the housing and output flange, for tighter integration into the customer's housing or machine structure.

| Simplicity Gear Unit | Silk Hat | Ultra-flat, Hollow shaft    | SHD-2SH | Peak Torque (Nm) | Reduction Ratio |
|----------------------|----------|-----------------------------|---------|------------------|-----------------|
| Simplicity Gear Unit | Silk Hat | Ultra-flat, Hollow shaft    | SHD-2SH | 12~450           | 50:1~120:1      |
|                      |          | Hollow Shaft                | SHF-2SH | 9.0~1800         | 30:1~160:1      |
|                      |          | High-torque, Hollow shaft   | SHG-2SH | 23~3400          | 50:1~160:1      |
|                      |          | Input coupling              | SHF-2SO | 9.0~1800         | 30:1~160:1      |
|                      |          | High-torque, Input coupling | SHG-2SO | 23~3400          | 50:1~160:1      |

### Phase Adjustment Unit

| Phase Adjustment Unit | Coupling Indexer | Manual Phase Adjuster | HDI              | Peak Torque (Nm) | Reduction Ratio |            |
|-----------------------|------------------|-----------------------|------------------|------------------|-----------------|------------|
| Phase Adjustment Unit | Coupling Indexer | Manual Phase Adjuster | HDI              | 100~500          | 100:1           |            |
|                       |                  | Pancake               | Differential     | FD               | 23~3400         | 80:1~320:1 |
|                       |                  |                       | 1:1 Differential | FBB              | 28~655          | 80:1~160:1 |

# Quick Connect®

### Gearhead

#### Planetary Gearing

### Gearhead

| Gearhead | Cup | Standard             | CSF-GH | Peak Torque (Nm) | Reduction Ratio | Motor Capacity (W) |
|----------|-----|----------------------|--------|------------------|-----------------|--------------------|
| Gearhead | Cup | Standard             | CSF-GH | 18~2600          | 50:1~160:1      | 30~5000            |
|          |     | High-torque          | CSG-GH | 23~3400          | 50:1~160:1      | 30~5000            |
| Gearhead | Cup | Standard             | HPG    | 5~3200           | 3:1~50:1        | 10~15000           |
|          |     | High-torque          | HPGP   | 12~3940          | 4:1~45:1        | 10~15000           |
|          |     | Helical              | HPG-R  | 5~400            | 3:1~10:1        | 10~15000           |
|          |     | Standard Right Angle | HPG-RA | 150~2200         | 5:1~50:1        | 500~8000           |
|          |     | Value                | HPN    | 9~752            | 3:1~50:1        | 30~7500            |
|          |     | Hollow shaft         | HPF    | 100~220          | 11:1            | 500~2000           |



CSF (Page 36)



CSG (Page 37)



CSD (Page 38)



FB (Page 39)



FR (Page 39)



SHF (Page 40)  
SHG (Page 41)



CSF-2UH  
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CSG-2UH  
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CSF -2UH-LW (Pg 43)  
CSG -2UH-LW (Pg 45)



CSG-2UK  
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CSD-2UH  
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CSD-2UF  
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CSF mini  
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CSF-2UP  
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SHF-2UH (Pg 52)  
SHG-2UH (Pg 54)



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SHG-2UJ (Page 54)



SHF -2UH-LW (Pg 53)  
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FD Series Component Type (Page 60)



FD Series Unit Type (Page 61)



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CSF-GH (Page 64)  
CSG-GH (Page 65)



HPG (Page 66)  
HPG-R (Page 67)



HPGP (Page 68)



HPG RA (Page 69)



HPN (Page 70)



HPF (Page 71)

## Hollow Shaft Brushless Actuators FHA-C Mini Series



These servo actuators utilize Harmonic Drive® precision gears combined with a performance matched brushless servomotor and incremental encoder. The cube shaped form factor is very compact and features a through hole in the center of the shaft. This hollow shaft may be used to pass cables, tubing or a laser beam through the axis of rotation.

The FHA-mini series is designed to operate with a wide range of third-party drivers, as well as Harmonic Drive LLC's DDP Series, DCJ Series, and DEP Series.

- Large center through hole
- Compact design
- Body width from 50 mm to 75 mm
- Body length from 48.5 mm to 66 mm

### •FHA-C mini Series Ratings

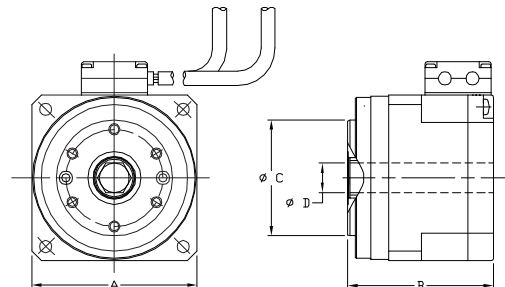
| Item                                          |                             | Model                  | FHA-8C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |         | FHA-11C                          |         |         | FHA-14C               |         |         |
|-----------------------------------------------|-----------------------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|----------------------------------|---------|---------|-----------------------|---------|---------|
| Ratio                                         |                             |                        | 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 50      | 100     | 30                               | 50      | 100     | 30                    | 50      | 100     |
| Maximum Torque <sup>2</sup>                   |                             | N•m                    | 1.8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3.3     | 4.8     | 4.5                              | 8.3     | 11      | 9                     | 18      | 28      |
|                                               |                             | in-lb                  | 15.9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 29.2    | 42.5    | 39.8                             | 73.5    | 97.4    | 79.7                  | 159.3   | 247.8   |
| Maximum Positioning Speed                     |                             | rpm                    | 200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 120     | 60      | 200                              | 120     | 60      | 200                   | 120     | 60      |
| Torque Constant 100V, 200V                    |                             | N•m/A <sub>rms</sub>   | 3.9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 6.7     | 14      | 3.8                              | 6.6     | 13      | 4.2                   | 7.2     | 15      |
|                                               |                             | in-lb/A <sub>rms</sub> | 34.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 59.3    | 123.9   | 33.6                             | 58.4    | 115.1   | 37.2                  | 63.7    | 132.8   |
| Torque Constant 24V                           |                             | N•m/A <sub>rms</sub>   | 0.8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1.3     | 2.7     | 0.8                              | 1.3     | 2.6     | 0.8                   | 1.4     | 2.9     |
|                                               |                             | in-lb/A <sub>m</sub>   | 7.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 11.5    | 23.9    | 7.1                              | 11.5    | 23.0    | 7.1                   | 12.4    | 25.7    |
| Maximum Current <sup>2</sup>                  | AC100V, 200V                | A <sub>rms</sub>       | 0.61                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.64    | 0.48    | 1.5                              | 1.6     | 1.1     | 2.9                   | 3.2     | 2.4     |
|                                               | DC 24V                      | A <sub>rms</sub>       | 3.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3.3     | 2.4     | 7.8                              | 8.2     | 5.6     | 14.8                  | 16.4    | 12.3    |
| Moment of Inertia                             | (GD <sup>2</sup> /4)<br>(J) | kg•m <sup>2</sup>      | 0.0026                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0.0074  | 0.029   | 0.0060                           | 0.017   | 0.067   | 0.018                 | 0.050   | 0.20    |
|                                               |                             | kg•cm•s <sup>2</sup>   | 0.027                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.075   | 0.30    | 0.061                            | 0.17    | 0.68    | 0.18                  | 0.51    | 2.0     |
| One-Way Positioning Accuracy                  |                             | arc/sec                | 150                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 120     | 120     | 120                              | 90      | 90      | 120                   | 90      | 90      |
| Allowable Moment Load                         |                             | N•m                    | 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |         |         | 40                               |         |         | 75                    |         |         |
|                                               |                             | in-lb                  | 133                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |         |         | 354                              |         |         | 664                   |         |         |
| Moment Stiffness                              |                             | N•m/rad                | 2x10 <sup>4</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |         |         | 4x10 <sup>4</sup>                |         |         | 8x10 <sup>4</sup>     |         |         |
|                                               |                             | in-lb/rad              | 18x10 <sup>4</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |         |         | 35x10 <sup>4</sup>               |         |         | 71x10 <sup>4</sup>    |         |         |
| Quad Encoder Resolution (At x 4) <sup>3</sup> |                             | Pulses/Revolution      | 240,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 400,000 | 800,000 | 240,000                          | 400,000 | 800,000 | 240,000               | 400,000 | 800,000 |
| Power Supply                                  |                             | V                      | DC 24, AC 100, AC 200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |         |         |                                  |         |         |                       |         |         |
| Weight                                        |                             | kg                     | 0.40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |         |         | 0.62                             |         |         | 1.2                   |         |         |
| Protection                                    |                             |                        | Totally closed, self-cooling (Equivalent to IP44)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |         |         |                                  |         |         |                       |         |         |
| Environmental Conditions                      |                             |                        | Operating temperature: 0 to 40°C • Storage temperature: -20 to +60°C. Operating and storage humidity: 20 to 80% RH (No condensation permitted). Vibration resistance : 25m/s <sup>2</sup> (frequency: 10 to 400Hz) • Shock resistance: 300m/s <sup>2</sup> . Indoor installation: No dust, no metal powder, no corrosive gas, no inflammable gas, no oil mist, no other foreign matter and no direct sunshine. Altitude 1000m or less. Insulation resistance: 100MΩ or higher (DC 500V). Dielectric strength: AC 1500V/1min. Insulation class: Class B |         |         |                                  |         |         |                       |         |         |
| Recommended Driver                            |                             | DC24V                  | DCJ-055-09/DDP-090-09/DEP-090-09                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         | DCJ-055-18/DDP-090-18/DEP-090-18 |         |         | DDP-090-36/DEP-090-36 |         |         |
|                                               |                             | AC100/200              | RTL-230-18/REL-230-18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |         |         |                                  |         |         |                       |         |         |

1 The figures in the table are those at the output shaft.

2 The figures are typical values.

3 The quad encoder resolution is obtained by the formula (motor encoder resolution) x4 x (reduction ratio).

| Unit: mm |    |      |      |      |
|----------|----|------|------|------|
| Model    | A  | B    | øC   | øD   |
| FHA-8C   | 50 | 48.5 | 33.5 | 6.2  |
| FHA-11C  | 60 | 56   | 41   | 8    |
| FHA-14C  | 75 | 66   | 52.5 | 13.5 |





# Hollow Shaft Brushless Actuators FHA-C Series



These servo actuators utilize Harmonic Drive® precision gears combined with a performance matched brushless servo motor and incremental encoder. The FHA has a low profile form factor and features a hollow shaft through the center of the output. This hollow shaft feature may be used to pass cables, tubing or a laser beam through the axis of rotation.

The FHA series is designed to operate with a wide range of third-party drivers, as well as Harmonic Drive LLC's DDP Series, DEP Series, and RTL Series.

- High torque
- Large center through hole
- Compact cylindrical design

## •FHA-C Series Ratings

| Item                                          |                        | Model             | FHA-17C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |           | FHA-25C                  |            |                          | FHA-32C              |           |           | FHA-40C                  |                          |           |
|-----------------------------------------------|------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|--------------------------|------------|--------------------------|----------------------|-----------|-----------|--------------------------|--------------------------|-----------|
| Ratio                                         |                        |                   | 50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 100       | 160       | 50                       | 100        | 160                      | 50                   | 100       | 160       | 50                       | 100                      | 160       |
| Maximum Torque <sup>2</sup>                   | N•m                    |                   | 39                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 57        | 64        | 150                      | 230        | 260                      | 281                  | 398       | 453       | 500                      | 690                      | 820       |
|                                               | in-lb                  |                   | 345                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 504       | 566       | 1328                     | 2036       | 2301                     | 2487                 | 3522      | 4009      | 4425                     | 6107                     | 7257      |
| Maximum Rotational Speed                      |                        | rpm               | 96                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 48        | 27        | 90                       | 45         | 28                       | 80                   | 40        | 25        | 70                       | 35                       | 22        |
| Torque Constant                               | N•m/A <sub>rms</sub>   |                   | 21                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 42        | 67        | 22                       | 45         | 72                       | 27                   | 54        | 86        | 31                       | 64                       | 102       |
|                                               | in-lb/A <sub>rms</sub> |                   | 186                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 372       | 593       | 195                      | 398        | 637                      | 239                  | 478       | 761       | 274                      | 566                      | 903       |
| Maximum Current <sup>2</sup>                  |                        | A <sub>rms</sub>  | 2.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1.6       | 1.1       | 7.3                      | 5.6        | 4.0                      | 11.4                 | 8.0       | 5.9       | 17.3                     | 11.8                     | 9.0       |
| Moment of Inertia (GD <sup>2</sup> /4) (J)    | kg•m <sup>2</sup>      |                   | 0.17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.67      | 1.7       | 0.81                     | 3.2        | 8.3                      | 1.8                  | 7.1       | 18.1      | 4.9                      | 19.5                     | 50        |
|                                               | kg•cm <sup>2</sup>     |                   | 1.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 6.9       | 17        | 8.3                      | 33         | 85                       | 18                   | 72        | 185       | 50                       | 200                      | 510       |
| One-Way Positioning Accuracy                  |                        | arc/sec           | 60                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 40        | 40        | 40                       | 30         | 30                       | 40                   | 30        | 30        | 40                       | 30                       | 30        |
| Allowable Moment Load                         | N•m                    |                   | 188                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |           | 370                      |            |                          | 530                  |           |           | 690                      |                          |           |
|                                               | in-lb                  |                   | 1664                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |           | 3275                     |            |                          | 4691                 |           |           | 6107                     |                          |           |
| Moment Stiffness                              | N•m/rad                |                   | 220x10 <sup>3</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |           | 490x10 <sup>3</sup>      |            |                          | 790x10 <sup>3</sup>  |           |           | 1400x10 <sup>3</sup>     |                          |           |
|                                               | in-lb/rad              |                   | 1947x10 <sup>3</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |           | 4337x10 <sup>3</sup>     |            |                          | 6992x10 <sup>3</sup> |           |           | 12390x10 <sup>3</sup>    |                          |           |
| Quad Encoder Resolution (At x 4) <sup>3</sup> |                        | Pulses/Revolution | 500,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1,000,000 | 1,600,000 | 500,000                  | 1,000,000  | 1,600,000                | 500,000              | 1,000,000 | 1,600,000 | 500,000                  | 1,000,000                | 1,600,000 |
| Power Supply                                  |                        | V                 | DC 24V, AC 100, AC 200                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |           | AC 100, AC 200           |            |                          | AC 100, AC 200       |           |           | AC 200                   |                          |           |
| Weight                                        |                        | kg                | 2.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |           | 4.0                      |            |                          | 6.5                  |           |           | 12                       |                          |           |
| Protection                                    |                        |                   | Totally closed, self-cooling (Equivalent to IP44)                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |           |                          |            |                          |                      |           |           |                          |                          |           |
| Environmental Conditions                      |                        |                   | Operating temperature: 0 to 40°C/Storage temperature: -20 to 60°C • Operating and storage humidity: 20 to 80% RH (no condensation permitted). Insulation resistance: 100MΩ (DC 500V) • Dielectric strength: AC 1500V/1min. Vibration resistance: 24.5m/s <sup>2</sup> (frequency: 10 to 400Hz) • Shock resistance: 294m/s <sup>2</sup> . Indoor installation: No dust, no metal powder, no corrosive gas, no oil mist, no other foreign matter and no direct sunshine • Altitude 1000m or less. |           |           |                          |            |                          |                      |           |           |                          |                          |           |
| Recommended Driver                            | DC 24V                 |                   | DDP-090-36/DEP-090-36                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |           | -                        |            |                          | -                    |           |           | -                        |                          |           |
|                                               | AC 100                 |                   | RTL-230-18/REL-230-18                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |           | RTL-230-36<br>REL-230-36 | RTL-230-18 | RTL-230-36<br>REL-230-36 | RTL-230-18           | -         |           |                          |                          |           |
|                                               | AC 200                 |                   | RTL-230-18/REL-230-18                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |           |                          |            |                          |                      |           |           | RTL-230-36<br>REL-230-36 | RTL-230-18<br>REL-230-18 |           |

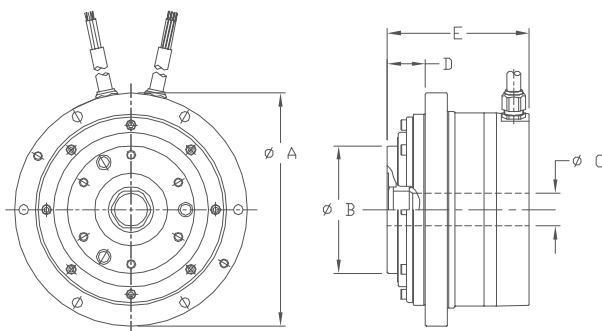
1 The figures in the table are those at the output shaft.

2 The figures are typical values.

3 The quad encoder resolution is obtained by the formula (motor encoder resolution) x4 x (reduction ratio). Please refer to the manual for details.

Unit: mm

| Size Symbol | FHA-17C | FHA-25C | FHA-32C | FHA-40C |
|-------------|---------|---------|---------|---------|
| øA          | 128     | 155     | 175     | 230     |
| øB          | 70      | 85      | 105     | 130     |
| øC          | 18      | 32      | 35      | 45      |
| D           | 21      | 25      | 22      | 30      |
| E           | 78      | 90.5    | 111.5   | 127     |



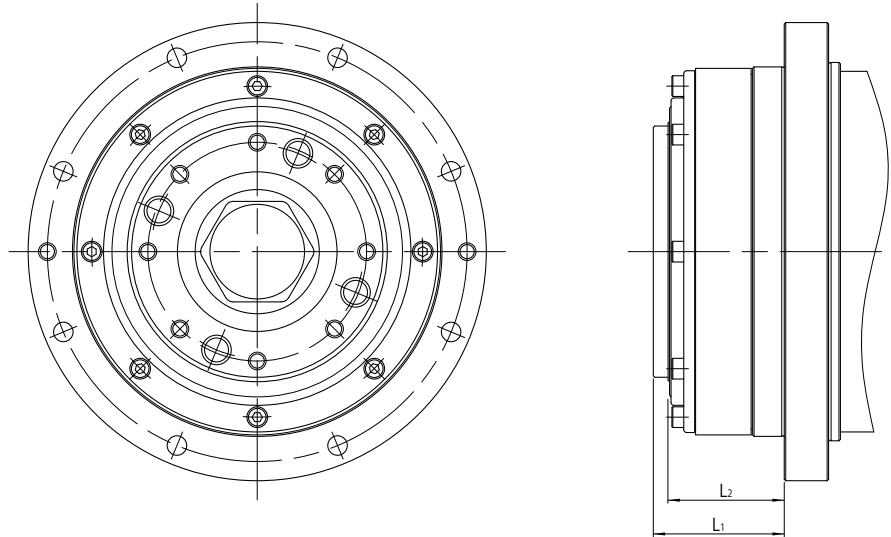
## Hollow Shaft Brushless Actuators FHA-C PR Series



FHA-C-PR features improved one way and bi-directional positioning repeatability and is ideal for high-precision rotary positioning. These servo actuators utilize Harmonic Drive® precision gears combined with a performance matched brushless servo motor and incremental encoder. The FHA has a low profile form factor and features a hollow shaft through the center of the output. This hollow shaft feature may be used to pass cables, tubing or a laser beam through the axis of rotation.

The FHA series is designed to operate with a wide range of third-party drivers, as well as Harmonic Drive LLC's DDP Series, DEP Series, and RTL Series.

- High torque
- Large center through hole
- Compact cylindrical design



### • Dimensions

(Unit: mm)

| Actuator Model           | FHA-17C-PR | FHA-25C-PR | FHA-32C-PR | FHA-40C-PR |
|--------------------------|------------|------------|------------|------------|
| Dimension L <sub>1</sub> | 35         | 44.3       | 46         | 58.5       |
| Dimension L <sub>2</sub> | 29.5       | 39.3       | 41         | 51.5       |

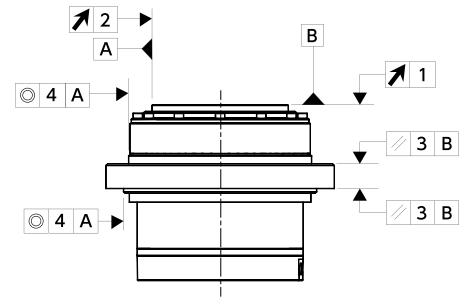
### • Mechanical Accuracy

The FHA-C-PR mechanical accuracies of the output shaft and mounting flange are shown below: (Unit: mm)

| Feature                                                 | FHA-17C-PR | FHA-25C-PR | FHA-32C-PR | FHA-40C-PR |
|---------------------------------------------------------|------------|------------|------------|------------|
| 1. Output shaft surface runout                          | 0.010      | 0.012      | 0.012      | 0.014      |
| 2. Output shaft axial runout                            | 0.010      | 0.012      | 0.012      | 0.014      |
| 3. Parallelism between output shaft and mounted surface | 0.040      | 0.050      | 0.050      | 0.060      |
| 4. Concentricity of output flange to mounting pilot     | 0.040      | 0.050      | 0.050      | 0.060      |

Note: For information on the measurement method, refer to the "FHA-C Series Technical Manual."

Note: Values are based on the Total Indicator Reading (T.I.R.).



# Hollow Shaft Brushless Actuators

## FHA-C PR Series

"200V" and "100V" in the table are referred to as the 200V specification (standard) and the 100V specification (option), respectively.

| Item                                  |  | Model                |                       | FHA-17C-PR                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |           | FHA-25C-PR          |           |           | FHA-32C-PR          |           |           | FHA-40C-PR           |           |           |
|---------------------------------------|--|----------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|---------------------|-----------|-----------|---------------------|-----------|-----------|----------------------|-----------|-----------|
|                                       |  |                      |                       | 50                                                                                                                                                                                                                                                                                                                                                                                                                                              | 100       | 160       | 50                  | 100       | 160       | 50                  | 100       | 160       | 50                   | 100       | 160       |
| Ratio                                 |  |                      |                       | 50                                                                                                                                                                                                                                                                                                                                                                                                                                              | 100       | 160       | 50                  | 100       | 160       | 50                  | 100       | 160       | 50                   | 100       | 160       |
| Maximum torque                        |  | N•m                  |                       | 39                                                                                                                                                                                                                                                                                                                                                                                                                                              | 57        | 64        | 150                 | 230       | 260       | 281                 | 398       | 453       | 500                  | 690       | 820       |
|                                       |  | in-lb                |                       | 345                                                                                                                                                                                                                                                                                                                                                                                                                                             | 504       | 566       | 1328                | 2036      | 2301      | 2487                | 3522      | 4009      | 4425                 | 6107      | 7257      |
| Maximum speed                         |  | rpm                  |                       | 96                                                                                                                                                                                                                                                                                                                                                                                                                                              | 48        | 30        | 90                  | 45        | 28        | 80                  | 40        | 25        | 70                   | 35        | 22        |
| Torque constant                       |  | 200V                 | N•m/A <sub>rms</sub>  | 21                                                                                                                                                                                                                                                                                                                                                                                                                                              | 42        | 67        | 22                  | 45        | 72        | 27                  | 54        | 86        | 31                   | 64        | 102       |
|                                       |  | 100V                 | N•m/A <sub>rms</sub>  | 11                                                                                                                                                                                                                                                                                                                                                                                                                                              | 21        | 33        | 11                  | 22        | 36        | 13                  | 27        | 43        | -                    | -         | -         |
| Maximum current <sup>2</sup>          |  | 200V                 | A <sub>rms</sub>      | 2.1                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1.6       | 1.1       | 7.3                 | 5.6       | 4.0       | 11.4                | 8.0       | 5.9       | 17.3                 | 11.8      | 9.0       |
|                                       |  | 100V                 | A <sub>rms</sub>      | 4.2                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3.2       | 2.2       | 15                  | 11        | 8.0       | 23                  | 16        | 12        | -                    | -         | -         |
| EMF voltage constant                  |  | 200V                 | V/(rpm)               | 2.3                                                                                                                                                                                                                                                                                                                                                                                                                                             | 4.7       | 7.5       | 2.5                 | 5.1       | 8.1       | 3.0                 | 5.9       | 9.5       | 3.6                  | 7.2       | 11.4      |
|                                       |  | 100V                 | V/(rpm)               | 1.2                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2.4       | 3.8       | 1.3                 | 2.6       | 4.1       | 1.5                 | 3.0       | 4.8       | -                    | -         | -         |
| Phase resistance                      |  | 200V                 | Ω (20°C)              | 7.9                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |           | 2.6                 |           |           | 1.0                 |           |           | 0.73                 |           |           |
|                                       |  | 100V                 | Ω (20°C)              | 2.0                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |           | 0.65                |           |           | 0.25                |           |           | -                    |           |           |
| Phase inductance                      |  | 200V                 | mH                    | 6.0                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |           | 2.6                 |           |           | 1.3                 |           |           | 1.5                  |           |           |
|                                       |  | 100V                 | mH                    | 1.5                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |           | 0.65                |           |           | 0.33                |           |           | -                    |           |           |
| Moment of inertia                     |  | (GD <sup>2</sup> /4) | kg•m <sup>2</sup>     | 0.21                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.83      | 2.1       | 0.90                | 3.5       | 9.2       | 2.1                 | 8.2       | 21        | 5.5                  | 22        | 56        |
|                                       |  | (J)                  | kgf•cm•s <sup>2</sup> | 2.1                                                                                                                                                                                                                                                                                                                                                                                                                                             | 8.5       | 21        | 9                   | 37        | 94        | 21                  | 84        | 215       | 56                   | 223       | 569       |
| Allowable radial load                 |  | kN                   |                       | 2.9                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |           | 4.9                 |           |           | 9.5                 |           |           | 14.7                 |           |           |
|                                       |  | kgf                  |                       | 300                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |           | 500                 |           |           | 970                 |           |           | 1500                 |           |           |
| Allowable axial load                  |  | kN                   |                       | 9.8                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |           | 14.7                |           |           | 24.5                |           |           | 39.2                 |           |           |
|                                       |  | kgf                  |                       | 1000                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |           | 1500                |           |           | 2500                |           |           | 4000                 |           |           |
| Max. moment load                      |  | N•m                  |                       | 188                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |           | 370                 |           |           | 530                 |           |           | 690                  |           |           |
|                                       |  | kgf•m                |                       | 19                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |           | 38                  |           |           | 54                  |           |           | 70                   |           |           |
| Moment stiffness                      |  | N•m/rad              |                       | 220×10 <sup>3</sup>                                                                                                                                                                                                                                                                                                                                                                                                                             |           |           | 490×10 <sup>3</sup> |           |           | 790×10 <sup>3</sup> |           |           | 1400×10 <sup>3</sup> |           |           |
|                                       |  | kgf•m/arc-min        |                       | 6.5                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |           | 15                  |           |           | 23                  |           |           | 42                   |           |           |
| One-way positioning accuracy          |  | arc-sec              |                       | 60                                                                                                                                                                                                                                                                                                                                                                                                                                              | 40        | 40        | 40                  | 30        | 30        | 40                  | 30        | 30        | 40                   | 30        | 30        |
| One-way repeatability                 |  | arc-sec              |                       | ±5                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |           | ±5                  |           |           | ±4                  |           |           | ±4                   |           |           |
| Bi-directional repeatability          |  | arc-sec              |                       | 75                                                                                                                                                                                                                                                                                                                                                                                                                                              | 30        | 30        | 60                  | 25        | 25        | 50                  | 20        | 20        | 50                   | 20        | 20        |
| Motor encoder                         |  |                      |                       | 2500 counts / revolution                                                                                                                                                                                                                                                                                                                                                                                                                        |           |           |                     |           |           |                     |           |           |                      |           |           |
| Quad encoder resolutions <sup>3</sup> |  | Pulse/rev            |                       | 500,000                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1,000,000 | 1,600,000 | 500,000             | 1,000,000 | 1,600,000 | 500,000             | 1,000,000 | 1,600,000 | 500,000              | 1,000,000 | 1,600,000 |
| Mass                                  |  | kg                   |                       | 2.8                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |           | 4.7                 |           |           | 7.1                 |           |           | 13.6                 |           |           |
| Enclosure                             |  |                      |                       | Totally enclosed self-cooling (IP44)                                                                                                                                                                                                                                                                                                                                                                                                            |           |           |                     |           |           |                     |           |           |                      |           |           |
| Environmental conditions              |  |                      |                       | Operating temperature: 0 to 40°C/storage temperature: -20 to 60°C<br>Operating humidity / storage humidity: 20 to 80%RH (no condensation)<br>Vibration resistance: 24.5m/s <sup>2</sup> (frequency: 10 to 400Hz) / shock resistance: 294 m/s <sup>2</sup><br>Do not expose to dust, metal powder, corrosive gas, flammable gas, or oil mist.<br>Use indoors, and do not expose to direct sunlight.<br>Altitude: 1000 m or lower above sea level |           |           |                     |           |           |                     |           |           |                      |           |           |
| Motor insulation                      |  |                      |                       | Insulation resistance: 100MΩ or higher (500 VDC), Withstanding voltage: AC1500V/1min, Insulation class: Type F                                                                                                                                                                                                                                                                                                                                  |           |           |                     |           |           |                     |           |           |                      |           |           |
| Mounting direction                    |  |                      |                       | All position                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |           |                     |           |           |                     |           |           |                      |           |           |
| Combination servo driver              |  | 200V                 |                       | HA-800*-3C-200                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |           | HA-800*-3C-200      |           |           | HA-800*-6C-200      |           |           | HA-800*-6C-200       |           |           |
|                                       |  | 100V                 |                       | HA-800*-3C-100                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |           | HA-800*-6C-100      |           |           | HA-800*-6C-100      |           |           | -                    |           |           |

1 The values in the table above are referred to as typical values for the output shaft.

2 The value when used with the HA-800 driver.

3 Quadrature resolutions are obtained by (motor encoder resolution x 4) x (reduction ratio)

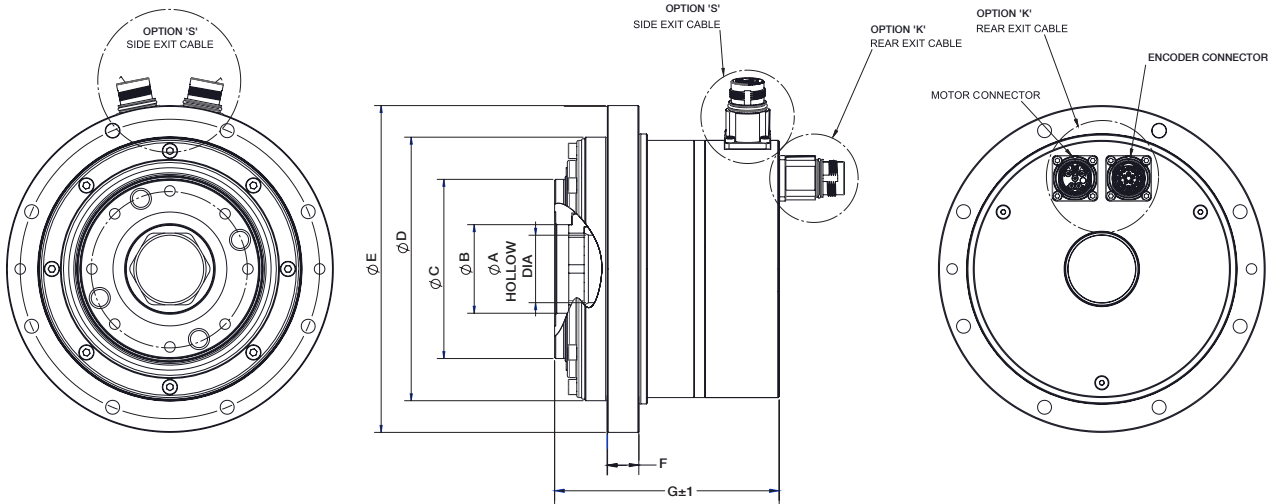
# Hollow Shaft Brushless Actuators FHA-C H Series



**New!** FHA-C Series servo actuators are now available with IP65 protection. Four sizes are available: 17, 25, 32 and 40. The IP65 rated FHA-C actuator is ideal for harsh environments. With IP65 and 480V, the FHA actuator is well suited for machine tool, packaging, and wash-down applications.

- High torque
- Large center through hole
- Compact cylindrical design
- IP65 Rating
- 480VAC\*
- EnDat® & HIPERFACE® Encoder Protocols
- DESINA style flex rated cables

\* Contact us for additional voltage options.



## • Dimensions

Unit: mm

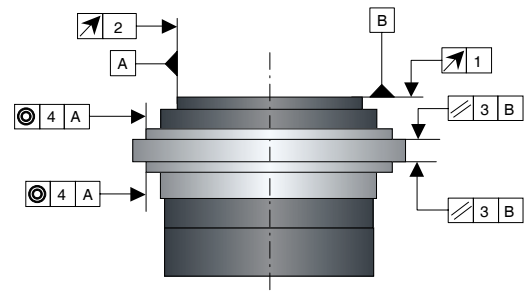
| Size Symbol | FHA-17C-H  | FHA-25C-H    | FHA-32C-H | FHA-40C-H    |
|-------------|------------|--------------|-----------|--------------|
| øA          | 18         | 32           | 35        | 45           |
| øB H7       | 25         | 42           | 60        | 60           |
| øC          | 70         | 85           | 105       | 130          |
| øD          | 105        | 125          | 140       | 185          |
| øE          | 128        | 155          | 175       | 230          |
| F           | 12         | 15           | 18        | 22           |
| G           | 105.5/121* | 106.5/132.5* | 129/155*  | 143.8/164.8* |

\* with brake

## • Mechanical Accuracy

Unit: mm (inches)

| Feature                                             | FHA-17C-H | FHA-25C-H | FHA-32C-H | FHA40C-H |
|-----------------------------------------------------|-----------|-----------|-----------|----------|
| 1. Axial run-out of output flange                   | 0.010     | 0.012     | 0.012     | 0.014    |
| 2. Radial run-out of output flange                  | 0.010     | 0.012     | 0.012     | 0.014    |
| 3. Parallelism of output flange and mounting flange | 0.040     | 0.050     | 0.050     | 0.060    |
| 4. Concentricity of output flange to mounting pilot | 0.040     | 0.050     | 0.050     | 0.060    |

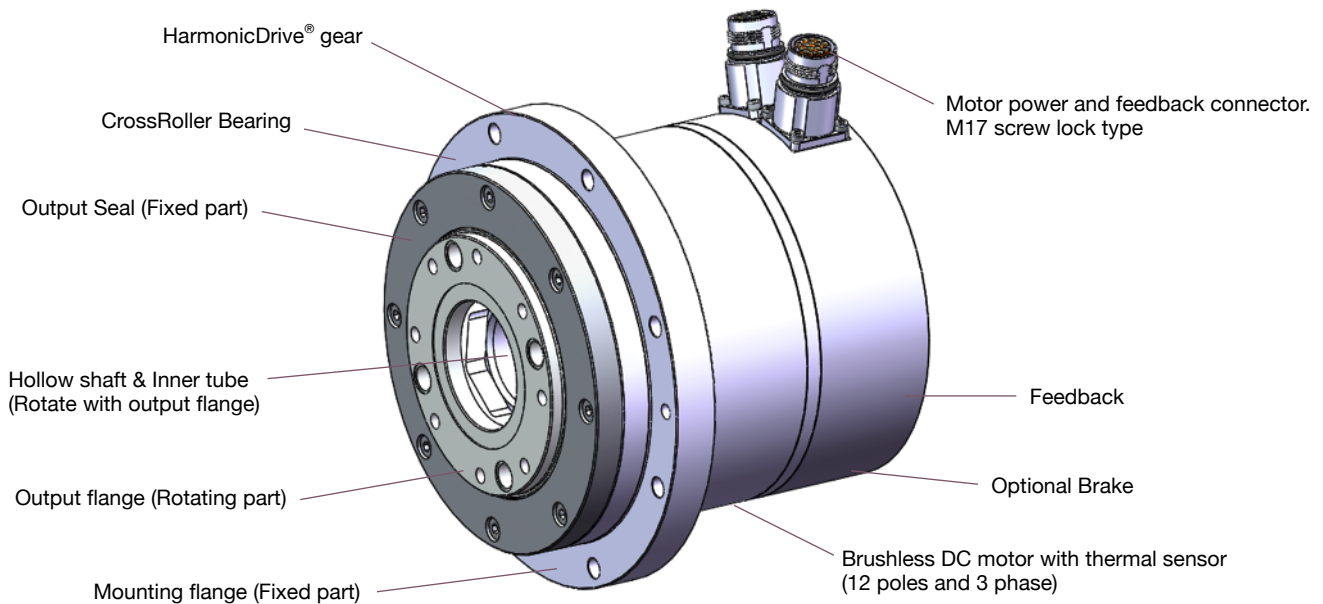


Note: All values are T.I.R. (Total Indicator Reading).

# Hollow Shaft Brushless Actuators FHA-C H Series

| Item                                          | Model             | Symbol            | FHA-17C-H<br>(Bus voltage 680VDC)                                      |           |      | FHA-25C-H<br>(Bus voltage 680VDC)                                      |      |      | FHA-32C-H<br>(Bus voltage 680VDC)                                      |       |      | FHA-40C-H<br>(Bus voltage 680VDC)                                      |      |      |  |
|-----------------------------------------------|-------------------|-------------------|------------------------------------------------------------------------|-----------|------|------------------------------------------------------------------------|------|------|------------------------------------------------------------------------|-------|------|------------------------------------------------------------------------|------|------|--|
|                                               |                   |                   | 50                                                                     | 100       | 160  | 50                                                                     | 100  | 160  | 50                                                                     | 100   | 160  | 50                                                                     | 100  | 160  |  |
| Ratio                                         |                   |                   | 50                                                                     | 100       | 160  | 50                                                                     | 100  | 160  | 50                                                                     | 100   | 160  | 50                                                                     | 100  | 160  |  |
| Maximum Torque                                | N·m               | TM                | 39                                                                     | 57        | 64   | 151                                                                    | 233  | 261  | 281                                                                    | 398   | 453  | 500                                                                    | 686  | 823  |  |
| Maximum Current                               | $A_{rms}$         | IM                | 1.4                                                                    | 1.1       | 0.8  | 3.9                                                                    | 3    | 2.2  | 6.5                                                                    | 4.7   | 3.5  | 9.3                                                                    | 6.4  | 5.0  |  |
| Continuous Torque                             | N·m               | TC                | 15                                                                     | 23        | 23.2 | 40                                                                     | 72   | 90   | 60                                                                     | 153.5 | 240  | 90                                                                     | 234  | 400  |  |
| Continuous Current                            | $A_{rms}$         | IC                | 0.65                                                                   | 0.55      | 0.45 | 1.3                                                                    | 1.3  | 1.25 | 2                                                                      | 2     | 1.9  | 2.4                                                                    | 2.4  | 2.4  |  |
| Maximum Speed                                 | rpm               | NM                | 96                                                                     | 48        | 30   | 90                                                                     | 45   | 28.1 | 80                                                                     | 40    | 25   | 70                                                                     | 35   | 21.9 |  |
| Torque Constant                               | N·m/ $A_{rms}$    | KT                | 37                                                                     | 75        | 120  | 42                                                                     | 86   | 138  | 49                                                                     | 100   | 160  | 59                                                                     | 120  | 193  |  |
| Motor EMF Constant<br>(Line-Line)             | $V_{rms}/(krpm)$  | $V_{EMF}$         | 50                                                                     |           |      | 57                                                                     |      |      | 67                                                                     |       |      | 80                                                                     |      |      |  |
|                                               | $V_{rms}/(rad/s)$ |                   | 0.48                                                                   |           |      | 0.55                                                                   |      |      | 0.64                                                                   |       |      | 0.77                                                                   |      |      |  |
| Phase Resistance<br>(20°C, Line-Line)         | $\Omega$          | R                 | 64                                                                     |           |      | 22.4                                                                   |      |      | 7.8                                                                    |       |      | 5.6                                                                    |      |      |  |
| Phase Inductance<br>(Line-Line)               | mH                | L                 | 42                                                                     |           |      | 20                                                                     |      |      | 9.8                                                                    |       |      | 11.2                                                                   |      |      |  |
| Number of Pole Pairs                          | p                 | P                 | 6                                                                      |           |      | 6                                                                      |      |      | 6                                                                      |       |      | 6                                                                      |      |      |  |
| Allowable Axial Load                          | kN                | LA                | 9.8                                                                    |           |      | 14.7                                                                   |      |      | 24.5                                                                   |       |      | 39.2                                                                   |      |      |  |
| Allowable Radial Load                         | kN                | LR                | 2.9                                                                    |           |      | 4.9                                                                    |      |      | 9.5                                                                    |       |      | 14.7                                                                   |      |      |  |
| Allowable Moment Load                         | Nm                | LM                | 188                                                                    |           |      | 370                                                                    |      |      | 530                                                                    |       |      | 690                                                                    |      |      |  |
| Moment Stiffness                              | N·m/rad           |                   | $220 \times 10^3$                                                      |           |      | $490 \times 10^3$                                                      |      |      | $790 \times 10^3$                                                      |       |      | $1400 \times 10^3$                                                     |      |      |  |
| One-Way Positional Accuracy                   | arc-sec           |                   | 60                                                                     | 40        | 40   | 40                                                                     | 30   | 30   | 40                                                                     | 30    | 30   | 40                                                                     | 30   | 30   |  |
| Feedback Type <sup>1</sup>                    |                   |                   | Single-turn absolute (EnDat and HIPERFACE) Multi-turn absolute (EnDat) |           |      | Single-turn absolute (EnDat and HIPERFACE) Multi-turn absolute (EnDat) |      |      | Single-turn absolute (EnDat and HIPERFACE) Multi-turn absolute (EnDat) |       |      | Single-turn absolute (EnDat and HIPERFACE) Multi-turn absolute (EnDat) |      |      |  |
| Mass                                          | kg                | M                 | 3.3                                                                    |           |      | 4.6                                                                    |      |      | 6.8                                                                    |       |      | 10.8                                                                   |      |      |  |
| Mass (with brake)                             |                   |                   | 3.7                                                                    |           |      | 5.4                                                                    |      |      | 7.7                                                                    |       |      | 12.8                                                                   |      |      |  |
| Motor Inertia<br>(without brake) <sup>2</sup> | EnDat             | kg·m <sup>2</sup> | JA                                                                     | 1.37      |      |                                                                        | 3.95 |      |                                                                        | 7.63  |      |                                                                        | 19.3 |      |  |
|                                               |                   |                   |                                                                        | HIPERFACE | 1.44 |                                                                        |      | 3.65 |                                                                        |       | 7.33 |                                                                        |      | 19.3 |  |
| Motor Inertia<br>(with brake) <sup>2</sup>    | EnDat             | kg·m <sup>2</sup> | JA                                                                     |           | 1.66 |                                                                        |      | 4.84 |                                                                        |       | 9.00 |                                                                        |      | 21.9 |  |
|                                               |                   |                   |                                                                        | HIPERFACE | 1.73 |                                                                        |      | 4.54 |                                                                        |       | 8.69 |                                                                        |      | 21.9 |  |

The table shows typical values. \*1 Refer to manual for details. \*2 Inertia shown in this table is at input side. To convert to output side, multiply the inertia by (ratio)<sup>2</sup>



## Hollow Shaft Brushless Actuators SHA-CG Series



SHA-CG high precision actuators are a great alternative for direct drive motors. SHA-CG actuators offer direct drive motor performance in a compact, significantly lighter package. The SHA-CG offers improved rotary positioning accuracy and a high precision output with surface runout less than 10 microns.

- Alternative to Direct Drive Motors
- High Accuracy Output Bearing
- Available with Mounting Base
- High Torque
- Hollow Shaft Design
- Compact
- Available in 4 sizes

### •SHA-CG Series Ratings

| Item                                                   | Model                  | SHA20A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |            |            |            | SHA25A (Motor voltage 100V)                           |            |            |            |            | SHA25A (Motor voltage 200V)             |            |            |            |            |            |
|--------------------------------------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|------------|------------|-------------------------------------------------------|------------|------------|------------|------------|-----------------------------------------|------------|------------|------------|------------|------------|
|                                                        |                        | 50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 80         | 100        | 120        | 160        | 50                                                    | 80         | 100        | 120        | 160        | 50                                      | 80         | 100        | 120        | 160        |            |
| Ratio                                                  |                        | 50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 80         | 100        | 120        | 160        | 50                                                    | 80         | 100        | 120        | 160        | 50                                      | 80         | 100        | 120        | 160        |            |
| Maximum Torque <sup>*1</sup>                           | N•m                    | 73                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 96         | 107        | 113        | 120        | 127                                                   | 178        | 204        | 217        | 229        | 127                                     | 178        | 204        | 217        | 229        |            |
|                                                        | in-lb                  | 642                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 850        | 947        | 100        | 1062       | 1124                                                  | 1575       | 1805       | 1920       | 2027       | 1124                                    | 1575       | 1805       | 1920       | 2027       |            |
| Maximum Rotational Speed                               | rpm                    | 120                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 75         | 60         | 50         | 37.5       | 96                                                    | 60         | 48         | 40         | 30         | 112                                     | 70         | 56         | 46.7       | 35         |            |
| Torque Constant                                        | N•m/A <sub>rms</sub>   | 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 26         | 33         | 39         | 53         | 10.9                                                  | 17.7       | 22         | 27         | 35         | 19                                      | 31         | 38         | 46         | 61         |            |
|                                                        | in-lb/A <sub>rms</sub> | 142                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 230        | 292        | 345        | 469        | 97                                                    | 157        | 195        | 239        | 308        | 168                                     | 274        | 336        | 407        | 540        |            |
| Maximum Current <sup>*1</sup>                          | A <sub>rms</sub>       | 6.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 5          | 4.6        | 4.1        | 3.4        | 15.1                                                  | 13.2       | 12.2       | 11         | 9          | 8.7                                     | 7.6        | 7          | 6.3        | 5.2        |            |
| Moment of Inertia GD <sup>2</sup> /4 (without brake) J | kg•m <sup>2</sup>      | 0.21                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0.53       | 0.82       | 1.2        | 2.1        | 0.5                                                   | 1.3        | 2          | 2.9        | 5.1        | 0.5                                     | 1.3        | 2          | 2.9        | 5.1        |            |
|                                                        | kgf•cm•s <sup>2</sup>  | 2.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 5.4        | 8          | 12         | 22         | 5.1                                                   | 13         | 20         | 29         | 52         | 5.1                                     | 13         | 20         | 29         | 52         |            |
| Moment of Inertia GD <sup>2</sup> /4 (with brake) J    | kg•m <sup>2</sup>      | 0.23                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0.6        | 0.94       | 1.3        | 2.4        | 0.6                                                   | 1.5        | 2.4        | 3.4        | 6.1        | 0.6                                     | 1.5        | 2.4        | 3.4        | 6.1        |            |
|                                                        | kgf•cm•s <sup>2</sup>  | 2.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 6.1        | 9.6        | 14         | 24         | 6.1                                                   | 16         | 24         | 35         | 62         | 6.1                                     | 16         | 24         | 35         | 62         |            |
| One-Way Positioning Accuracy                           | arc•sec                | 60                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 50         | 50         | 50         | 50         | 50                                                    | 40         | 40         | 40         | 40         | 50                                      | 40         | 40         | 40         | 40         |            |
| Allowable Moment Load                                  | N•m                    | 187                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |            |            |            | 258                                                   |            |            |            |            |                                         |            |            |            |            |            |
|                                                        | in-lb                  | 1655                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |            |            |            | 2283                                                  |            |            |            |            |                                         |            |            |            |            |            |
| Moment Stiffness                                       | N•m/rad                | 25.2×10 <sup>4</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |            |            |            | 39.2×10 <sup>4</sup>                                  |            |            |            |            |                                         |            |            |            |            |            |
|                                                        | in-lb/rad              | 7.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |            |            |            | 11.6                                                  |            |            |            |            |                                         |            |            |            |            |            |
| Output Resolution                                      | Pulses/Revolution      | 6,553,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 10,485,760 | 13,107,200 | 15,728,640 | 20,971,520 | 6,553,600                                             | 10,485,760 | 13,107,200 | 15,728,640 | 20,971,520 | 6,553,600                               | 10,485,760 | 13,107,200 | 15,728,640 | 20,971,520 | 15,859,712 |
| Power Supply                                           | V                      | 200V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |            |            |            | 100V                                                  |            |            |            |            | 200V                                    |            |            |            |            |            |
| Mass (without brake)                                   | kg                     | 2.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |            |            |            | 3.95                                                  |            |            |            |            |                                         |            |            |            |            |            |
| Mass (with brake)                                      | kg                     | 2.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |            |            |            | 4.1                                                   |            |            |            |            |                                         |            |            |            |            |            |
| Protection Structure                                   |                        | Enclosed, self-cooled (IP54)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |            |            |            |                                                       |            |            |            |            |                                         |            |            |            |            |            |
| Environmental Conditions                               |                        | Operating temperature: 0 to 40°C • Storage temperature: -20 to +60°C. Operating and storage humidity: 20 to 80% RH (No condensation permitted).<br>Vibration resistance : 25m/s <sup>2</sup> (frequency: 10 to 400Hz) • Shock resistance: 300m/s <sup>2</sup> . Indoor installation: No dust, no metal powder, no corrosive gas, no inflammable gas, no oil mist, no other foreign matter and no direct sunshine. Altitude 1000m or less. Insulation resistance: 100MΩ or higher (DC 500V). Dielectric strength: AC 1500V/1min. Insulation class: Class E |            |            |            |            |                                                       |            |            |            |            |                                         |            |            |            |            |            |
| Recommended Driver                                     |                        | REL-230-18, HA-800-3D/E-200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |            |            |            | REL-230-18, REL-230-36, HA-800-6D/E-100 <sup>*1</sup> |            |            |            |            | REL-230-18, REL-230-36, HA-800-3D/E-200 |            |            |            |            |            |
| Encoder Type                                           |                        | Magnetic absolute encoder                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |            |            |            | Magnetic absolute encoder                             |            |            |            |            |                                         |            |            |            |            |            |

The table shows typical output values of actuators.

\*1 Typical specifications when combined with our drivers.

# Hollow Shaft Brushless Actuators

## SHA-CG Series

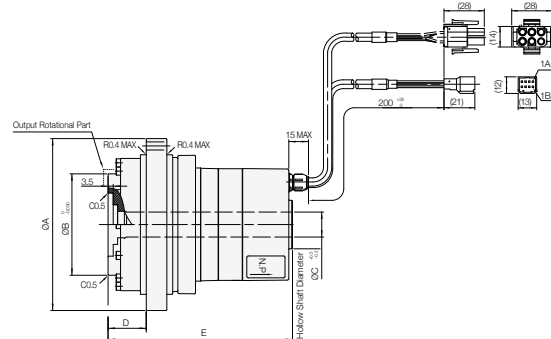
### SHA-CG Series Ratings

| Item                                                   | Model                  | SHA32A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |            |            |            | SHA40A                                   |            |            |            |            |
|--------------------------------------------------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|------------|------------|------------------------------------------|------------|------------|------------|------------|
|                                                        |                        | 50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 80         | 100        | 120        | 160        | 50                                       | 80         | 100        | 120        | 160        |
| Ratio                                                  |                        | 50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 80         | 100        | 120        | 160        | 50                                       | 80         | 100        | 120        | 160        |
| Maximum Torque <sup>1</sup>                            | N·m                    | 281                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 395        | 433        | 459        | 484        | 523                                      | 675        | 738        | 802        | 841        |
|                                                        | in-lb                  | 2487                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3496       | 3832       | 4062       | 4283       | 4629                                     | 5974       | 6531       | 7098       | 7443       |
| Maximum Rotational Speed                               | rpm                    | 96                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 60         | 48         | 40         | 30         | 80                                       | 50         | 40         | 33.3       | 25         |
| Torque Constant                                        | N·m/A <sub>rms</sub>   | 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 33         | 41         | 49         | 66         | 25                                       | 40         | 50         | 60         | 80         |
|                                                        | in-lb/A <sub>rms</sub> | 177                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 292        | 363        | 434        | 584        | 221                                      | 354        | 443        | 531        | 708        |
| Maximum Current <sup>1</sup>                           | A <sub>rms</sub>       | 17.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 15.4       | 13.7       | 12.2       | 10         | 27.2                                     | 22         | 19.6       | 18         | 14.7       |
| Moment of Inertia GD <sup>2</sup> /4 (without brake) J | kg·m <sup>2</sup>      | 1.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 4.3        | 6.7        | 9.7        | 17         | 4.8                                      | 12         | 19         | 27         | 49         |
|                                                        | kgf·cm·s <sup>2</sup>  | 17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 44         | 68         | 99         | 175        | 49                                       | 124        | 194        | 280        | 497        |
| Moment of Inertia GD <sup>2</sup> /4 (with brake) J    | kg·m <sup>2</sup>      | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 5.1        | 7.9        | 11         | 20         | 5.8                                      | 15         | 23         | 33         | 59         |
|                                                        | kgf·cm·s <sup>2</sup>  | 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 52         | 81         | 116        | 207        | 59                                       | 150        | 235        | 338        | 601        |
| One-Way Positioning Accuracy                           | arc·sec                | 40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 30         | 30         | 30         | 30         | 40                                       | 30         | 30         | 30         | 30         |
| Allowable Moment Load                                  | N·m                    | 580                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |            |            |            | 849                                      |            |            |            |            |
|                                                        | in-lb                  | 5133                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |            |            |            | 7514                                     |            |            |            |            |
| Moment Stiffness                                       | N·m/rad                | 100×10 <sup>4</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |            |            |            | 179×10 <sup>4</sup>                      |            |            |            |            |
|                                                        | in-lb/rad              | 29.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |            |            |            | 53.2                                     |            |            |            |            |
| Output Resolution                                      | Pulses/Revolution      | 6,553,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 10,485,760 | 13,107,200 | 15,728,640 | 20,971,520 | 6,553,600                                | 10,485,760 | 13,107,200 | 15,728,640 | 20,971,520 |
| Power Supply                                           | V                      | 200V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |            |            |            | 200V                                     |            |            |            |            |
| Mass (without brake)                                   | kg                     | 7.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |            |            |            | 13                                       |            |            |            |            |
| Mass (with brake)                                      | kg                     | 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |            |            |            | 13.8                                     |            |            |            |            |
| Protection Structure                                   |                        | Enclosed, self-cooled (IP54)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |            |            |            |                                          |            |            |            |            |
| Environmental Conditions                               |                        | Operating temperature: 0 to 40°C • Storage temperature: -20 to +60°C. Operating and storage humidity: 20 to 80% RH (No condensation permitted).<br>Vibration resistance : 25m/s <sup>2</sup> (frequency: 10 to 400Hz) • Shock resistance: 300m/s <sup>2</sup> . Indoor installation: No dust, no metal powder, no corrosive gas, no inflammable gas, no oil mist, no other foreign matter and no direct sunshine. Altitude 1000m or less. Insulation resistance: 100MΩ or higher (DC 500V).<br>Dielectric strength: AC 1500V/1min. Insulation class: Class E |            |            |            |            |                                          |            |            |            |            |
| Recommended Driver                                     |                        | REL-230-18, REL-230-36, HA-800-6D/E-200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |            |            |            | REL-230-36, REL-230-40, HA-800-24D/E-200 |            |            |            |            |
| Encoder Type                                           |                        | Magnetic absolute encoder                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |            |            |            | Magnetic absolute encoder                |            |            |            |            |

The table shows typical output values of actuators.  
\*1 Typical specifications when combined with our drivers.

Units: mm

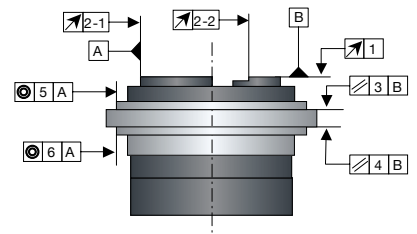
| Size Symbol | SHA20A | SHA25A | SHA32A | SHA40A |
|-------------|--------|--------|--------|--------|
| øA          | 117    | 144    | 175    | 225    |
| øB          | 69     | 84     | 110    | 132    |
| øC          | 17     | 27     | 35     | 45     |
| D           | 26     | 28.5   | 34     | 40     |
| E           | 125.5  | 127.5  | 144    | 170    |



The mechanical accuracies of the output shaft and mounting flange are as follows:

Units: microns

| Size Symbol                                                              | SHA20A | SHA25A | SHA32A | SHA40A |
|--------------------------------------------------------------------------|--------|--------|--------|--------|
| 1. Output shaft surface runout                                           | 10     | 10     | 10     | 10     |
| 2-1. Output shaft axial runout (Outside diameter)                        | 10     | 10     | 10     | 10     |
| 2-2. Output shaft axial runout (Inside diameter)                         | 15     | 15     | 15     | 15     |
| 3. Parallelism between the output shaft and actuator mounting surface    | 30     | 30     | 35     | 35     |
| 4. Parallelism between the output shaft and actuator mounting surface    | 40     | 40     | 45     | 45     |
| 5. Concentricity between the output shaft and actuator mounting diameter | 50     | 50     | 55     | 60     |
| 6. Concentricity between the output shaft and actuator mounting diameter | 60     | 60     | 65     | 70     |



Note: All values are T.I.R. (Total Indicator Reading).

## Hollow Shaft Brushless Actuators

### SHA-SG Series



SHA Series AC Servo Actuators provide high torque and highly accurate rotary operation.

These servo actuators utilize Harmonic Drive® precision gears combined with a brushless servomotor and magnetic absolute encoder. The SHA Series is an advanced version of the FHA series AC Servo Actuators, featuring a larger hollow shaft with a smaller, outside diameter.

The SHA Series is designed to operate with REL Series and HA-800 drivers.

- High torque
- Compact, slim design
- Large center through hole
- Low voltage winding available for SHA25A

### •SHA Series Ratings

| Item                                                   | Model                  | SHA20A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |            |            |            | SHA25A                 |                            |            |            |            | SHA32A     |                                   |                       |            |            |            |            |
|--------------------------------------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|------------|------------|------------------------|----------------------------|------------|------------|------------|------------|-----------------------------------|-----------------------|------------|------------|------------|------------|
|                                                        |                        | 51                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 81         | 101        | 121        | 161        | 11HP                   | 51                         | 81         | 101        | 121        | 161        | 11HP                              | 51                    | 81         | 101        | 121        | 161        |
| Ratio                                                  |                        | 51                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 81         | 101        | 121        | 161        | 11HP                   | 51                         | 81         | 101        | 121        | 161        | 11HP                              | 51                    | 81         | 101        | 121        | 161        |
| Maximum Torque <sup>2</sup>                            | N•m                    | 73                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 96         | 107        | 113        | 120        | 26                     | 127                        | 178        | 204        | 217        | 229        | 62                                | 281                   | 395        | 433        | 459        | 484        |
|                                                        | in-lb                  | 646                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 850        | 947        | 1,000      | 1,062      | 203                    | 1124                       | 1575       | 1805       | 1920       | 2027       | 549                               | 2487                  | 3496       | 3832       | 4062       | 4283       |
| Maximum Rotational Speed                               | rpm                    | 117.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 74.1       | 59.4       | 49.6       | 37.3       | 509.1                  | 109.8                      | 69.1       | 55.4       | 46.3       | 34.8       | 436.4                             | 94.1                  | 59.3       | 47.5       | 39.7       | 29.8       |
| Torque Constant                                        | N•m/A <sub>rms</sub>   | 16.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 27         | 33         | 40         | 53         | 4.2                    | 19                         | 31         | 39         | 46         | 62         | 4.5                               | 21                    | 33         | 42         | 50         | 66         |
|                                                        | in-lb/A <sub>rms</sub> | 146                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 239        | 292        | 354        | 469        | 37                     | 168                        | 274        | 345        | 407        | 549        | 40                                | 186                   | 292        | 372        | 443        | 584        |
| Maximum Current <sup>2</sup>                           | A <sub>rms</sub>       | 6.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 4.9        | 4.5        | 4.0        | 3.4        | 8.9                    | 8.6                        | 7.5        | 7.0        | 6.3        | 5.2        | 19                                | 17.3                  | 15.2       | 13.5       | 12.2       | 9.9        |
| Moment of Inertia GD <sup>2</sup> /4 (without brake) J | kg•m <sup>2</sup>      | 0.23                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0.58       | 0.91       | 1.3        | 2.3        | 0.029                  | 0.56                       | 1.42       | 2.2        | 3.2        | 5.6        | 0.092                             | 2.0                   | 5.1        | 8.0        | 11         | 20         |
|                                                        | kgf•cm•s <sup>2</sup>  | 2.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 6.0        | 9.3        | 13         | 24         | 0.296                  | 5.7                        | 14.4       | 22         | 32         | 57         | 0.930                             | 21                    | 52         | 81         | 17         | 207        |
| Moment of Inertia GD <sup>2</sup> /4 (with brake) J    | kg•m <sup>2</sup>      | 0.26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0.65       | 1.0        | 1.4        | 2.6        | 0.034                  | 0.66                       | 1.66       | 2.6        | 3.7        | 6.6        | 0.107                             | 2.3                   | 5.9        | 9.2        | 13         | 23         |
|                                                        | kgf•cm•s <sup>2</sup>  | 2.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 6.6        | 10         | 15         | 26         | 0.347                  | 6.7                        | 17         | 26         | 38         | 67         | 1.087                             | 24                    | 60         | 94         | 135        | 238        |
| One-Way Positioning Accuracy                           | arc•sec                | 60                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 50         | 50         | 50         | 50         | 120                    | 50                         | 40         | 40         | 40         | 40         | 120                               | 50                    | 40         | 40         | 40         | 40         |
| Allowable Moment Load                                  | N•m                    | 187                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |            |            |            | 410                    | 258                        |            |            |            |            | 932                               | 580                   |            |            |            |            |
|                                                        | in-lb                  | 1,655                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |            |            |            | 3629                   | 2283                       |            |            |            |            | 8248                              | 5133                  |            |            |            |            |
| Moment Stiffness                                       | N•m/rad                | 25.2 x 10 <sup>4</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |            |            |            | 37.4 x 10 <sup>4</sup> | 39.2 x 10 <sup>4</sup>     |            |            |            |            | 86.1 x 10 <sup>4</sup>            | 100 x 10 <sup>4</sup> |            |            |            |            |
|                                                        | in-lb/rad              | 223 x 10 <sup>4</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |            |            |            | 335 x 10 <sup>4</sup>  | 346.9 x 10 <sup>4</sup>    |            |            |            |            | 761 x 10 <sup>4</sup>             | 885 x 10 <sup>4</sup> |            |            |            |            |
| Output Resolution                                      | Pulses/Revolution      | 6,684,672                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 10,616,832 | 13,238,272 | 15,859,712 | 21,102,592 | 1,441,792              | 6,684,672                  | 10,616,832 | 13,238,272 | 15,859,712 | 21,102,592 | 1,441,792                         | 6,684,672             | 10,616,832 | 13,238,272 | 15,859,712 | 21,102,592 |
| Power Supply                                           | V                      | AC 200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |            |            |            | AC 200                 | AC 100, AC 200, DC 48V-90V |            |            |            |            | AC 200                            | AC 200, DC 48V-90V    |            |            |            |            |
| Mass (without brake)                                   | kg                     | 2.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |            |            |            | 5                      | 2.95                       |            |            |            |            | 9.4                               | 5.9                   |            |            |            |            |
| Mass (with brake)                                      | kg                     | 2.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |            |            |            | 5.1                    | 3.1                        |            |            |            |            | 9.7                               | 6.2                   |            |            |            |            |
| Protection Structure                                   |                        | Totally enclosed self-cooled type (equivalent to IP54)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |            |            |            |                        |                            |            |            |            |            |                                   |                       |            |            |            |            |
| Environmental Conditions                               |                        | Operating temperature: 0 to 40°C • Storage temperature: -20 to +60°C. Operating and storage humidity: 20 to 80% RH (No condensation permitted).<br>Vibration resistance : 25m/s <sup>2</sup> (frequency: 10 to 400Hz) • Shock resistance: 300m/s <sup>2</sup> . Indoor installation: No dust, no metal powder, no corrosive gas, no inflammable gas, no oil mist, no other foreign matter and no direct sunshine. Altitude 1000m or less. Insulation resistance: 100MΩ or higher (DC 500V). Dielectric strength: AC 1500V/1min. Insulation class: Class E |            |            |            |            |                        |                            |            |            |            |            |                                   |                       |            |            |            |            |
| Recommended Driver DC 48V-90V                          |                        | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |            |            |            | -                      | DEP-090-36                 |            |            |            |            | -                                 | DEP-090-36            |            |            |            |            |
| Recommended Driver AC-100V                             |                        | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |            |            |            | -                      | REL-230-18, REL-230-36     |            |            |            |            | -                                 | -                     |            |            |            |            |
| Recommended Driver AC-200V                             |                        | REL-230-18, HA-800-3D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |            |            |            | REL-230-18             | REL-230-18, HA-800-3D      |            |            |            |            | REL-230-18, REL-230-36, HA-800-6D |                       |            |            |            |            |

1 The table shows typical output values of actuators.

2 When combined with HA-800 driver.

3 Encoder Type: Magnetic absolute encoder. Single-turn: 2<sup>17</sup> (313,072). Multi-turn: 2<sup>16</sup> (65,536) (Battery back-up).

4 Please refer to the manual for rating details.



# Hollow Shaft Brushless Actuators

## SHA-SG Series

### SHA Series Ratings

| Item                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Model                    |            | SHA40A     |            |                          |            | SHA58A     |            |                          |            | SHA65A     |            |            |  |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------|------------|------------|--------------------------|------------|------------|------------|--------------------------|------------|------------|------------|------------|--|
| Ratio                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 51                       | 81         | 101        | 121        | 161                      | 81         | 101        | 121        | 161                      | 81         | 101        | 121        | 161        |  |
| Maximum Torque <sup>2</sup>                            | N•m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 523                      | 675        | 738        | 802        | 841                      | 1924       | 2067       | 2236       | 2392                     | 2400       | 2990       | 3263       | 3419       |  |
|                                                        | in-lb                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 4629                     | 5974       | 6531       | 7098       | 7443                     | 17027      | 18293      | 19789      | 21169                    | 21240      | 26462      | 28878      | 30258      |  |
| Maximum Rotational Speed                               | rpm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 78.4                     | 49.4       | 39.6       | 33.1       | 24.8                     | 37.0       | 29.7       | 24.8       | 18.6                     | 34.6       | 27.7       | 23.1       | 17.4       |  |
| Torque Constant                                        | N•m/A <sub>rms</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 25                       | 41         | 51         | 61         | 81                       | 54         | 68         | 81         | 108                      | 54         | 68         | 81         | 108        |  |
|                                                        | in-lb/A <sub>rms</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 221                      | 363        | 451        | 540        | 717                      | 478        | 602        | 717        | 956                      | 478        | 602        | 717        | 956        |  |
| Maximum Current <sup>2</sup>                           | A <sub>rms</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 26.7                     | 21.8       | 19.4       | 17.9       | 14.6                     | 45         | 39         | 36         | 30                       | 55         | 55         | 51         | 41         |  |
| Moment of Inertia GD <sup>2</sup> /4 (without brake) J | kg•m <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 5.0                      | 13         | 20         | 28         | 50                       | 96         | 149        | 214        | 379                      | 110        | 171        | 245        | 433        |  |
|                                                        | kgf•cm•s <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 51                       | 130        | 202        | 290        | 513                      | 980        | 1520       | 2180       | 3870                     | 1120       | 1740       | 2500       | 4420       |  |
| Moment of Inertia GD <sup>2</sup> /4 (with brake) J    | kg•m <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 6.1                      | 15         | 24         | 34         | 61                       | 106        | 165        | 237        | 420                      | 120        | 187        | 268        | 475        |  |
|                                                        | kgf•cm•s <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 62                       | 157        | 244        | 350        | 619                      | 1090       | 1690       | 2420       | 4290                     | 130        | 1910       | 2740       | 4850       |  |
| One-Way Positioning Accuracy                           | arc•sec                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 50                       | 40         | 40         | 40         | 40                       | 40         | 40         | 40         | 40                       | 40         | 40         | 40         | 40         |  |
| Allowable Moment Load                                  | N•m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 849                      |            |            |            | 2,180                    |            |            |            | 2,740                    |            |            |            |            |  |
|                                                        | in-lb                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 7514                     |            |            |            | 19293                    |            |            |            | 24249                    |            |            |            |            |  |
| Moment Stiffness                                       | N•m/rad                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 179 x 10 <sup>4</sup>    |            |            |            | 531 x 10 <sup>4</sup>    |            |            |            | 741 x 10 <sup>4</sup>    |            |            |            |            |  |
|                                                        | in-lb/rad                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1584.2 x 10 <sup>4</sup> |            |            |            | 4699.4 x 10 <sup>4</sup> |            |            |            | 6557.9 x 10 <sup>4</sup> |            |            |            |            |  |
| Output Resolution                                      | Pulses/Revolution                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 6,684,672                | 10,616,832 | 13,238,272 | 15,859,712 | 21,102,592               | 10,616,832 | 13,238,272 | 15,859,712 | 21,102,592               | 10,616,832 | 13,238,272 | 15,859,712 | 21,102,592 |  |
| Power Supply                                           | V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | AC 200                   |            |            |            | AC 200                   |            |            |            | AC 200                   |            |            |            |            |  |
| Mass (without brake)                                   | kg                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 9.9                      |            |            |            | 29.5                     |            |            |            | 37.5                     |            |            |            |            |  |
| Mass (with brake)                                      | kg                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 10.7                     |            |            |            | 32                       |            |            |            | 40                       |            |            |            |            |  |
| Protection Structure                                   | Totally enclosed self-cooled type (equivalent to IP54)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |            |            |            |                          |            |            |            |                          |            |            |            |            |  |
| Environmental Conditions                               | Operating temperature: 0 to 40°C • Storage temperature: -20 to +60°C. Operating and storage humidity: 20 to 80% RH (No condensation permitted). Vibration resistance: 25m/s <sup>2</sup> (frequency: 10 to 400Hz) • Shock resistance: 300m/s <sup>2</sup> . Indoor installation: No dust, no metal powder, no corrosive gas, no inflammable gas, no oil mist, no other foreign matter and no direct sunshine. Altitude 1000m or less. Insulation resistance: 100MΩ or higher (DC 500V). Dielectric strength: AC 1500V/1min. Insulation class: Class E |                          |            |            |            |                          |            |            |            |                          |            |            |            |            |  |
| Recommended Driver AC-200V                             | REL-230-36, REL-230-40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |            |            | -          |                          |            |            | -          |                          |            |            |            |            |  |
| Recommended Driver                                     | HA-800-24D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                          |            |            | HA-800-24D |                          |            |            | HA-800-24D |                          |            |            |            |            |  |

1 The table shows typical output values of actuators.

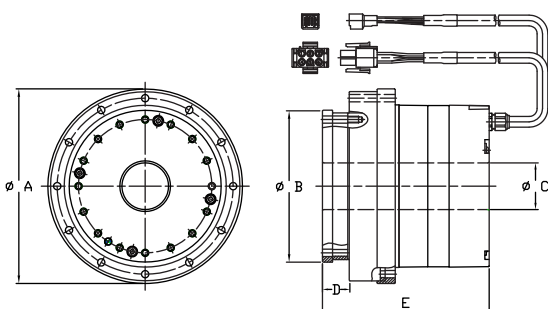
2 When combined with HA-800 driver.

3 Encoder Type: Magnetic absolute encoder. Single-turn: 2<sup>17</sup> (313,072). Multi-turn: 2<sup>16</sup> (65,536) (Battery back-up).

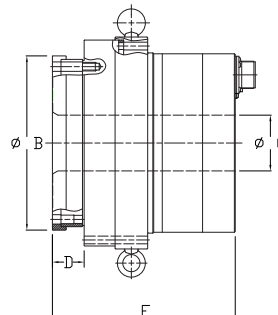
4 Please refer to the manual for detail of ratings.

Units: mm

| Size Symbol | SHA20A | SHA25A | SHA32A | SHA40A | SHA58A | SHA65A |
|-------------|--------|--------|--------|--------|--------|--------|
| øA          | 94     | 114    | 146    | 175    | 247    | 284    |
| øB          | 70     | 86     | 114    | 140    | 203    | 223    |
| øC          | 17     | 27     | 35     | 45     | 65     | 65     |
| D           | 11.5   | 15.5   | 20     | 26     | 37     | 42.5   |
| E           | 103    | 109    | 125    | 148    | 213    | 222    |

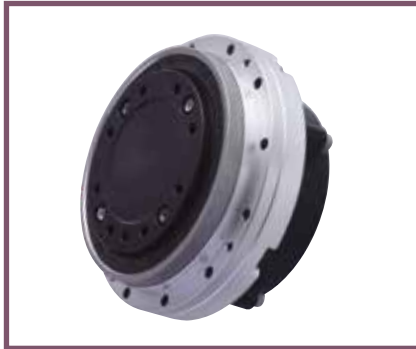


SHA20A, SHA25A, SHA32A, SHA40A



SHA58A, SHA65A

## Brushless Actuators FLA Series



The new ultra-flat, ultra-light brushless actuators combine our high-precision/high-performance reducers with a compact, high-output brushless DC motor. FLA actuators are available with our high-speed, high-efficiency Harmonic Planetary® gearhead or with our high-precision, high-torque Harmonic Drive® reducer.

- Ultra-Flat Shape
- Multiple Options Available: Three sizes, three ratios and two voltages
- Light Weight
- Designed to operate with a wide range of third-party servo drives

### •FLA Series Ratings

| Item                                      |                  | Model | FLA-11A-08HP                       | FLA-14A-08HP          | FLA-17A-09HP          |
|-------------------------------------------|------------------|-------|------------------------------------|-----------------------|-----------------------|
| Ratio                                     |                  |       | 8                                  | 8                     | 9                     |
| Maximum Torque                            | N•m              |       | 1.8                                | 3.7                   | 7.3                   |
| Allowable Continuous Torque               | N•m              |       | 0.6                                | 1.2                   | 3                     |
| Maximum Speed                             | rpm              |       | 500                                | 500                   | 500                   |
| Allowable Continuous Speed                | rpm              |       | 100                                | 100                   | 100                   |
| Maximum Current (24VDC)                   | A <sub>rms</sub> |       | 8.7                                | 18.0                  | 26.2                  |
| Maximum Current (48VDC)                   | A <sub>rms</sub> |       | 4.5                                | 9.6                   | 13.6                  |
| Allowable Continuous Current (24VDC)      | A <sub>rms</sub> |       | 3.0                                | 6.0                   | 10.4                  |
| Allowable Continuous Current (48VDC)      | A <sub>rms</sub> |       | 1.6                                | 3.0                   | 5.3                   |
| Moment of Inertia (GD <sup>2</sup> /4)    | kgm <sup>2</sup> |       | 0.00013                            | 0.00039               | 0.001                 |
| Allowable Moment Load                     | v                |       | 1.2                                | 1.6                   | 2.0                   |
| Moment Stiffness                          | N•m/rad          |       | 2.0 x 10 <sup>3</sup>              | 3.3 x 10 <sup>3</sup> | 4.4 x 10 <sup>3</sup> |
| Motor Position Sensor                     |                  |       | Hall sensor                        |                       |                       |
| Positioning Resolution per Motor Rotation | pls/rev          |       | 30                                 | 30                    | 30                    |
| Output Shaft Resolution                   | pls/rev          |       | 240                                | 240                   | 270                   |
| Weight                                    | g                |       | 390                                | 620                   | 870                   |
| Enclosure                                 |                  |       | Fully enclosed self-cooling (IP40) |                       |                       |

| Item                                      |                  | Model | FLA-11A-xxFB                       |       | FLA-14A-xxFB          |       | FLA-17A-xxFB          |       |
|-------------------------------------------|------------------|-------|------------------------------------|-------|-----------------------|-------|-----------------------|-------|
| Ratio                                     |                  |       | 50                                 | 100   | 50                    | 100   | 50                    | 100   |
| Maximum Torque                            | N•m              |       | 6.7                                | 11    | 11.2                  | 18.2  | 23                    | 34    |
| Allowable Continuous Torque               | N•m              |       | 1.7                                | 2.4   | 2.6                   | 3.8   | 7.9                   | 11.4  |
| Maximum Speed                             | rpm              |       | 100                                | 50    | 100                   | 50    | 100                   | 50    |
| Allowable Continuous Speed                | rpm              |       | 60                                 | 30    | 60                    | 30    | 60                    | 30    |
| Maximum Current (24VDC)                   | A <sub>rms</sub> |       | 6.0                                | 5.0   | 9.7                   | 8.7   | 18.4                  | 14.3  |
| Maximum Current (48VDC)                   | A <sub>rms</sub> |       | 3.1                                | 2.6   | 4.8                   | 4.2   | 9.4                   | 7.2   |
| Allowable Continuous Current (24VDC)      | A <sub>rms</sub> |       | 1.9                                | 1.7   | 3.0                   | 2.5   | 6.8                   | 5.3   |
| Allowable Continuous Current (48VDC)      | A <sub>rms</sub> |       | 1.0                                | 0.8   | 1.5                   | 1.2   | 3.4                   | 2.9   |
| Moment of Inertia (GD <sup>2</sup> /4)    | kgm <sup>2</sup> |       | 0.0073                             | 0.029 | 0.019                 | 0.077 | 0.048                 | 0.19  |
| Allowable Moment Load                     | v                |       | 1.2                                |       | 1.6                   |       | 2.0                   |       |
| Moment Stiffness                          | N•m/rad          |       | 2.0 x 10 <sup>3</sup>              |       | 3.3 x 10 <sup>3</sup> |       | 4.4 x 10 <sup>3</sup> |       |
| Motor Position Sensor                     |                  |       | Hall sensor                        |       |                       |       |                       |       |
| Positioning Resolution per Motor Rotation | pls/rev          |       | 30                                 |       | 30                    |       | 30                    |       |
| Output Shaft Resolution                   | pls/rev          |       | 1,500                              | 3,000 | 1,500                 | 3,000 | 1,500                 | 3,000 |
| Weight                                    | g                |       | 420                                |       | 720                   |       | 940                   |       |
| Enclosure                                 |                  |       | Fully enclosed self-cooling (IP40) |       |                       |       |                       |       |

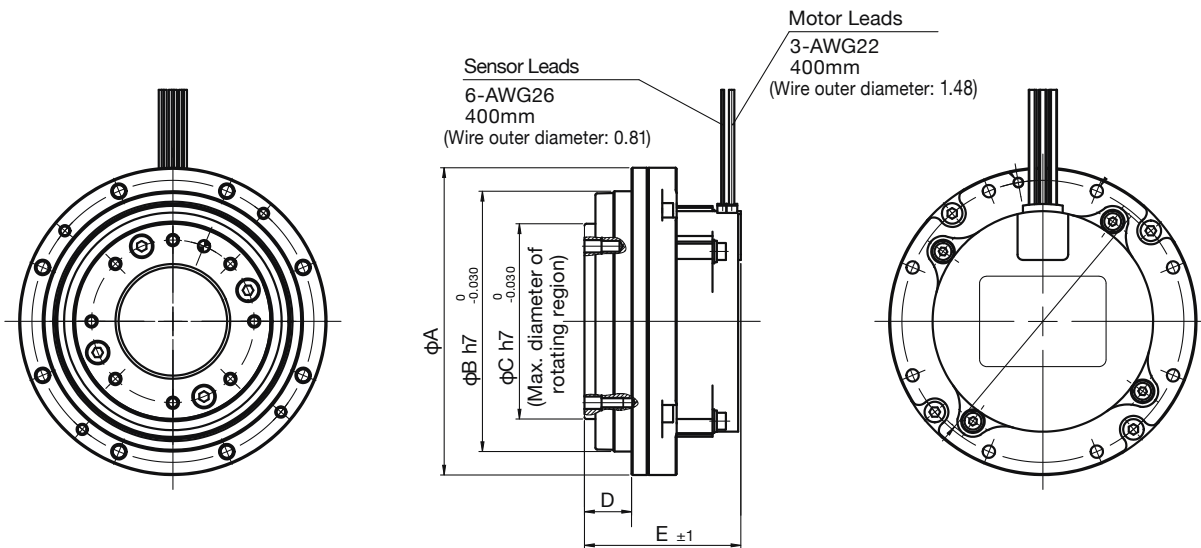
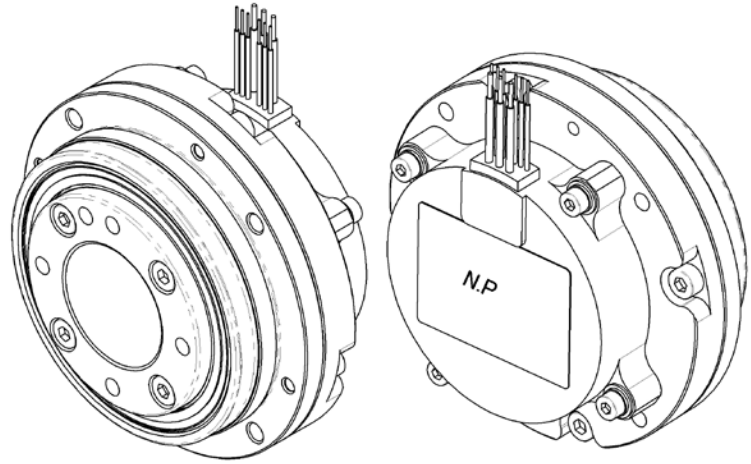
# Brushless Actuators FLA Series

## MAGNETIC POLE SENSOR LEAD WIRE

| COLOR  | SIGNAL NAME | DESCRIPTION                  |
|--------|-------------|------------------------------|
| WHITE  | HU          | Hall Sensor Output (U-Phase) |
| GREEN  | HV          | Hall Sensor Output (V-Phase) |
| BLUE   | HW          | Hall Sensor Output (W-Phase) |
| RED    | +5V         | Power Input +5 V             |
| BLACK  | 0V          | Power Input 0 V (GND)        |
| YELLOW | TH          | Thermistor Output            |

## MOTOR LEAD WIRE

| COLOR | SIGNAL        |
|-------|---------------|
| RED   | Motor U-Phase |
| WHITE | Motor V-Phase |
| BLACK | Motor W-Phase |



## • FLA-HP Dimensions

Unit: mm

| Size Symbol | FLA-11 | FLA-14 | FLA-17 | FLA-20 |
|-------------|--------|--------|--------|--------|
| $\phi A$    | 71     | 85     | 92     | 100    |
| $\phi B$    | 58     | 72     | 79     | 87     |
| $\phi C$    | 43     | 54     | 60     | 64     |
| D           | 13     | 13     | 14     | 14.5   |
| E           | 39.8   | 43.3   | 48.7   | 47.8   |

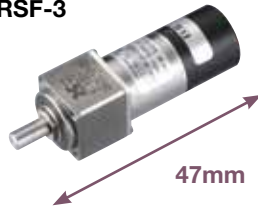
## • FLA-FB Dimensions

Unit: mm

| Size Symbol | FLA-11 | FLA-14 | FLA-17 | FLA-20 |
|-------------|--------|--------|--------|--------|
| $\phi A$    | 71     | 85     | 92     | 100    |
| $\phi B$    | 58     | 72     | 79     | 87     |
| $\phi C$    | 43     | 54     | 60     | 64     |
| D           | 13.5   | 15     | 17.1   | 18.1   |
| E           | 40.3   | 45.3   | 51.8   | 51.4   |

## Brushless Actuators RSF Supermini Series

RSF-3



These extremely small servo actuators utilize zero backlash Harmonic Drive® precision gears, a brushless servo motor and an incremental encoder to deliver precision motion control. The RSF Supermini series is designed to operate with a wide range of third party drivers as well as Harmonic Drive LLC's DCJ Series, DDP Series, DEP Series, and HA680 drivers. The units are small enough to fit inside the finger of a robotic hand.

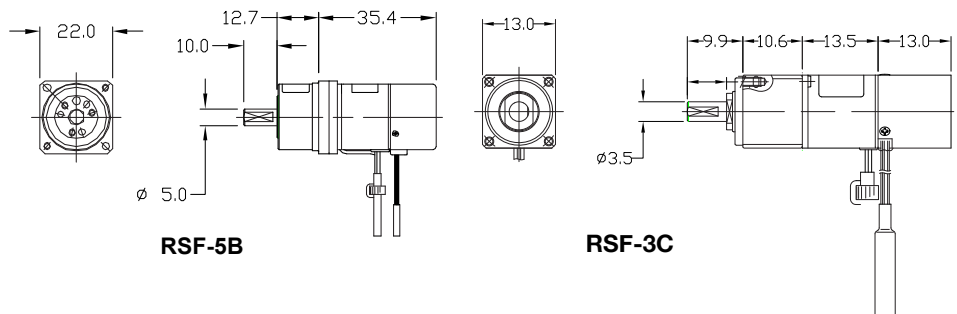
- Compact, lightweight
- High output torque
- High positional accuracy
- RSF-5B is available with an optional brake

### •RSF Supermini Series Ratings

| Item                                                  |  | Model                  | RSF-3C                           |                       |                       | RSF-5B                    |                                                   |                                                   |                                                   |
|-------------------------------------------------------|--|------------------------|----------------------------------|-----------------------|-----------------------|---------------------------|---------------------------------------------------|---------------------------------------------------|---------------------------------------------------|
|                                                       |  |                        | 30                               | 50                    | 100                   | 30                        | 50                                                | 100                                               |                                                   |
| Ratio                                                 |  |                        | 30                               | 50                    | 100                   | 30                        | 50                                                | 100                                               |                                                   |
| Power Supply Voltage (driver)                         |  | V                      | DC24±10%                         |                       |                       | DC24±10%                  |                                                   |                                                   |                                                   |
| Maximum Continuous Current                            |  | A <sub>rms</sub>       | 0.65                             | 0.66                  | 0.56                  | 1.11                      | 0.92                                              | 0.76                                              |                                                   |
| Rated Torque<br>(during operation at allowable)       |  | N•m                    | 0.03                             | 0.07                  | 0.11                  | 0.18                      | 0.29                                              | 0.44                                              |                                                   |
|                                                       |  | in-lb                  | 0.27                             | 0.62                  | 0.97                  | 1.6                       | 2.6                                               | 3.9                                               |                                                   |
| Maximum Rotational Speed (output shaft)               |  | rpm                    | 150                              | 90                    | 45                    | 150                       | 90                                                | 45                                                |                                                   |
| Continuous Stall Torque                               |  | N•m                    | 0.04                             | 0.08                  | 0.12                  | 0.28                      | 0.44                                              | 0.65                                              |                                                   |
|                                                       |  | in-lb                  | 0.35                             | 0.71                  | 1.06                  | 2.5                       | 3.9                                               | 5.8                                               |                                                   |
| Maximum Instantaneous Current                         |  | A <sub>rms</sub>       | 1.5                              | 1.4                   | 1.1                   | 2.3                       | 2.2                                               | 1.7                                               |                                                   |
| Maximum Torque                                        |  | N•m                    | 0.13                             | 0.21                  | 0.3                   | 0.5                       | 0.9                                               | 1.4                                               |                                                   |
|                                                       |  | in-lb                  | 1.15                             | 1.86                  | 2.66                  | 4.4                       | 8                                                 | 12.4                                              |                                                   |
| Maximum Speed                                         |  | rpm                    | 333                              | 200                   | 100                   | 333                       | 200                                               | 100                                               |                                                   |
| Torque Constant                                       |  | N•m/A <sub>rms</sub>   | 0.11                             | 0.18                  | 0.4                   | 0.3                       | 0.54                                              | 1.1                                               |                                                   |
|                                                       |  | in-lb/A <sub>rms</sub> | 0.97                             | 1.59                  | 3.54                  | 2.66                      | 4.78                                              | 9.74                                              |                                                   |
| EMF Constant                                          |  | V/(rpm)                | 0.015                            | 0.025                 | 0.05                  | 0.04                      | 0.07                                              | 0.13                                              |                                                   |
| Phase Resistance (at 20°C)                            |  | Ω                      | 1.34                             |                       |                       | 0.82                      |                                                   |                                                   |                                                   |
| Phase Inductance                                      |  | mH                     | 0.18                             |                       |                       | 0.27                      |                                                   |                                                   |                                                   |
| Moment of Inertia <sup>4</sup>                        |  | GD <sup>2</sup> /4     | kg•m <sup>2</sup>                | 0.11x10 <sup>-4</sup> | 0.29x10 <sup>-4</sup> | 1.17x10 <sup>-4</sup>     | 0.66x10 <sup>-4</sup><br>(0.11x10 <sup>-3</sup> ) | 1.83x10 <sup>-4</sup><br>(0.31x10 <sup>-3</sup> ) | 7.31x10 <sup>-4</sup><br>(1.23x10 <sup>-3</sup> ) |
|                                                       |  | J                      | kgf•cm•s <sup>2</sup>            | 1.07x10 <sup>-4</sup> | 2.98x10 <sup>-4</sup> | 11.90x10 <sup>-4</sup>    | 0.67x10 <sup>-3</sup><br>(1.13x10 <sup>-3</sup> ) | 1.87x10 <sup>-3</sup><br>(3.15x10 <sup>-3</sup> ) | 7.45x10 <sup>-3</sup><br>(12.6x10 <sup>-3</sup> ) |
| One-Way Positioning Accuracy                          |  | arc/sec                | 600                              | 600                   | 600                   | 240                       | 180                                               | 180                                               |                                                   |
| Allowable Radial Load<br>(output shaft central value) |  | N                      | 36                               |                       |                       | 90                        |                                                   |                                                   |                                                   |
|                                                       |  | lbf                    | 8                                |                       |                       | 20                        |                                                   |                                                   |                                                   |
| Allowable Axial Load                                  |  | N                      | 130                              |                       |                       | 270                       |                                                   |                                                   |                                                   |
|                                                       |  | lbf                    | 29                               |                       |                       | 61                        |                                                   |                                                   |                                                   |
| Encoder Pulses (motor shaft)                          |  | Pulse                  | 200                              |                       |                       | 500                       |                                                   |                                                   |                                                   |
| Quad Encoder Resolutions <sup>5</sup>                 |  | Pulse/rev.             | 24,000                           | 40,000                | 80,000                | 60,000                    | 100,000                                           | 200,000                                           |                                                   |
| Motor Shaft Brake                                     |  | Input Power Voltage    | -                                |                       |                       | DC24±10%                  |                                                   |                                                   |                                                   |
|                                                       |  | Retention Torque       | N•m                              | -                     |                       |                           | 0.18                                              | 0.29                                              | 0.44                                              |
|                                                       |  |                        | in-lb                            | -                     |                       |                           | 0.16                                              | 0.26                                              | 0.39                                              |
| Mass <sup>6</sup>                                     |  | Without Brake          | 31.0(except clamp filter)        |                       |                       | 66.0(except clamp filter) |                                                   |                                                   |                                                   |
|                                                       |  | With Brake             | -                                |                       |                       | 86.0(except clamp filter) |                                                   |                                                   |                                                   |
| Recommended Driver                                    |  | DC24V                  | DCJ-055-09/DDP-090-09/DEP-090-09 |                       |                       | HA-680-4B-24              |                                                   |                                                   |                                                   |

**Notes:**

- The table shows typical output values of actuators.
- The values in the table above are obtained when it is combined with the driver (HA-680-4B-24).
- All values are typical.
- The moment of inertia is the total value of the motor shaft and the gear's moment of inertia values converted to the output side. The values in parentheses are for equipment with a brake.
- The quad encoder resolution is (motor shaft encoder resolution when multiplied by 4) x (gear ratio).
- The weight of clamp filter is 6g each.



# Brushless Actuators RSF-Mini Series



These brushless servo actuators utilize zero backlash Harmonic Drive® precision gears for precise motion control. The RSF Mini Series is designed to operate with a wide range of third party drivers as well as Harmonic Drive LLC's DCJ Series, DDP Series, DEP Series, and HA680 drivers.

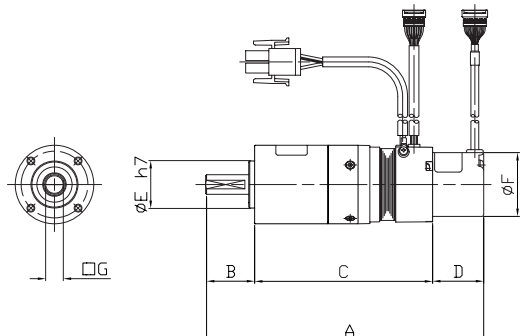
- Exceptional positional accuracy
- Compact design

## •RSF Mini Series Ratings

| Model                                       |                      | RSF-8B                                            |        |        | RSF-11B                            |        |        | RSF-14B |        |        |     |
|---------------------------------------------|----------------------|---------------------------------------------------|--------|--------|------------------------------------|--------|--------|---------|--------|--------|-----|
| Item                                        |                      | 30                                                | 50     | 100    | 30                                 | 50     | 100    | 30      | 50     | 100    |     |
| Ratio                                       |                      | 30                                                | 50     | 100    | 30                                 | 50     | 100    | 30      | 50     | 100    |     |
| Power Supply Voltage                        | V                    | DC24                                              |        |        |                                    |        |        |         |        |        |     |
| Maximum Torque <sup>3</sup>                 | N•m                  | 1.8                                               | 3.3    | 4.8    | 4.5                                | 8.3    | 11     | 9       | 18     | 28     |     |
|                                             | in-lb                | 15.9                                              | 29.2   | 42.5   | 39.8                               | 73.5   | 97.4   | 79.7    | 159    | 248    |     |
| Maximum Speed <sup>3</sup>                  | rpm                  | 200                                               | 120    | 60     | 200                                | 120    | 60     | 200     | 120    | 60     |     |
| Maximum Current <sup>3</sup>                | A <sub>rms</sub>     | 3.8                                               | 3.9    | 2.9    | 14.4                               | 15.8   | 9.4    | 14.4    | 17.2   | 12.3   |     |
| Allowable Continuous Torque <sup>3,4</sup>  | N•m                  | 0.78                                              | 1.4    | 2.0    | 1.1                                | 2.0    | 4.0    | 1.7     | 3.0    | 6.0    |     |
|                                             | in-lb                | 6.9                                               | 12.4   | 17.7   | 9.7                                | 17.7   | 35.4   | 15.0    | 26.6   | 53.1   |     |
| Allowable Continuous Current <sup>3,4</sup> | A <sub>rms</sub>     | 2.0                                               | 2.0    | 1.5    | 5.0                                | 4.9    | 4.9    | 4.9     | 4.7    | 4.7    |     |
| Allowable Continuous Speed <sup>3</sup>     | rpm                  | 100                                               | 60     | 30     | 100                                | 60     | 30     | 100     | 60     | 30     |     |
| Torque Constant                             | N•m/A <sub>rms</sub> | 0.62                                              | 1.1    | 2.1    | 0.4                                | 0.66   | 1.5    | 0.76    | 1.3    | 2.6    |     |
| EMF Constant                                | V(rpm)               | 0.07                                              | 0.11   | 0.22   | 0.04                               | 0.07   | 0.15   | 0.08    | 0.13   | 0.28   |     |
| Phase Resistance                            | Ω (25°C)             | 0.93                                              |        |        | 0.19                               |        |        | 0.23    |        |        |     |
| Phase Inductance                            | mH                   | 0.45                                              |        |        | 0.1                                |        |        | 0.19    |        |        |     |
| Moment of Inertia                           | GD <sup>2</sup> /4   | ×10 <sup>-2</sup><br>k•gm <sup>2</sup>            | 0.06   | 0.16   | 0.65                               | 0.18   | 0.49   | 2.0     | 0.41   | 1.1    | 4.5 |
|                                             | J                    | ×10 <sup>-2</sup><br>kgf•cm•s <sup>2</sup>        | 0.6    | 1.7    | 6.6                                | 1.8    | 5.0    | 20      | 4.1    | 11     | 46  |
| Allowable Radial Load                       | N                    | 196                                               |        |        | 245                                |        |        | 392     |        |        |     |
|                                             | lbf                  | 44                                                |        |        | 55                                 |        |        | 88      |        |        |     |
| Allowable Axial Load                        | N                    | 98                                                |        |        | 196                                |        |        | 392     |        |        |     |
|                                             | lbf                  | 22                                                |        |        | 44                                 |        |        | 88      |        |        |     |
| One-Way Positioning Accuracy                | arc/sec              | 180                                               | 150    | 150    | 150                                | 120    | 120    | 150     | 120    | 120    |     |
| Quad Encoder Resolutions <sup>6</sup>       | p/rev                | 120000                                            | 200000 | 400000 | 120000                             | 200000 | 400000 | 120000  | 200000 | 400000 |     |
| Mass                                        | kg                   | 0.3                                               |        |        | 0.5                                |        |        | 0.8     |        |        |     |
| Insulation Class                            |                      | B                                                 |        |        |                                    |        |        |         |        |        |     |
| Insulation Resistance                       |                      | 100M Ω (DC500V) or more                           |        |        |                                    |        |        |         |        |        |     |
| Withstanding Voltage                        |                      | AC500V/1 min                                      |        |        |                                    |        |        |         |        |        |     |
| Recommended Driver                          | DC24V                | DCJ-055-09/DDP-090-09/<br>DEP-090-09/HA-680-4B-24 |        |        | DDP-090-36/DEP-090-36/HA-680-6B-24 |        |        |         |        |        |     |

- Notes:  
 1 The table shows output values of the actuator.  
 2 All specifications are applicable for actuators mounted on an aluminum heat sink of size: 150 x 150 x 6(mm).  
 3 Values for saturated actuator temperature. Other values are for actuator temperature of 20°C.  
 4 Values are during operation at allowable continuous rotation speed.  
 5 All values are typical.  
 6 Quad encoder resolution is (motor shaft encoder resolution) x 4 x (gear ratio).  
 7 The specifications above are based on using HA-680 driver.

| Model   | A     | B    | C     | D  | øEh7 | øF   | G    |
|---------|-------|------|-------|----|------|------|------|
| RSF-8B  | 124.3 | 21.8 | 76.5  | 26 | 21   | 34.5 | 7.5  |
| RSF-11B | 141.7 | 25   | 90.7  | 26 | 24   | 32.5 | 9.5  |
| RSF-14B | 168.5 | 28   | 114.5 | 26 | 30   | 32.5 | 11.5 |



## Brushless Actuators RSF Series



The RSF series is compact and includes high torque AC servo actuators with high rotational accuracy, a shaft output combining Harmonic Drive® strain wave gearing for precision control and an AC servomotor. The RSF Series is designed to operate with a wide range of third party drivers as well as Harmonic Drive LLC's RTL Series, and REL Series.

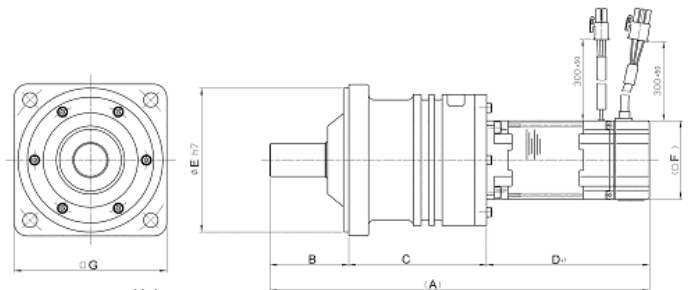
- Compact and lightweight
- High power
- High positioning and high rotational accuracies

### •RSF Series Ratings

| Item                                 | Model                                     | RSF-17                 |         | RSF-20A |         | RSF-25A |         | RSF-32A |         |
|--------------------------------------|-------------------------------------------|------------------------|---------|---------|---------|---------|---------|---------|---------|
|                                      |                                           |                        |         |         |         |         |         |         |         |
| Ratio                                |                                           | 50                     | 100     | 50      | 100     | 50      | 100     | 50      | 100     |
| Rated Output                         | W                                         | 62                     | 62      | 120     | 111     | 180     | 190     | 310     | 310     |
| Power Supply Voltage (driver)        | V                                         | AC200V                 |         |         |         |         |         |         |         |
| Rated Torque                         | N·m                                       | 9.8                    | 20      | 19      | 35      | 29      | 59      | 49      | 98      |
|                                      | in-lb                                     | 87                     | 177     | 168     | 310     | 257     | 522     | 434     | 867     |
| Rated Rotational Speed               | rpm                                       | 60                     | 30      | 60      | 30      | 60      | 30      | 60      | 30      |
| Continuous Stall Torque              | N·m                                       | 9.8                    | 20      | 19      | 35      | 29      | 59      | 49      | 98      |
|                                      | in-lb                                     | 87                     | 177     | 168     | 310     | 257     | 522     | 434     | 867     |
| Max. Momentary Torque                | N·m                                       | 34                     | 54      | 56      | 82      | 98      | 157     | 220     | 330     |
|                                      | in-lb                                     | 301                    | 478     | 496     | 726     | 867     | 1389    | 1947    | 2921    |
| Max. Rotational Speed                | rpm                                       | 90                     | 45      | 90      | 45      | 90      | 45      | 90      | 45      |
| Moment of Inertia <sup>4</sup>       | (GD <sup>2</sup> /4)<br>kg.m <sup>2</sup> | 0.047                  | 0.19    | 0.098   | 0.39    | 0.19    | 0.77    | 0.67    | 2.7     |
|                                      | (J) kgfcm <sup>2</sup>                    | 0.48                   | 1.9     | 1.0     | 4.0     | 2.0     | 7.9     | 6.9     | 27      |
| One-Way Positioning Accuracy         | arc/sec                                   | 120                    |         | 90      |         | 90      |         | 90      |         |
| Allowable Radial Load                | N                                         | 780                    |         | 1400    |         | 2900    |         | 4400    |         |
|                                      | Lbf                                       | 175                    |         | 315     |         | 652     |         | 989     |         |
| Allowable Axial Load                 | N                                         | 780                    |         | 1370    |         | 2900    |         | 4400    |         |
|                                      | Lbf                                       | 175                    |         | 308     |         | 652     |         | 989     |         |
| Quad Encoder Resolution <sup>5</sup> | Pulses/<br>Revolution                     | 400,000                | 800,000 | 400,000 | 800,000 | 400,000 | 800,000 | 400,000 | 800,000 |
| Mass                                 | kg                                        | 2.1                    |         | 2.9     |         | 4.7     |         | 8.7     |         |
| Recommended Driver                   | AC200                                     | RTL-230-18, REL-230-18 |         |         |         |         |         |         |         |

#### Notes:

- 1 The values in the table are those at the output shaft.
- 2 The actuator specification is the value when mounted on the following aluminum radiation plate:  
RSF-17, RSF-20 250 x 250 x 12mm  
RSF-25, RSF-32 300 x 300 x 15mm
- 3 The values are those on temperature rise saturation. The other values are those at 20°C.
- 4 The moment of inertia is the sum of the inertia of the motor and Harmonic Drive® gear reflected at the output shaft.
- 5 Quad Encoder resolution is calculated using (Motor shaft encoder resolution) x 4 x (Reduction ratio).



Unit: mm

| Model   | A     | B  | C     | D±1 | ø Eh7 | F  | G   | Mass(kg) |
|---------|-------|----|-------|-----|-------|----|-----|----------|
| RSF-17A | 210   | 40 | 88    | 82  | 20    | 60 | 76  | 2.1      |
| RSF-20A | 242   | 48 | 98    | 96  | 85    | 60 | 93  | 2.9      |
| RSF-25A | 288.7 | 60 | 104.7 | 124 | 110   | 60 | 116 | 4.7      |
| RSF-32A | 331   | 80 | 123   | 128 | 130   | 80 | 137 | 8.7      |

# Brushless Actuators RKF Series



The RKF series is compact and includes high torque AC servo actuators with high rotational accuracy, a flange output combining Harmonic Drive® strain wave gearing for precision control and an AC servo motor. The RKF Series is designed to operate with a wide range of third party drivers as well as Harmonic Drive LLC's RTL Series, and REL Series.

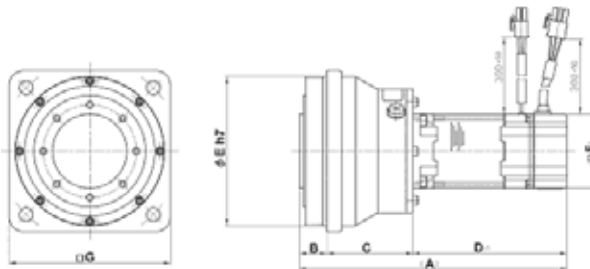
- Compact and lightweight
- High power
- High positioning and high rotational accuracies

## •RKF Series Ratings

| Item                                 | Model                                     | RKF-20A                |         | RKF-25A |         | RKF-32A |         |
|--------------------------------------|-------------------------------------------|------------------------|---------|---------|---------|---------|---------|
|                                      |                                           |                        |         |         |         |         |         |
| Ratio                                |                                           | 50                     | 100     | 50      | 100     | 50      | 100     |
| Rated Output                         | W                                         | 120                    | 111     | 180     | 190     | 310     | 310     |
| Power Supply Voltage (driver)        | V                                         | AC200                  |         |         |         |         |         |
| Rated Torque                         | N•m                                       | 19                     | 35      | 29      | 59      | 49      | 98      |
|                                      | in-lb                                     | 168                    | 310     | 257     | 522     | 434     | 867     |
| Rated Rotational Speed               | rpm                                       | 60                     | 30      | 60      | 30      | 60      | 30      |
| Continuous Stall Torque              | N•m                                       | 19                     | 35      | 29      | 59      | 49      | 98      |
|                                      | in-lb                                     | 168                    | 310     | 257     | 522     | 434     | 867     |
| Max. Momentary Torque                | N•m                                       | 56                     | 82      | 98      | 157     | 220     | 330     |
|                                      | in-lb                                     | 496                    | 726     | 867     | 1389    | 1947    | 2921    |
| Max. Rotational Speed                | rpm                                       | 90                     | 45      | 90      | 45      | 90      | 45      |
| Moment of Inertia <sup>4</sup>       | (GD <sup>2</sup> /4)<br>kg.m <sup>2</sup> | 0.098                  | 0.39    | 0.19    | 0.77    | 0.67    | 2.7     |
|                                      | (J) kgfcm <sup>2</sup>                    | 1.0                    | 4.0     | 2.0     | 7.9     | 6.9     | 27      |
| One-Way Positioning Accuracy         | arc/sec                                   | 90                     |         | 90      |         | 90      |         |
| Allowable Radial Load                | N                                         | 2000                   |         | 2500    |         | 3900    |         |
|                                      | Lbf                                       | 450                    |         | 562     |         | 877     |         |
| Allowable Axial Load                 | N                                         | 880                    |         | 1100    |         | 1600    |         |
|                                      | Lbf                                       | 198                    |         | 247     |         | 360     |         |
| Quad Encoder Resolution <sup>5</sup> | Pulses/Revolution                         | 400,000                | 800,000 | 400,000 | 800,000 | 400,000 | 800,000 |
| Mass                                 | kg                                        | 2.9                    |         | 5.0     |         | 9.5     |         |
| Recommended Driver                   | AC200                                     | RTL-230-18, REL-230-18 |         |         |         |         |         |

**Notes:**

- 1 The aforementioned values are those at the output shaft including the Harmonic Drive® gear efficiency.
- 2 The actuator specifications are based on operating when mounted on an aluminum heat sink of the following sizes or its equivalent:  
 RKF-20                    250 x 250 x 12mm  
 RKF-25, RKF-32        300 x 300 x 15mm
- 3 The values are those on temperature rise saturation. The other values are those at 20°C.
- 4 The moment of inertia is the total of the inertia moments of the motor shaft and Harmonic Drive® gear converted into the output shaft side.
- 5 Quad Encoder resolution is calculated using (Motor shaft encoder resolution) x 4 x (Reduction ratio).



Unit: mm

| Model   | A     | B    | C    | D±1 | ø Eh7 | F  | G   | Mass(kg) |
|---------|-------|------|------|-----|-------|----|-----|----------|
| RKF-20A | 180   | 20   | 64   | 96  | 100   | 60 | 108 | 2.9      |
| RKF-25A | 215.5 | 22   | 69.5 | 124 | 120   | 60 | 130 | 5.0      |
| RKF-32A | 241   | 25.5 | 87.5 | 128 | 155   | 80 | 165 | 9.5      |

## DC Servo Actuators RH Mini Series



This RH Mini Series is a DC servo actuator incorporating Harmonic Drive® precision gears, a high performance brush DC servomotor and an incremental encoder.

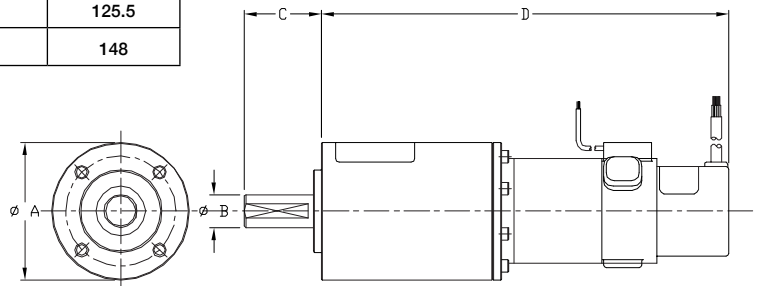
- High torque
- Precise positional accuracy
- Compact design

### •RH Series Ratings

| Item                            | Model                                                                                                                                                               | RH-5A                              |                     |                     | RH-8D                              |                      | RH-11D               |                      | RH-14D               |                      |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|---------------------|---------------------|------------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|                                 |                                                                                                                                                                     | 8802                               | 5502                | 4402                | 6006                               | 3006                 | 6001                 | 3001                 | 6002                 | 3002                 |
| Rated Output                    | W                                                                                                                                                                   | 1.5                                | 1.7                 | 1.4                 | 8.6                                | 6.2                  | 13.6                 | 12.3                 | 20.3                 | 18.5                 |
| Rated Voltage                   | V                                                                                                                                                                   | 12                                 | 12                  | 12                  | 24                                 | 24                   | 24                   | 24                   | 24                   | 24                   |
| Maximum Momentary Torque        | N•m                                                                                                                                                                 | 0.39                               | 0.59                | 0.69                | 2.7                                | 3.5                  | 4.9                  | 7.8                  | 14                   | 20                   |
|                                 | in-lb                                                                                                                                                               | 3.45                               | 5.22                | 6.11                | 23.9                               | 31.0                 | 43.4                 | 60.0                 | 123.9                | 177.0                |
| Maximum Continuous Stall Torque | N•m                                                                                                                                                                 | 0.24                               | 0.39                | 0.43                | 1.5                                | 2.3                  | 2.5                  | 4.4                  | 5.4                  | 7.8                  |
|                                 | in-lb                                                                                                                                                               | 2.12                               | 3.45                | 3.81                | 13.3                               | 20.4                 | 22.1                 | 38.9                 | 47.8                 | 69.0                 |
| Rated Torque                    | N•m                                                                                                                                                                 | 0.16                               | 0.29                | 0.29                | 1.4                                | 2                    | 2.2                  | 3.9                  | 3.2                  | 5.9                  |
|                                 | in-lb                                                                                                                                                               | 1.42                               | 2.57                | 2.57                | 12.4                               | 17.7                 | 19.5                 | 34.5                 | 28.3                 | 52.5                 |
| Maximum Positioning Speed       | rpm                                                                                                                                                                 | 180                                | 110                 | 90                  | 100                                | 50                   | 100                  | 50                   | 100                  | 50                   |
| Rated Positioning Speed         | rpm                                                                                                                                                                 | 88                                 | 55                  | 44                  | 60                                 | 30                   | 60                   | 30                   | 60                   | 30                   |
| Maximum Momentary Current       | A <sub>rms</sub>                                                                                                                                                    | 0.83                               | 0.78                | 0.77                | 1.6                                | 1.1                  | 2.4                  | 2.1                  | 5.4                  | 4.1                  |
| Rated Current                   | A <sub>rms</sub>                                                                                                                                                    | 0.5                                | 0.5                 | 0.5                 | 1.0                                | 0.8                  | 1.3                  | 1.3                  | 1.8                  | 1.8                  |
| Torque Constant                 | N•m/A <sub>rms</sub>                                                                                                                                                | 0.69                               | 1.11                | 1.38                | 2.1                                | 4.2                  | 2.46                 | 4.91                 | 2.92                 | 5.76                 |
|                                 | in-lb/A <sub>rms</sub>                                                                                                                                              | 6.1                                | 9.8                 | 12.2                | 18.6                               | 37.2                 | 21.7                 | 43.5                 | 25.8                 | 51                   |
| Moment of Inertia               | kg•m <sup>2</sup>                                                                                                                                                   | 6.3x10 <sup>-4</sup>               | 16x10 <sup>-4</sup> | 25x10 <sup>-4</sup> | 37x10 <sup>-4</sup>                | 150x10 <sup>-4</sup> | 110x10 <sup>-4</sup> | 430x10 <sup>-4</sup> | 210x10 <sup>-4</sup> | 810x10 <sup>-4</sup> |
|                                 | kgf•cm•s <sup>2</sup>                                                                                                                                               | 0.007                              | 0.016               | 0.026               | 0.04                               | 0.15                 | 0.11                 | 0.44                 | 0.21                 | 0.83                 |
| One-Way Positioning Accuracy    | arc/sec                                                                                                                                                             | 290                                | 290                 | 290                 | 150                                | 150                  | 120                  | 120                  | 120                  | 120                  |
| Allowable Axial Load            | N                                                                                                                                                                   | 29                                 | 29                  | 29                  | 98                                 | 98                   | 196                  | 196                  | 392                  | 392                  |
|                                 | lbf                                                                                                                                                                 | 7                                  | 7                   | 7                   | 22                                 | 22                   | 44                   | 44                   | 88                   | 88                   |
| Reduction Ratio                 |                                                                                                                                                                     | 50                                 | 80                  | 100                 | 50                                 | 100                  | 50                   | 100                  | 50                   | 100                  |
| Mass                            | kg                                                                                                                                                                  | 0.09                               | 0.09                | 0.09                | 0.3                                | 0.3                  | 0.5                  | 0.5                  | 0.77                 | 0.77                 |
| Environmental Conditions        | Time constant: Continuous • Protection: Totally closed, self-cooling • Ambient temperature: 0 to 40°C<br>Ambient humidity: 35 to 80% RH (no condensation permitted) |                                    |                     |                     |                                    |                      |                      |                      |                      |                      |
| Recommended Driver              | DC 20V                                                                                                                                                              | DCJ-055-09, DDP-090-09, DEP-090-09 |                     |                     | -                                  |                      | -                    |                      | -                    |                      |
|                                 |                                                                                                                                                                     | -                                  |                     |                     | DCJ-055-09, DDP-090-09, DEP-090-09 |                      |                      |                      |                      |                      |

Unit: mm

| Model  | øA | øB | C    | D     |
|--------|----|----|------|-------|
| RH-5A  | 20 | 5  | 11   | 78    |
| RH-8D  | 33 | 8  | 21.8 | 107.2 |
| RH-11D | 40 | 10 | 25   | 125.5 |
| RH-14D | 50 | 12 | 28   | 148   |





# Direct Drive Motor KDU Series



The KDU Series are Direct Drive Motors which achieve 10 arc-sec positioning accuracy as well as  $\pm 0.5$  arc-sec repeatability with a resolution of 0.16 arc-sec. Also, the KDU has a large Hollow Shaft design which allows cables, shafts or lasers to pass through the axis of rotation.

- Exceptional positional accuracy
- Exceptional repeatability
- Ultra high resolution

## •KDU Series Ratings

| Item                                       | Model                       | KDU-13SB                                                                                                        | KDU-13WB                |
|--------------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------|-------------------------|
|                                            | Maximum Torque <sup>2</sup> | N•m                                                                                                             | 7.0Nm (62.0 In.lb)      |
| Max. Rotational Speed                      | rpm                         | 127                                                                                                             | 127                     |
| Torque Constant                            | N•m/A <sub>rms</sub>        | 3.1 (26.9 In.lb/A(rms))                                                                                         | 6.5 (56.4 In.lb/A(rms)) |
| Input Power Supply Voltage                 | V                           | AC 100/AC200                                                                                                    |                         |
| Moment of Inertia                          | kg•m <sup>2</sup>           | 0.0047                                                                                                          | 0.0065                  |
| Moment Stiffness                           | N•m/rad                     | 2.4 x 10 <sup>5</sup>                                                                                           |                         |
| Motor Position Sensor                      | pulse/rev                   | Incremental encoder<br>Square wave : phase A and B: 11,840,000<br>Z Index Pulse Signal                          |                         |
| Repeatability <sup>3</sup>                 | arc sec                     | $\pm 0.5$                                                                                                       |                         |
| Absolute Positioning Accuracy <sup>4</sup> | arc sec                     | 10 (Angular position corrected)                                                                                 |                         |
| Mass                                       | kg                          | 4.0                                                                                                             | 5.0                     |
| Mounting Direction                         | -                           | Output shaft to face upward                                                                                     |                         |
| Combined Driver                            | -                           | HA-770-2                                                                                                        |                         |
| Induced Voltage Constant                   | V/ (rpm)                    | .033                                                                                                            | 0.68                    |
| Line Resistance                            | W (20°C)                    | 9.1                                                                                                             | 14.0                    |
| Line Inductance                            | mH                          | 19                                                                                                              | 35                      |
| Motor Insulation                           | -                           | Insulation Resistance: 100 M W more (DC500V)<br>Insulation Strength: AC1500V/1min.<br>Insulation Class: Class B |                         |
| Protective Structure <sup>5</sup>          | -                           | Total-enclosed self-enclosed type (IP 40 or equivalent)                                                         |                         |

1 The table above shows output values of output shaft.  
 2 The values in the table above are obtained when connected to HA-770 servo driver.  
 3 The repeatability and absolute repeatability are the values measured in an environment of 23  $\pm$  0.3°C in temperature, 50% RH in humidity and with output shaft facing upward in mounting direction. Please contact Harmonic Drive LLC, to inquire about use with different environmental conditions.  
 4 Value after angular position of the HA-770 servo driver is corrected.  
 5 All parts, except the rotary sliding parts (oil seal), of the actuators are protected against solid bodies of superior dimensions to 1mm, and against the water sprays.

### •Direct Drive Motor HA-770 Series

| Model                  | HA-770-2                                                                                                                    |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Rated Current          | 1.8A                                                                                                                        |
| Maximum Current        | 10A                                                                                                                         |
| Power Source Voltage   | AC100V~115V(Single-phase) + 10%~-15% 50/60Hz,<br>AC200V~230V (Single-phase) + 10%~-15% 50/60Hz                              |
| Position Command Pulse | Line driver system: Maximum response frequency, Two-pulse system, One-pulse system: 1MHz,<br>Two-phase pulse system: 200kHz |
| Control System         | Sine wave PWM system, switching frequency: 25kHz                                                                            |
| Control Mode           | Position control                                                                                                            |
| Weight                 | 0.8kg                                                                                                                       |

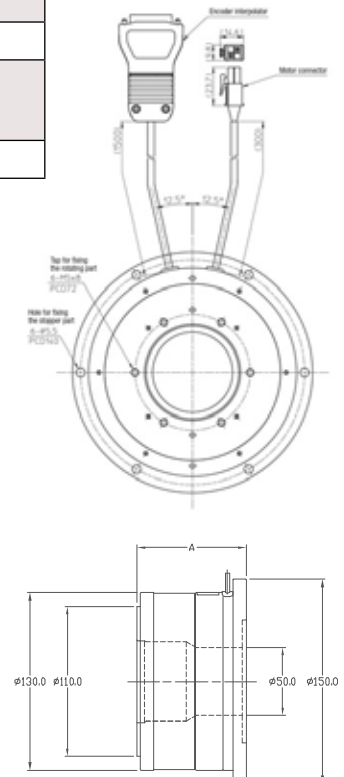
### •Motor Length

Unit: mm

|   | KDU-13SB | KDU-13WB |
|---|----------|----------|
| A | 80       | 94       |



HA-770 Series



## Hollow Shaft Motor HMA Motor



Harmonic Drive LLC offers HMA hollow shaft motors. Hollow shaft design allows cables, shafts or lasers to pass through the axis of rotation.

- Large Hollow Shaft
- 17-bit Absolute Encoder
- Available in 5 frame sizes

### •HMA Motor Ratings

| Item                                          |                                               | Model                                   | HMAC08                    | HMAB09         |                  | HMAB12           | HMAB15            | HMAA21A           |
|-----------------------------------------------|-----------------------------------------------|-----------------------------------------|---------------------------|----------------|------------------|------------------|-------------------|-------------------|
| Combined driver                               |                                               |                                         | HA-800□-3D-200            | HA-800□-3D-200 | HA-800□-6D-E-100 | HA-800□-6D-E-200 | HA-800□-24D-E-200 | HA-800□-24D-E-200 |
| Input power supply voltage                    | V                                             |                                         | 200                       | 200            | 100              | 200              | 200               | 200               |
| Rated output                                  | W                                             |                                         | 163                       | 251            |                  | 406              | 754               | 1320              |
| Instantaneous maximum torque <sup>1</sup>     | N•m                                           |                                         | 1.8                       | 3.0            |                  | 6.6              | 13                | 33                |
| Rated torque <sup>1,2</sup>                   | N•m                                           |                                         | 0.52                      | 0.80           |                  | 1.55             | 3.60              | 12.6              |
| Maximum speed <sup>1</sup>                    | rpm                                           |                                         | 6,000                     | 5,600          | 4,800            | 4,800            | 4,000             | 3,000             |
| Rated speed                                   | rpm                                           |                                         | 3,000                     | 3,000          |                  | 2,500            | 2,000             | 1,000             |
| Instantaneous maximum current <sup>1</sup>    | A                                             |                                         | 6.5                       | 8.9            | 15.4             | 18               | 29                | 55                |
| Rated current <sup>1,2</sup>                  | A <sub>rms</sub>                              |                                         | 2.1                       | 2.5            | 4.3              | 4.2              | 7.8               | 20.0              |
| Torque constant <sup>1</sup>                  | N•m/A <sub>rms</sub>                          |                                         | 0.35                      | 0.41           | 0.24             | 0.44             | 0.54              | 0.72              |
| EMF constant <sup>3</sup>                     | V/(rpm)                                       |                                         | 0.037                     | 0.043          | 0.025            | 0.046            | 0.057             | 0.075             |
| Phase resistance (20°C)                       | Ω                                             |                                         | 1.43                      | 1.2            | 0.4              | 0.33             | 0.19              | 0.028             |
| Phase inductance                              | mH                                            |                                         | 2.5                       | 3.0            | 1.0              | 1.4              | 1.2               | 0.29              |
| Moment of Inertia<br>( ) indicates with brake | GD <sup>2</sup> /4                            | ×10 <sup>-4</sup> kg•m <sup>2</sup>     | 0.734<br>(0.828)          | 1.78<br>(2.16) |                  | 6.45<br>(6.83)   | 15.8<br>(19.8)    | 125<br>(141)      |
|                                               | J                                             | ×10 <sup>-4</sup> kgf•cm•s <sup>2</sup> | 7.49<br>(8.45)            | 18.2<br>(22.1) |                  | 65.8<br>(69.7)   | 161<br>(202)      | 1280<br>(1444)    |
| Allowable radial load<br>(static)             | N                                             |                                         | 800                       | 800            |                  | 1200             | 2400              | 4500              |
|                                               | kgf                                           |                                         | 81.6                      | 81.6           |                  | 122              | 245               | 459               |
| Allowable axial load (static)                 | N                                             |                                         | 1900                      | 2400           |                  | 3600             | 5000              | 14000             |
|                                               | kgf                                           |                                         | 194                       | 245            |                  | 367              | 510               | 1429              |
| Rated radial load<br>(At the rated speed)     | N                                             |                                         | 175                       | 185            |                  | 233              | 530               | 1040              |
|                                               | kgf                                           |                                         | 17.9                      | 18.9           |                  | 23.8             | 54.1              | 106.1             |
| Rated axial load<br>(At the rated speed)      | N                                             |                                         | 100                       | 105            |                  | 130              | 180               | 880               |
|                                               | kgf                                           |                                         | 10.2                      | 10.7           |                  | 13.3             | 18.4              | 89.8              |
| Encoder type                                  |                                               |                                         | Absolute encoder          |                |                  |                  |                   |                   |
| Encoder resolution<br>capability              | Single turn motor<br>revolution               |                                         | 2 <sup>17</sup> (131,072) |                |                  |                  |                   |                   |
|                                               | Multi-turn revolution<br>counter <sup>4</sup> |                                         | 2 <sup>16</sup> (65,536)  |                |                  |                  |                   |                   |
| Weight<br>( ) indicates with brake            | kg                                            |                                         | 1.4 (1.5)                 | 2.0 (2.1)      |                  | 3.4 (3.8)        | 5.5 (6.2)         | 17.5 (19.7)       |

The values in the table above show typical values.

<sup>1</sup>: When tested with HA-800.

<sup>2</sup>: This is the value for saturated temperature when installed on the next aluminum heatsink of the following size:

HMAC08: 320 x 320 x 16 [mm], HMAB09: 350 x 350 x 18 [mm], HMAB12: 400 x 400 x 20 [mm], HMAB15: 500 x 500 x 25 [mm], HMAA21A: 650 x 650 x 30 [mm]

<sup>3</sup>: This is the value of the phase EMF constant multiplied by 3.

<sup>4</sup>: The range of the multi revolution counter is from -32,768 to 32,767.

## Precision Linear Actuators LBC Series

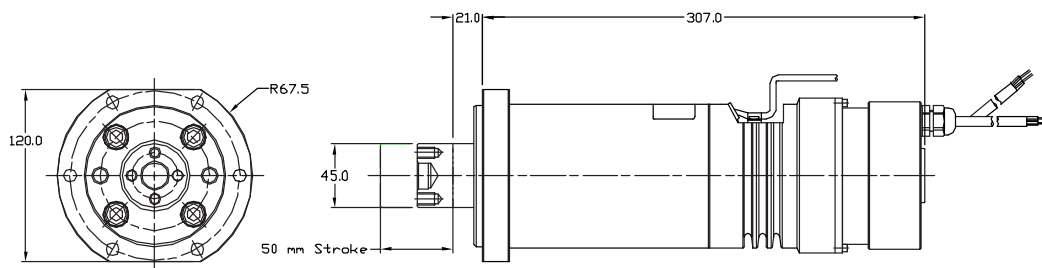


The precision lead screw provides positioning accuracy in the micron range with sub-micron repeatability. The actuator is capable of thrust forces up to 12,000 N. This product is useful for precise positioning of heavy loads or applications where high force is required such as molding equipment or precision presses.


- 12,000 N Force
- 0.32  $\mu\text{m}$  positioning resolution
- Brushless servomotor with incremental encoder
- Integral Limit Switches

### •LBC Series Ratings

| Model         | Item | Drive           | Stroke (mm) | Maximum Driving Force (N) | Resolution ( $\mu\text{m}$ ) | Maximum Speed (mm/s) | Repeatability                          | Outside Dimensions (mm) | Total length (mm) |
|---------------|------|-----------------|-------------|---------------------------|------------------------------|----------------------|----------------------------------------|-------------------------|-------------------|
| LBC-25A-5D6K  |      | Brushless Motor | 50          | 6000                      | 0.32                         | 20                   | $\pm 5\mu\text{m}$ or less/50mm stroke | $\phi 136$              | 353               |
| LBC-25A-5D12K |      | Brushless Motor | 50          | 12000                     | 0.16                         | 10                   |                                        |                         |                   |



Precision Linear Actuators  
**LA Series**

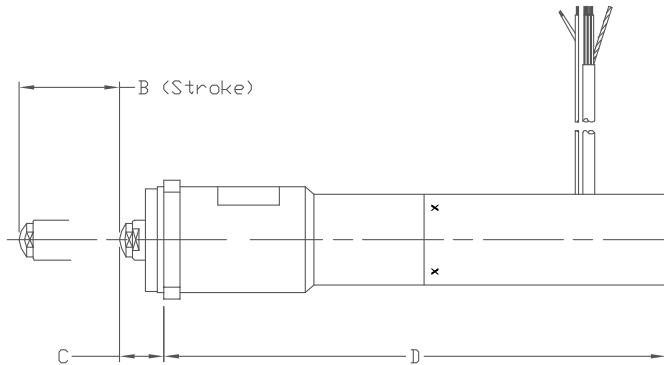
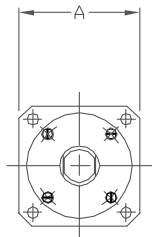
|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>A precision ball screw provides positioning accuracy better than 2 microns and repeatability of 0.1 microns.</p> <p>This product is well suited for measuring instruments, test and inspection systems, optical equipment, semiconductor and LCD manufacturing equipment.</p> <ul style="list-style-type: none"> <li>• 49 N Force</li> <li>• 2 micron positioning accuracy</li> <li>• Brush DC motor with incremental encoder</li> </ul> |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

•LA Series Ratings


| Item<br>Model | Drive    | Stroke<br>(mm) | Maximum<br>Driving Force (N) | Resolution<br>( $\mu\text{m}$ ) | Maximum<br>Speed (mm/s) | One-way<br>Positioning<br>Accuracy                    | Repeatability                                 | Outside<br>Dimensions<br>(mm) | Total length<br>(mm) |
|---------------|----------|----------------|------------------------------|---------------------------------|-------------------------|-------------------------------------------------------|-----------------------------------------------|-------------------------------|----------------------|
| LA-30B-10-F   | DC motor | 10             | 49                           | 0.0174                          | 0.9                     | 2 $\mu\text{m}$ or<br>less/40 $\mu\text{m}$<br>stroke | $\pm 0.1\mu\text{m}$ or<br>less/1mm<br>stroke | 28                            | 143                  |
| LA-32-30-F    | DC motor | 30             | 49                           | 0.0174                          | 0.9                     |                                                       |                                               | 36                            | 164                  |

Unit: mm

| Size      | LA-30B-10F | LA-32-30-F |
|-----------|------------|------------|
| A         | 28         | 36         |
| B(Stroke) | 10         | 30         |
| C         | 10         | 13.3       |
| D         | 133        | 150.8      |



# LAH Series



LAH-46                      LAH-80

A precision ball screw provides positioning accuracy better than 4 microns and repeatability of 1 micron.

This product is well suited for measuring instruments, test and inspection systems, optical equipment, semiconductor and LCD manufacturing equipment.

- 392 to 3000 N Force
- 4 micron positioning accuracy

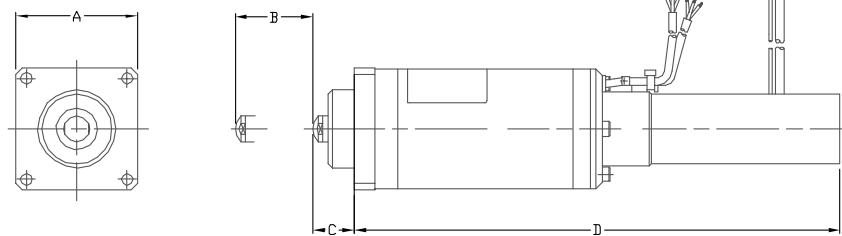
## •LAH Series Ratings

| Model \ Item     | Drive         | Stroke (mm) | Maximum Driving Force (N) | Resolution (μm) | Maximum Speed (mm/s) | One-way Positioning Accuracy | Repeatability             | Outside Dimensions (mm) | Total length (mm) |
|------------------|---------------|-------------|---------------------------|-----------------|----------------------|------------------------------|---------------------------|-------------------------|-------------------|
| LAH-46-1002-F    | DC motor      | 10          | 392                       | 0.069           | 3.7                  | 4μm or less/.02mm stroke     | ±0.5μm or less/1mm stroke | 47                      | 185               |
| LAH-46-3002-F    | DC motor      | 30          | 392                       | 0.069           | 3.7                  |                              |                           | 47                      | 204               |
| LAH-80-5020-F-PA | Stepper motor | 50          | 3000                      | 2               | 10                   | 4μm or less/2mm stroke       | ±1μm or less/1mm stroke   | 85                      | 320               |

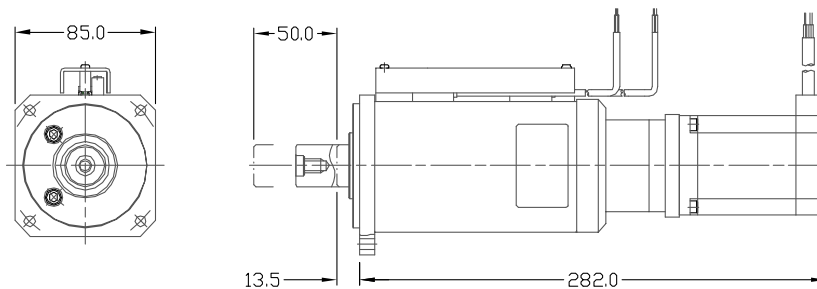
Unit: mm

| Model \ Symbol | LAH-46-1002-F | LAH-46-3002-F |
|----------------|---------------|---------------|
| A              | 47            | 47            |
| B(Stroke)      | 10            | 30            |
| C              | 16            | 16            |
| D              | 169           | 188           |

LAH-46



LAH-80



## Galvano Optical Scanners LSA Series



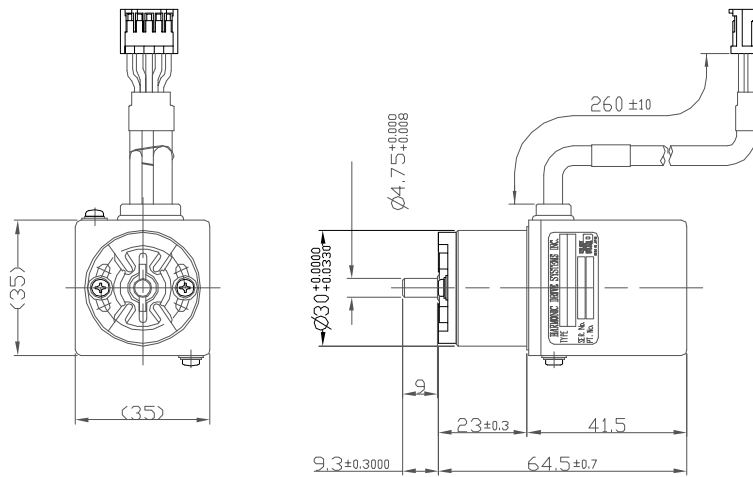
Galvanometric Laser Scanning Actuator. LSA laser scanning actuators are Galvanometric scanners capable of scanning at high speed with high precision. A newly developed optical sensor and our unique moving magnet motors are used in the LSA Series laser scanning actuators

- High response frequency
- High accuracy / repeatability
- Continuous scanning or discrete pointing

### •LSA Series Ratings


| Item                                                      |                       | Model | LSA-10A-30 |
|-----------------------------------------------------------|-----------------------|-------|------------|
| Maximum Angular Runout                                    | Degrees               |       | ±15        |
| Rotor Moment of Inertia                                   | $g \cdot cm^2$        |       | 1.9        |
| Torque Constant                                           | $N \cdot m / A_{rms}$ |       | 0.008      |
| Coil Resistance                                           | $\Omega$              |       | 0.28       |
| Coil Inductance                                           | mH                    |       | 0.098      |
| Sensor Linearity (At full scale)                          | %                     |       | ±0.06      |
| Sensor Angle Sensitivity                                  | $V/^\circ$            |       | 0.275      |
| Offset Drift                                              | $\mu rad/^\circ C$    |       | 25         |
| Scale Drift                                               | $\% / ^\circ C$       |       | 0.005      |
| Repeatability (Excluding offset/scale drift) <sup>1</sup> | mrad                  |       | ±5         |
| 1°step Response Load Condition: $(2g \cdot cm^2)^2$       | ms                    |       | 0.5        |
| Sensor Power Supply                                       | V                     |       | 5±5%-15±5% |
| Sensor Power Consumption                                  | 5V±5%                 | mA    | 90(Max)    |
|                                                           | -15V±5%               | mA    | 120(Max)   |
| Weight                                                    | g                     |       | 180        |

<sup>1</sup> All angles are mechanical angles.



LSA-10A-30

# Micro Encoder Series

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>Available in two sizes, the micro encoders are ultra-miniature, high resolution incremental encoders.</p> <p>The ultra-micro model</p> <ul style="list-style-type: none"> <li>Dimensions <math>\varnothing 7.5 \times 10.5\text{mm}</math>, Incremental encoder 360 line count</li> <li>Output phases: A, B, Z</li> <li>Square wave open collector output</li> </ul> <p>The micro model</p> <ul style="list-style-type: none"> <li>Dimensions <math>\varnothing 13 \times 20\text{mm}</math>, Incremental encoder 1000 line count</li> <li>Output phases: A, B, Z</li> <li>Square wave open collector output</li> <li>Hollow shaft is also available</li> </ul> |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## •Micro Encoder Series Ratings

| Item                                                                           | Model | MES-6- <input type="checkbox"/> PC<br>Number of Pulses                                                                                 | ME <input type="checkbox"/> -9- <input type="checkbox"/> PC<br>Shaft Shape<br>*S: Single Shaft<br>*H: Hollow Shaft<br>Number of Pulses |
|--------------------------------------------------------------------------------|-------|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Power Supply                                                                   |       | DC5V $\pm$ 10%                                                                                                                         | DC5V $\pm$ 10%                                                                                                                         |
| Current Consumption                                                            |       | 30mA or less (under no load)                                                                                                           | 40mA or less (under no load)                                                                                                           |
| Detection System                                                               |       | Incremental                                                                                                                            | Incremental                                                                                                                            |
| Number of Output Pulses (Standard)<br>[Number of Pulses/Number of Revolutions] |       | 100 200 300 360                                                                                                                        | 100 200 300 360 500   1000                                                                                                             |
| Output Phases                                                                  |       | A, B and Z phases                                                                                                                      | A, B and Z phases                                                                                                                      |
| Output Mode                                                                    |       | Square wave, open collector output                                                                                                     | Square wave, open collector output                                                                                                     |
| Maximum Response Frequency<br>(Number of Response Pulses)                      |       | 100kHz                                                                                                                                 | 100kHz                                                                                                                                 |
| Output Phase Difference                                                        |       | Difference between A and B Phases $90^{\circ} \pm 45^{\circ}$<br>( $T/4 \pm T/8$ ), Z Phase $T \pm T/2$ (See output waveform diagram.) | Difference between A and B Phases $90^{\circ} \pm 45^{\circ}$<br>( $T/4 \pm T/8$ ), Z Phase $T \pm T/2$ (See output waveform diagram.) |
| Permissible Maximum Positioning Speed<br>(Mechanical)                          |       | 6000rpm                                                                                                                                | 6000rpm                                                                                                                                |
| Operating Temperature and Humidity                                             |       | 0°C-60°C RH 35%-90%<br>No condensation permitted                                                                                       | 0°C-60°C RH 35%-90%<br>No condensation permitted                                                                                       |
| Storage Ambient Temperature                                                    |       | -20°C-80°C                                                                                                                             | -20°C-80°C                                                                                                                             |
| Weight                                                                         |       | 5g                                                                                                                                     | 10g                                                                                                                                    |

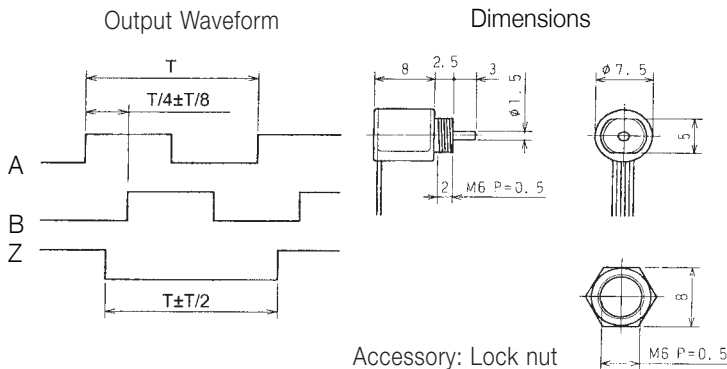
## •Model Ordering Code

ME- X- X- XXXPX  
1 2 3 4

- 1 Shaft shape : S, H\*\*
- 2 Size : 6, 9
- 3 Output pulses : 100, 200, 300, 360, 500\*\*, 1000\*\*
- 4 Output circuit : C = Open collector output  
None = Voltage output \*\*\*

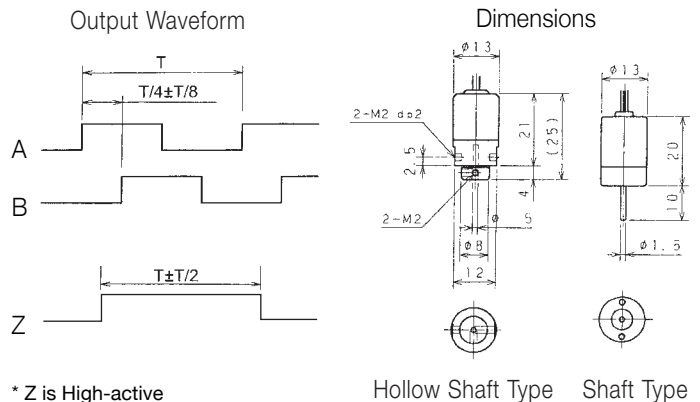
\*\* Hollow shaft feature and line counts of 500 and 1000 are only available in size 9  
\*\*\* Voltage output is only available in size 9.

### 06 SERIES



\* Z is Low-active

### 09 SERIES



\* Z is High-active

# Servo Drivers



## •Servo Driver Specifications

### •DC Digital Servo Drive DCJ Series

| MODEL      | Vdc   | Ic (Apk) | Ip (Apk) | Control Modes                                                                                                                                       | Control Interface                                                                                                                                                             | Encoder                                   |
|------------|-------|----------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| DCJ-055-09 | 20-55 | 3        | 9        | <ul style="list-style-type: none"> <li>· Indexer, Point-to-Point</li> <li>· Camming, Gearing</li> <li>· Position, Velocity, Torque (PVT)</li> </ul> | CANopen/DeviceNet<br>ASCII and discrete I/O,<br>Stepper commands<br>± 10V position/velocity/torque command<br>PWM velocity/torque command<br>Master encoder (Gearing/Camming) | 14 Wire Standard Incremental Encoder Type |
| DCJ-055-18 | 20-55 | 6        | 18       |                                                                                                                                                     |                                                                                                                                                                               |                                           |
| DCJ-090-03 | 20-90 | 1        | 3        |                                                                                                                                                     |                                                                                                                                                                               |                                           |
| DCJ-090-09 | 20-90 | 3        | 9        |                                                                                                                                                     |                                                                                                                                                                               |                                           |
| DCJ-090-12 | 20-91 | 6        | 12       |                                                                                                                                                     |                                                                                                                                                                               |                                           |



### •DC Digital Servo Drive DDP Series

| MODEL      | Vdc | Ic (Apk) | Ip (Apk) | Control Modes                                                                                                                                       | Control Interface                                                                                                                                                             | Encoder                                   |
|------------|-----|----------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| DDP-090-09 | 90  | 3        | 9        | <ul style="list-style-type: none"> <li>· Indexer, Point-to-Point</li> <li>· Camming, Gearing</li> <li>· Position, Velocity, Torque (PVT)</li> </ul> | CANopen/DeviceNet<br>ASCII and discrete I/O,<br>Stepper commands<br>± 10V position/velocity/torque command<br>PWM velocity/torque command<br>Master encoder (Gearing/Camming) | 14 Wire Standard Incremental Encoder Type |
| DDP-090-18 | 90  | 6        | 18       |                                                                                                                                                     |                                                                                                                                                                               |                                           |
| DDP-090-36 | 90  | 12       | 36       |                                                                                                                                                     |                                                                                                                                                                               |                                           |
| DDP-055-18 | 55  | 6        | 18       |                                                                                                                                                     |                                                                                                                                                                               |                                           |
| DDP-180-09 | 180 | 3        | 9        |                                                                                                                                                     |                                                                                                                                                                               |                                           |
| DDP-180-18 | 180 | 6        | 18       |                                                                                                                                                     |                                                                                                                                                                               |                                           |



### •DC Digital Servo Drive DEP Series

| MODEL      | Vdc | Ic (Apk) | Ip (Apk) | Control Modes                                                                                                                                       | Control Interface                                                                                                                   | Encoder                                                                                                                                                                          |
|------------|-----|----------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DEP-090-09 | 90  | 3        | 9        | <ul style="list-style-type: none"> <li>· Indexer, Point-to-Point</li> <li>· Camming, Gearing</li> <li>· Position, Velocity, Torque (PVT)</li> </ul> | CANopen over EtherCAT (CoE)<br>ASCII and discrete I/O<br>± 10V position/velocity/torque command<br>Master encoder (Gearing/Camming) | 14 Wire Standard Incremental Encoder Type<br>EnDat 2.1/2.2<br>4 Wire Serial Communication Incremental Encoder<br>HD Absolute Encoder A Type<br>Biss-C (multi-turn, Bi-direction) |
| DEP-090-18 | 90  | 6        | 18       |                                                                                                                                                     |                                                                                                                                     |                                                                                                                                                                                  |
| DEP-090-36 | 90  | 12       | 36       |                                                                                                                                                     |                                                                                                                                     |                                                                                                                                                                                  |
| DEP-055-18 | 55  | 6        | 18       |                                                                                                                                                     |                                                                                                                                     |                                                                                                                                                                                  |
| DEP-180-09 | 180 | 3        | 9        |                                                                                                                                                     |                                                                                                                                     |                                                                                                                                                                                  |
| DEP-180-18 | 180 | 6        | 18       |                                                                                                                                                     |                                                                                                                                     |                                                                                                                                                                                  |
| DEP-090-09 | 90  | 3        | 9        |                                                                                                                                                     |                                                                                                                                     |                                                                                                                                                                                  |
| DEP-090-18 | 90  | 6        | 18       |                                                                                                                                                     |                                                                                                                                     |                                                                                                                                                                                  |
| DEP-090-36 | 90  | 12       | 36       |                                                                                                                                                     |                                                                                                                                     |                                                                                                                                                                                  |
| DEP-090-09 | 90  | 3        | 9        |                                                                                                                                                     |                                                                                                                                     |                                                                                                                                                                                  |
| DEP-090-18 | 90  | 6        | 18       |                                                                                                                                                     |                                                                                                                                     |                                                                                                                                                                                  |
| DEP-090-36 | 90  | 12       | 36       |                                                                                                                                                     |                                                                                                                                     |                                                                                                                                                                                  |



### •AC Digital Servo Drive RTL Series

| MODEL      | Vac     | Ic (Apk) | Ip (Apk) | Control Modes                                                                                                                                       | Control Interface                                                                                                                                                             | Encoder                                   |
|------------|---------|----------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| RTL-230-18 | 100-240 | 6        | 18       | <ul style="list-style-type: none"> <li>· Indexer, Point-to-Point</li> <li>· Camming, Gearing</li> <li>· Position, Velocity, Torque (PVT)</li> </ul> | CANopen/DeviceNet<br>ASCII and discrete I/O,<br>Stepper commands<br>± 10V position/velocity/torque command<br>PWM velocity/torque command<br>Master encoder (Gearing/Camming) | 14 Wire Standard Incremental Encoder Type |
| RTL-230-36 | 100-240 | 12       | 36       |                                                                                                                                                     |                                                                                                                                                                               |                                           |
| RTL-230-40 | 100-240 | 20       | 40       |                                                                                                                                                     |                                                                                                                                                                               |                                           |



### •AC Digital Servo Drive REL Series

| MODEL      | Vac     | Ic (Apk) | Ip (Apk) | Control Modes                                                                                                                                       | Control Interface                                                                                                                                                                       | Encoder                                                                                                                                                                                                        |
|------------|---------|----------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| REL-230-18 | 100-240 | 6        | 18       | <ul style="list-style-type: none"> <li>· Indexer, Point-to-Point</li> <li>· Camming, Gearing</li> <li>· Position, Velocity, Torque (PVT)</li> </ul> | CANopen over EtherCAT (CoE)<br>ASCII and discrete I/O,<br>Stepper commands<br>± 10V position/velocity/torque command<br>PWM velocity/torque command<br>Master encoder (Gearing/Camming) | 14 Wire Standard Incremental Encoder Type<br>4 Wire Serial Communication Incremental Encoder<br>HD Absolute Encoder S Type<br>HD Absolute Encoder A Type<br>Biss-C (multi-turn, Bi-direction)<br>EnDat 2.1/2.2 |
| REL-230-36 | 100-240 | 12       | 36       |                                                                                                                                                     |                                                                                                                                                                                         |                                                                                                                                                                                                                |
| REL-230-18 | 100-240 | 6        | 18       |                                                                                                                                                     |                                                                                                                                                                                         |                                                                                                                                                                                                                |
| REL-230-36 | 100-240 | 12       | 36       |                                                                                                                                                     |                                                                                                                                                                                         |                                                                                                                                                                                                                |
| REL-230-18 | 100-240 | 6        | 18       |                                                                                                                                                     |                                                                                                                                                                                         |                                                                                                                                                                                                                |
| REL-230-36 | 100-240 | 12       | 36       |                                                                                                                                                     |                                                                                                                                                                                         |                                                                                                                                                                                                                |
| REL-230-18 | 100-240 | 6        | 18       |                                                                                                                                                     |                                                                                                                                                                                         |                                                                                                                                                                                                                |
| REL-230-36 | 100-240 | 12       | 36       |                                                                                                                                                     |                                                                                                                                                                                         |                                                                                                                                                                                                                |
| REL-230-40 | 100-240 | 20       | 40       |                                                                                                                                                     |                                                                                                                                                                                         |                                                                                                                                                                                                                |
| REL-230-40 | 100-240 | 20       | 40       |                                                                                                                                                     |                                                                                                                                                                                         |                                                                                                                                                                                                                |





# Recommended Driver

## •Combinations with Servo Drive and Actuator

### •DC Digital Servo Drive DCJ Series

| MODEL      | Vdc   | Ic (Apk) | Ip (Apk) | Supply Voltage | Combination Actuator                                                                                                |
|------------|-------|----------|----------|----------------|---------------------------------------------------------------------------------------------------------------------|
| DCJ-055-09 | 20-55 | 3        | 9        | DC24V          | FHA-8C-30 / 50 / 100-US200-E, RSF-8B-30 / 50 / 100-F100-24B, RSF-5A-30 / 50 / 100-US050, RSF-3B-30 / 50 / 100-US020 |
| DCJ-055-18 | 20-55 | 6        | 18       |                | FHA-11C-30 / 50 / 100-US200-E                                                                                       |
| DCJ-090-03 | 20-90 | 1        | 3        |                | -                                                                                                                   |
| DCJ-090-09 | 20-90 | 3        | 9        |                | -                                                                                                                   |
| DCJ-090-12 | 20-90 | 6        | 12       |                | -                                                                                                                   |

### •DC Digital Servo Drive DDP Series

| MODEL      | Vdc | Ic (Apk) | Ip (Apk) | Supply Voltage | Combination Actuator                                                                                                             |
|------------|-----|----------|----------|----------------|----------------------------------------------------------------------------------------------------------------------------------|
| DDP-090-09 | 90  | 3        | 9        | DC24V          | FHA-8C-30 / 50 / 100-US200-E, RSF-8B-30 / 50 / 100-F100-24B, RSF-5A-30 / 50 / 100-US050, RSF-3B-30 / 50 / 100-US020              |
| DDP-090-18 | 90  | 6        | 18       |                | FHA-11C-30 / 50 / 100-US200-E                                                                                                    |
| DDP-090-36 | 90  | 12       | 36       |                | FHA-14C-30 / 50 / 100-US200-E, FHA-17C50* / 100 / 160-US250-E-SP, RSF-14B-30 / 50 / 100-F100-24B, RSF-11B-30 / 50 / 100-F100-24B |
| DDP-055-18 | 55  | 6        | 18       |                | -                                                                                                                                |
| DDP-180-09 | 180 | 3        | 9        |                | -                                                                                                                                |
| DDP-180-18 | 180 | 6        | 18       |                | -                                                                                                                                |

### •DC Digital Servo Drive DEP Series

| MODEL      | Vdc | Ic (Apk) | Ip (Apk) | Supply Voltage | Combination Actuator                                                                                                                                      |
|------------|-----|----------|----------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| DEP-090-09 | 90  | 3        | 9        | DC24V          | FHA-8C-30 / 50 / 100-US200 / 12S176b / E200, RSF-8B-30 / 50 / 100-F100-24B, RSF-5A-30 / 50 / 100-US050, RSF-3B-30 / 50 / 100-US020                        |
| DEP-090-18 | 90  | 6        | 18       |                | FHA-11C-30 / 50 / 100-US200 / 12S176b / E200                                                                                                              |
| DEP-090-36 | 90  | 12       | 36       |                | FHA-14C-30 / 50 / 100-US200 / 12S176b / E200, FHA-17C50* / 100* / 160-US250 / E250 / S248, RSF-14B-30 / 50 / 100-F100-24B, RSF-11B-30 / 50 / 100-F100-24B |

### •AC Digital Servo Drive RTL Series

| MODEL      | Vac     | Ic (Apk) | Ip (Apk) | Supply Voltage | Combination Actuator                                                                                                                                      |
|------------|---------|----------|----------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| RTL-230-18 | 100-240 | 6        | 18       | AC100/200V     | FHA-8C-30 / 50 / 100-US200 / 12S176b / E200, FHA-11C-30 / 50 / 100-US200 / 12S176b / E200, FHA-14C-30 / 50 / 100-US200 / 12S176b / E200                   |
|            |         |          |          | AC100V         | FHA-17C-50 / 100 / 160-US250 / E250 / S248, FHA-25C-100 / 160-US250 / E250 / S248, FHA-32C-160-US250 / E250 / S248                                        |
|            |         |          |          | AC200V         | FHA-17C-50 / 100 / 160-US250 / E250 / S248, FHA-25C-100 / 160-US250 / E250 / S248, FHA-32C-160-US250 / E250 / S248, FHA-40C-100 / 160-US250 / E250 / S248 |
| RTL-230-36 | 100-240 | 12       | 36       | AC100V         | FHA-25C-50-US250 / E250 / S248, FHA-32C-50 / 100-US250 / E250 / S248                                                                                      |
|            |         |          |          | AC200V         | FHA-40C-50-US250 / E250 / S248                                                                                                                            |
| RTL-230-40 | 100-240 | 20       | 40       | AC200V         | -                                                                                                                                                         |

### •AC Digital Servo Drive REL Series

| MODEL      | Vac     | Ic (Apk) | Ip (Apk) | Supply Voltage | Combination Actuator                                                                                                                                                       |
|------------|---------|----------|----------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| REL-230-18 | 100-240 | 6        | 18       | AC100/200V     | FHA-8C-30 / 50 / 100-US200 / 12S17b / E200, FHA-11C-30 / 50 / 100-US200 / 12S17b / E200, FHA-14C-30 / 50 / 100-US200 / 12S17b / E200                                       |
|            |         |          |          | AC100V         | FHA-17C-50 / 100 / 160-US250 / E250 / S248, FHA-25C-100 / 160-US250 / E250 / S248, FHA-32C-160-US250 / E250 / S248                                                         |
|            |         |          |          | AC200V         | FHA-17C-50 / 100 / 160-US250 / E250 / S248, FHA-25C-50 / 100 / 160-US250 / E250 / S248, FHA-32C-50 / 100 / 160-US250 / E250 / S248, FHA-40C-100 / 160-US250 / E250 / S248  |
| REL-230-36 | 100-240 | 12       | 36       | AC100V         | FHA-25C-50-US250 / E250 / S248, FHA-32C-50 / 100-US250 / E250 / S248                                                                                                       |
|            |         |          |          | AC200V         | FHA-40C-50-US250 / E250 / S248                                                                                                                                             |
| REL-230-18 | 100-240 | 6        | 18       | AC200V         | SHA-20SG-51 / 81 / 101 / 121 / 161, SHA-20CG-50 / 80 / 100 / 120 / 160, SHA-25SG-51 / 81 / 101 / 121 / 161, SHA-25CG-50 / 80 / 100 / 120 / 160, SHA-32SG-161, SHA-32CG-160 |
| REL-230-36 | 100-240 | 12       | 36       |                | SHA-32SG-51 / 81 / 101 / 121, SHA-32CG-50 / 80 / 100 / 120, SHA-40SG-121 / 161, SHA-40CG-120 / 160                                                                         |
| REL-230-40 | 100-240 | 20       | 40       |                | SHA-40SG-51 / 81 / 101, SHA-40CG-50 / 80 / 100                                                                                                                             |

# Servo Drivers



|  |         |
|--|---------|
|  | HA-800A |
|  | HA-800B |
|  | HA-800C |

## •Servo Driver Specifications

### •AC Servo Digital Drivers HA-800 Series

| Item                                     | Model                                                          | HA-800□-1                                                                                                                                                                                                                                                                                                                                                                              | HA-800□-3 | HA-800□-6 | HA-800□-24                            |
|------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|---------------------------------------|
| Rated Current*                           |                                                                | 1.5A                                                                                                                                                                                                                                                                                                                                                                                   | 3.0A      | 6.0A      | 24.0A                                 |
| Maximum Current*                         |                                                                | 4.0A                                                                                                                                                                                                                                                                                                                                                                                   | 9.5A      | 19.0A     | 55.0A                                 |
| Power Supply                             | Main Circuit                                                   | AC100~115V (Single phase) or AC200~230V (Single phase/3 phases) +10~-15%                                                                                                                                                                                                                                                                                                               |           |           | AC200~230V (3 phases)<br>+10~-15%     |
|                                          | Control Circuit                                                | AC100~115V (Single phase) or AC200~230V (Single phase) +10~-15%                                                                                                                                                                                                                                                                                                                        |           |           | AC200~230V (Single phase)<br>+10~-15% |
| Power Supply Frequency                   |                                                                | 50/60Hz                                                                                                                                                                                                                                                                                                                                                                                |           |           |                                       |
| Environmental Conditions                 |                                                                | :0~50°C, :-20~65°C, :95%RH<br>Operating temperature: 0 to 50°C. Storage temperature: 20 to 65°C. Operating/Storage humidity: 95% RH or less and no condensation.<br>Resistance to vibration: 4.9m/s <sup>2</sup> (Frequency: 10 to 55Hz). Shock resistance: 98m/s <sup>2</sup> . Ambient atmosphere: There should be no dust, metal powder, corrosive gas, flammable gas and oil mist. |           |           |                                       |
| Control Mode                             |                                                                | Position control, speed control, torque control (Available to change from I/O)                                                                                                                                                                                                                                                                                                         |           |           |                                       |
| Position Command Pulse                   |                                                                | Line driver type: maximum response frequency. 2-pulse system, 1-pulse system: 2-phase pulse system: 200kHz<br>Open collector type: maximum response frequency 200kHz                                                                                                                                                                                                                   |           |           |                                       |
| Monitor Terminal                         |                                                                | 3ch motor rpm, current command, general-purpose output (parameter selection)                                                                                                                                                                                                                                                                                                           |           |           |                                       |
| Regenerative Processing                  | External regenerative resistance<br>Mounting terminal attached | Regenerative resistance installed<br>Mounting terminal for the external regenerative resistance attached                                                                                                                                                                                                                                                                               |           |           |                                       |
| Regenerative Resistance Absorption Power | -                                                              | 3W Max                                                                                                                                                                                                                                                                                                                                                                                 | 8W Max    | 90W Max   |                                       |
| Surge Current Suppress Function          |                                                                | Built-in (CPU control by the main circuit voltage monitoring)                                                                                                                                                                                                                                                                                                                          |           |           |                                       |
| Weight                                   |                                                                | 1kg                                                                                                                                                                                                                                                                                                                                                                                    | 1.2kg     | 5.8kg     |                                       |

\*The values shown represent the driver rated and maximum currents. Currents are adjusted to match the actuator current ratings before shipment.

### •HA-800B (MECHATROLINK Compatible) Communication Specification

| Item                              | Specification                        |
|-----------------------------------|--------------------------------------|
| MECHATROLINK Version              | MECHATROLINK-II                      |
| Transmission Speed                | 10Mbps                               |
| Maximum Transmission Distance     | 50m                                  |
| Minimum Distance Between Channels | 0.5m                                 |
| Transmission Medium               | Shielded twist pair cable (Two-core) |
| Number of Connected Station       | Max: 30 slave stations               |
| Topology                          | Bus                                  |
| Communication Cycle               | 1, 1.5, 2, 3, 4, 5ms                 |
| Communication Method              | Master-slave full synchronization    |
| Encoding                          | Manchester encoding                  |
| Data Length                       | 17 bytes/32 bytes, selectable        |
| Number of Connectable Units       | Max: 30 units                        |

- 1 A repeater is required when communicating with 17 or more drives or if the total distance is 30m or longer when communicating with 16 or more drives. The maximum allowable number of units connected depends on the communication cycle setting and the number of allowable retries. For details, please see MECHATROLINK Association web site (<http://www.mechatrolink.org>).
- 2 Use MP2300 (Yaskawa Electric) controller.
- 3 Be sure to use the dedicated cable. Do not use commercially available USB cable.
- 4 When CC-Link Ver 1.00 compatible cable coexists: The total cable extension and the inter-office cable length will be the specification of Ver 1.00.

### •HA-800C (CC-LINK Compatible) Communication Specification

| Item                        | Specification                                                                       |                |         |         |       |        |
|-----------------------------|-------------------------------------------------------------------------------------|----------------|---------|---------|-------|--------|
| CC-LINK Version             | Ver1.10                                                                             |                |         |         |       |        |
| Station Type                | Remote device station                                                               |                |         |         |       |        |
| Communication Speed         | 10M/5M/2.5M/625K/156Kbps                                                            |                |         |         |       |        |
| Communication Method        | Broadcast polling method                                                            |                |         |         |       |        |
| Synchronization Method      | Frame synchronization method                                                        |                |         |         |       |        |
| Encoding Method             | NRZI                                                                                |                |         |         |       |        |
| Transmission Path Format    | Bus format (EIA RS-485 compliant)                                                   |                |         |         |       |        |
| Error Control Method        | CRC (X <sup>16</sup> +X <sup>12</sup> +X <sup>6</sup> +1)                           |                |         |         |       |        |
| Connection Cable            | CC-Link, Ver.1.10 compatible cable (Shielded twist pair cable (Three-core))         |                |         |         |       |        |
| Transmission Format         | HDLC compliant                                                                      |                |         |         |       |        |
| Remote Channel              | 1~64                                                                                |                |         |         |       |        |
| Number of Occupied Stations | 1 station, 2 station                                                                |                |         |         |       |        |
| Cable Length                | Communication Speed                                                                 | 156kbps        | 625kbps | 2.5Mbps | 5Mbps | 10Mbps |
|                             | Maximum Total Cable Extension                                                       | 1,200m         | 900m    | 400m    | 160m  | 100m   |
|                             | Cable Length                                                                        | 0.2m or longer |         |         |       |        |
| Number of Connectable Units | Maximum 42 units with remote device station only, can be shared with other devices. |                |         |         |       |        |

# Servo Drivers



## •Servo Driver Specifications

### •AC Servo Digital Drivers (DC24V) HA-680 Series

| Item             | Model           | HA-680-4-24                                         |      | HA-680-6-24 |
|------------------|-----------------|-----------------------------------------------------|------|-------------|
| Rated Current*   |                 | 1.8A                                                | 3.9A | 6.0A        |
| Maximum Current* |                 | 3.4A                                                | 8.4A | 16.5A       |
| Power Supply     | Main Circuit    | DC24V(20~28V)                                       |      |             |
|                  | Control Circuit | DC24V(20~28V)                                       |      |             |
| Control System   |                 | Sine wave PWM control, switching frequency: 12.5kHz |      |             |
| Control Mode     |                 | Position control, speed control, torque control     |      |             |
| Weight           |                 | 230g                                                |      |             |

\* The values shown represent the driver rated and maximum currents. Currents are adjusted to match the actuator current ratings before shipment.

| Item                 | Model           | HA-680ML-4-24<br>HA-680ML-6-24                                                        | HA-680CL-4-24<br>HA-680CL-6-24 | HA-680ML-4B-24<br>HA-680ML-6B-24 | HA-680CL-4B-24<br>HA-680CL-6B-24 |
|----------------------|-----------------|---------------------------------------------------------------------------------------|--------------------------------|----------------------------------|----------------------------------|
| Power Source Voltage | Main Circuit    | DC24V(20~28V)                                                                         |                                |                                  |                                  |
|                      | Control Circuit | DC24V(20~28V)                                                                         |                                |                                  |                                  |
| Control System       |                 | Sine wave PWM method, switching frequency: 12.5kHz                                    |                                |                                  |                                  |
| Encoder              |                 | 4-line spec., serial transmission method, line driver input                           |                                | 14-line spec., line driver input |                                  |
| Input/Output Signal  |                 | DI: 5 Points (Insulation by photo-coupler), DO:4 Points (Insulation by photo-coupler) |                                |                                  |                                  |
| Encoder Monitor      |                 | Phases A, B, Z line driver output                                                     |                                |                                  |                                  |
| Control Mode         |                 | Position control                                                                      |                                |                                  |                                  |
| Weight               |                 | MECHATROLINK compatible: 260g, CC-Link compatible: 270g                               |                                |                                  |                                  |

Note: Parameter settings for the driver are adjusted to match a specific actuator before shipment. This driver cannot be used in combination with a different actuator.

### •HA-680ML (MECHATROLINK Compatible) Communication Specification

| Item                              | Specification                        |
|-----------------------------------|--------------------------------------|
| MECHATROLINK Version              | MECHATROLINK-II                      |
| Transmission Speed                | 10Mbps                               |
| Maximum Transmission Distance     | 50m                                  |
| Minimum Distance Between Channels | 0.5m                                 |
| Transmission Medium               | Shielded twist pair cable (Two-core) |
| Number of Connected Station       | Max: 30 slave stations               |
| Topology                          | Bus                                  |
| Communication Cycle               | 1, 2, 3, 4, 5ms                      |
| Communication Method              | Master-slave full synchronization    |
| Encoding                          | Manchester encoding                  |
| Data Length                       | 17 bytes/32 bytes, selectable        |
| Number of Connectable Units       | Max: 30 units                        |

1 A repeater is required when communication with 17 units or more is performed or the total extended distance is 30m or longer when communication with 16 units or more is performed. The maximum number of connectable units restricted through setting communication cycle and the number of retry. For details, please see MECHATROLINK Association web site (<http://www.mechatrolink.org>).

### •HA-680CL (CC-LINK Compatible) Communication Specification

| Item                        | Specification                                                                       |                |         |         |       |        |
|-----------------------------|-------------------------------------------------------------------------------------|----------------|---------|---------|-------|--------|
| CC-LINK Version             | Ver1.10                                                                             |                |         |         |       |        |
| Station Type                | Remote device station                                                               |                |         |         |       |        |
| Communication Speed         | 10M/5M/2.5M/625K/156Kbps                                                            |                |         |         |       |        |
| Communication Method        | Broadcast polling method                                                            |                |         |         |       |        |
| Synchronization Method      | Frame synchronization method                                                        |                |         |         |       |        |
| Encoding Method             | NRZI                                                                                |                |         |         |       |        |
| Transmission Path Format    | Bus format (EIA RS-485 compliant)                                                   |                |         |         |       |        |
| Error Control Method        | CRC (X <sup>16</sup> +X <sup>12</sup> +X <sup>6</sup> +1)                           |                |         |         |       |        |
| Connection Cable            | CC-Link, Ver.1.10 compatible cable (Shielded twist pair cable (Three-core))         |                |         |         |       |        |
| Transmission Format         | HDLC compliant                                                                      |                |         |         |       |        |
| Remote Control              | 1~64                                                                                |                |         |         |       |        |
| Number of Occupied Stations | 1 station                                                                           |                |         |         |       |        |
| Cable Length                | Communication Speed                                                                 | 156kbps        | 625kbps | 2.5Mbps | 5Mbps | 10Mbps |
|                             | Maximum Total Cable Extension                                                       | 1,200m         | 900m    | 400m    | 160m  | 100m   |
|                             | Cable Length                                                                        | 0.2m or longer |         |         |       |        |
| Number of Connectable Units | Maximum 42 units with remote device station only, can be shared with other devices. |                |         |         |       |        |

# Cup Type CSF Series



The Harmonic Drive® CSF gears can be directly integrated into your machinery/ equipment. Available in a variety of sizes and ratios, you can select the unit that is most suitable for your needs.

- Zero backlash
- Compact design
- High torque capacity
- High torsional stiffness
- High positioning accuracy
- Housed configuration is available (see p. 42)

$L_{10}$  Life: 7,000 h

## •CSF Series Ratings

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 8            | 30    | 0.9                     | 8     | 1.8                            | 16    | 3.3                             | 29    |
|              | 50    | 1.8                     | 16    | 3.3                            | 29    | 6.6                             | 58    |
|              | 100   | 2.4                     | 21    | 4.8                            | 42    | 9.0                             | 80    |
| 11           | 30    | 2.2                     | 19    | 4.5                            | 40    | 8.5                             | 75    |
|              | 50    | 3.5                     | 31    | 8.3                            | 73    | 17                              | 150   |
|              | 100   | 5.0                     | 44    | 11                             | 97    | 25                              | 221   |
| 14           | 30    | 4.0                     | 35    | 9.0                            | 80    | 17                              | 150   |
|              | 50    | 5.4                     | 48    | 18                             | 159   | 35                              | 310   |
|              | 80    | 7.8                     | 69    | 23                             | 204   | 47                              | 416   |
|              | 100   | 7.8                     | 69    | 28                             | 248   | 54                              | 478   |
| 17           | 30    | 8.8                     | 78    | 16                             | 142   | 30                              | 266   |
|              | 50    | 16                      | 142   | 34                             | 301   | 70                              | 620   |
|              | 80    | 22                      | 195   | 43                             | 381   | 87                              | 770   |
|              | 100   | 24                      | 212   | 54                             | 478   | 108                             | 956   |
| 20           | 120   | 24                      | 212   | 54                             | 478   | 86                              | 761   |
|              | 30    | 15                      | 133   | 27                             | 239   | 50                              | 443   |
|              | 50    | 25                      | 221   | 56                             | 496   | 98                              | 867   |
|              | 80    | 34                      | 301   | 74                             | 655   | 127                             | 1124  |
|              | 100   | 40                      | 354   | 82                             | 726   | 147                             | 1301  |
| 25           | 120   | 40                      | 354   | 87                             | 770   | 147                             | 1301  |
|              | 160   | 40                      | 354   | 92                             | 814   | 147                             | 1301  |
|              | 30    | 27                      | 239   | 50                             | 443   | 95                              | 841   |
|              | 50    | 39                      | 345   | 98                             | 867   | 186                             | 1646  |
|              | 80    | 63                      | 558   | 137                            | 1212  | 255                             | 2257  |
|              | 100   | 67                      | 593   | 157                            | 1389  | 284                             | 2513  |
| 32           | 120   | 67                      | 593   | 167                            | 1478  | 304                             | 2690  |
|              | 160   | 67                      | 593   | 176                            | 1558  | 314                             | 2779  |
|              | 30    | 54                      | 478   | 100                            | 885   | 200                             | 1770  |
|              | 50    | 76                      | 673   | 216                            | 1912  | 382                             | 3381  |
|              | 80    | 118                     | 1044  | 304                            | 2690  | 568                             | 5027  |
| 40           | 100   | 137                     | 1212  | 333                            | 2947  | 647                             | 5726  |
|              | 120   | 137                     | 1212  | 353                            | 3124  | 686                             | 6071  |
|              | 160   | 137                     | 1212  | 372                            | 3292  | 686                             | 6071  |
|              | 50    | 137                     | 1212  | 402                            | 3558  | 686                             | 6071  |
| 40           | 80    | 206                     | 1823  | 519                            | 4593  | 980                             | 8673  |
|              | 100   | 265                     | 2345  | 568                            | 5027  | 1080                            | 9558  |
|              | 120   | 294                     | 2602  | 617                            | 5460  | 1180                            | 10443 |
|              | 160   | 294                     | 2602  | 647                            | 5726  | 1180                            | 10443 |

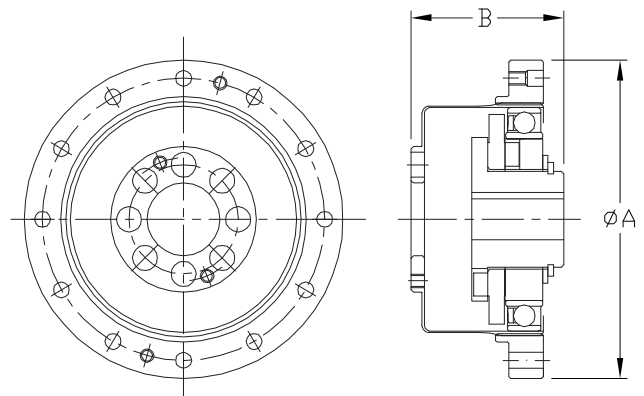
| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |        |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|--------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb  |
| 45           | 50    | 176                     | 1558  | 500                            | 4425  | 950                             | 8408   |
|              | 80    | 313                     | 2770  | 706                            | 6248  | 1270                            | 11240  |
|              | 100   | 353                     | 3124  | 755                            | 6682  | 1570                            | 13895  |
|              | 120   | 402                     | 3558  | 823                            | 7284  | 1760                            | 15576  |
|              | 160   | 402                     | 3558  | 882                            | 7806  | 1910                            | 16904  |
| 50           | 50    | 245                     | 2168  | 715                            | 6328  | 1430                            | 12656  |
|              | 80    | 372                     | 3292  | 941                            | 8328  | 1860                            | 16461  |
|              | 100   | 470                     | 4160  | 980                            | 8673  | 2060                            | 18231  |
|              | 120   | 529                     | 4682  | 1080                           | 9558  | 2060                            | 18231  |
| 58           | 160   | 529                     | 4682  | 1180                           | 10443 | 2450                            | 21683  |
|              | 50    | 353                     | 3124  | 1020                           | 9027  | 1960                            | 17346  |
|              | 80    | 549                     | 4859  | 1480                           | 13098 | 2450                            | 21683  |
|              | 100   | 696                     | 6160  | 1590                           | 14072 | 3180                            | 28143  |
|              | 120   | 745                     | 6593  | 1720                           | 15222 | 3330                            | 29471  |
| 65           | 160   | 745                     | 6593  | 1840                           | 16284 | 3430                            | 30356  |
|              | 50    | 490                     | 4337  | 1420                           | 12567 | 2830                            | 25046  |
|              | 80    | 745                     | 6593  | 2110                           | 18674 | 3720                            | 32922  |
|              | 100   | 951                     | 8416  | 2300                           | 20355 | 4750                            | 42038  |
|              | 120   | 951                     | 8416  | 2510                           | 22214 | 4750                            | 42038  |
| 80           | 160   | 951                     | 8416  | 2630                           | 23276 | 4750                            | 42038  |
|              | 50    | 872                     | 7717  | 2440                           | 21594 | 4870                            | 43100  |
|              | 80    | 1320                    | 11682 | 3430                           | 30356 | 6590                            | 58322  |
|              | 100   | 1700                    | 15045 | 4220                           | 37347 | 7910                            | 70004  |
|              | 120   | 1990                    | 17612 | 4590                           | 40622 | 7910                            | 70004  |
| 90           | 160   | 1990                    | 17612 | 4910                           | 43454 | 7910                            | 70004  |
|              | 50    | 1180                    | 10443 | 3530                           | 31241 | 6660                            | 58941  |
|              | 80    | 1550                    | 13718 | 3990                           | 35312 | 7250                            | 64163  |
|              | 100   | 2270                    | 20090 | 5680                           | 50268 | 9020                            | 79827  |
| 100          | 120   | 2570                    | 22745 | 6160                           | 54516 | 9800                            | 86730  |
|              | 160   | 2700                    | 23895 | 6840                           | 60534 | 11300                           | 100005 |
|              | 50    | 1580                    | 13983 | 4450                           | 39383 | 8900                            | 78765  |
|              | 80    | 2380                    | 21063 | 6060                           | 53631 | 11600                           | 102660 |
|              | 100   | 2940                    | 26019 | 7350                           | 65048 | 14100                           | 124785 |
| 100          | 120   | 3180                    | 28143 | 7960                           | 70446 | 15300                           | 135405 |
|              | 160   | 3550                    | 31418 | 9180                           | 81243 | 15500                           | 137175 |

## •Dimensions

Unit: mm

| Size   | 8    | 11   | 14   | 17   | 20   | 25 | 32  | 40  |
|--------|------|------|------|------|------|----|-----|-----|
| Symbol |      |      |      |      |      |    |     |     |
| øA     | 30   | 40   | 50   | 60   | 70   | 85 | 110 | 135 |
| B      | 22.1 | 25.8 | 28.5 | 32.5 | 33.5 | 37 | 44  | 53  |

| Size   | 45   | 50  | 58   | 65  | 80  | 90    | 100 |
|--------|------|-----|------|-----|-----|-------|-----|
| Symbol |      |     |      |     |     |       |     |
| øA     | 155  | 170 | 195  | 215 | 265 | 300   | 330 |
| B      | 58.5 | 64  | 75.5 | 83  | 101 | 112.5 | 125 |



# Cup Type - High Torque CSG Series

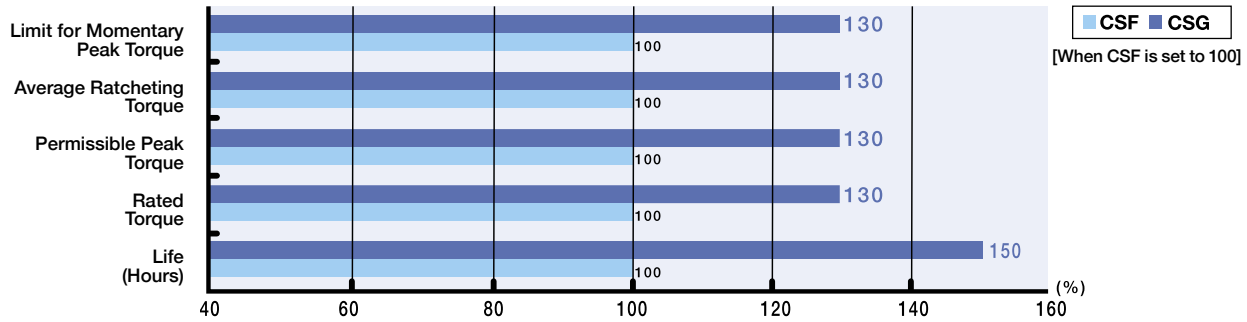


CSG is available in 10 sizes with gear reduction ratios from 50:1 to 160:1. CSG high torque series was based on our CSF standard torque series with the goal of upgrading load capacity, strength & reliability and extending service life.

- Zero backlash
- Compact and simple design
- High torque capacity
- High torsional stiffness
- High positioning accuracy
- Housed unit type is available (see p. 44)
- 30% higher torque than a CSF unit

$L_{10}$  Life: 10,000 h

## •Performance comparison of CSF and CSG Series Harmonic Drive® gearing



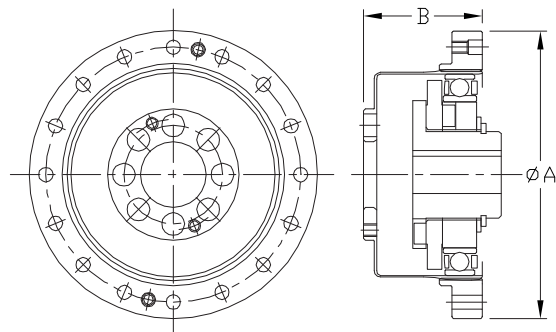
## •CSG Series Ratings

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 14           | 50    | 7.0                     | 62    | 23                             | 204   | 46                              | 407   |
|              | 80    | 10                      | 89    | 30                             | 266   | 61                              | 540   |
|              | 100   | 10                      | 89    | 36                             | 319   | 70                              | 620   |
| 17           | 50    | 21                      | 186   | 44                             | 389   | 91                              | 805   |
|              | 80    | 29                      | 257   | 56                             | 496   | 113                             | 1000  |
|              | 100   | 31                      | 274   | 70                             | 620   | 143                             | 1266  |
| 20           | 50    | 33                      | 292   | 73                             | 646   | 127                             | 1124  |
|              | 80    | 44                      | 389   | 96                             | 850   | 165                             | 1460  |
|              | 100   | 52                      | 460   | 107                            | 947   | 191                             | 1690  |
| 25           | 50    | 51                      | 451   | 127                            | 1124  | 242                             | 2142  |
|              | 80    | 82                      | 726   | 178                            | 1575  | 332                             | 2938  |
|              | 100   | 87                      | 770   | 204                            | 1805  | 369                             | 3266  |
| 32           | 50    | 99                      | 876   | 281                            | 2487  | 497                             | 4398  |
|              | 80    | 153                     | 1354  | 395                            | 3496  | 738                             | 6531  |
|              | 100   | 178                     | 1575  | 433                            | 3832  | 841                             | 7443  |

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 40           | 50    | 178                     | 1575  | 523                            | 4629  | 892                             | 7894  |
|              | 80    | 268                     | 2372  | 675                            | 5974  | 1270                            | 11240 |
|              | 100   | 345                     | 3053  | 738                            | 6531  | 1400                            | 12390 |
|              | 120   | 382                     | 3381  | 802                            | 7098  | 1530                            | 13541 |
| 45           | 50    | 229                     | 2027  | 650                            | 5753  | 1235                            | 10930 |
|              | 80    | 407                     | 3602  | 918                            | 8124  | 1651                            | 14611 |
|              | 100   | 459                     | 4062  | 982                            | 8691  | 2041                            | 18063 |
| 50           | 50    | 229                     | 2027  | 650                            | 5753  | 1235                            | 10930 |
|              | 80    | 407                     | 3602  | 918                            | 8124  | 1651                            | 14611 |
|              | 100   | 459                     | 4062  | 982                            | 8691  | 2041                            | 18063 |
| 58           | 80    | 714                     | 6319  | 1924                           | 17027 | 3185                            | 28187 |
|              | 100   | 905                     | 8009  | 2067                           | 18293 | 4134                            | 36586 |
|              | 120   | 969                     | 8576  | 2236                           | 19789 | 4329                            | 38312 |
| 65           | 80    | 969                     | 8576  | 2743                           | 24276 | 4836                            | 42799 |
|              | 100   | 1236                    | 10939 | 2990                           | 26462 | 6175                            | 54649 |
|              | 120   | 1236                    | 10939 | 3263                           | 28878 | 6175                            | 54649 |

## •Dimensions

| Size     | 14   | 17   | 20   | 25 | 32  | 40  | 45   | 50  | 58   | 65  |
|----------|------|------|------|----|-----|-----|------|-----|------|-----|
| Symbol   |      |      |      |    |     |     |      |     |      |     |
| $\phi A$ | 50   | 60   | 70   | 85 | 110 | 135 | 155  | 170 | 195  | 215 |
| B        | 28.5 | 32.5 | 33.5 | 37 | 44  | 53  | 58.5 | 64  | 75.5 | 83  |



Cup Type - Super Flat  
**CSD Series**



The ultra-flat CSD precision gears are available in seven sizes, opening up new applications for motion control speed reducers.

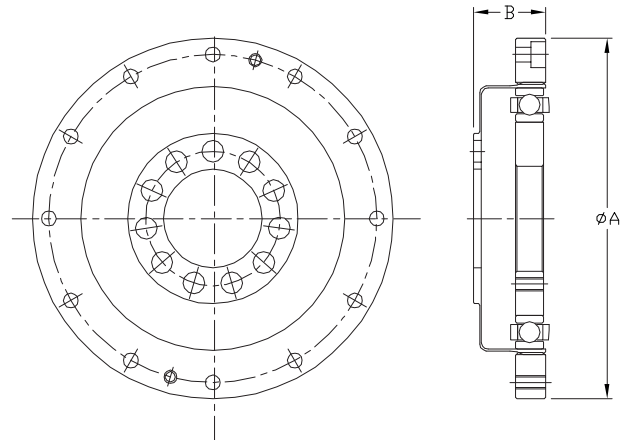
- Zero backlash
- Extremely high positioning accuracy
- Excellent Repeatability
- Superior axial compactness
- Hollow through bore, also available with extra large through bore

$L_{10}$  Life: 7,000 h

•CSD Series Ratings

| Item<br>Size | Ratio | Rated Torque<br>at 2000 rpm | Limit for<br>Repeated<br>Peak Torque | Limit for<br>Momentary<br>Peak Torque |
|--------------|-------|-----------------------------|--------------------------------------|---------------------------------------|
|              |       | Nm                          | Nm                                   | Nm                                    |
| 14           | 50    | 3.7                         | 12                                   | 24                                    |
|              | 80    | 5.4                         | 16                                   | 31                                    |
|              | 100   | 5.4                         | 19                                   | 31                                    |
| 17           | 50    | 11                          | 23                                   | 48                                    |
|              | 80    | 15                          | 29                                   | 55                                    |
|              | 100   | 16                          | 37                                   | 55                                    |
|              | 120   | 16                          | 37                                   | 55                                    |
| 20           | 50    | 17                          | 39                                   | 69                                    |
|              | 80    | 24                          | 51                                   | 76 (65)                               |
|              | 100   | 28                          | 57                                   | 76 (65)                               |
|              | 120   | 28                          | 60                                   | 76 (65)                               |
| 25           | 50    | 27                          | 69                                   | 127                                   |
|              | 80    | 44                          | 96                                   | 152 (135)                             |
|              | 100   | 47                          | 110                                  | 152 (135)                             |
|              | 120   | 47                          | 117                                  | 152 (135)                             |
| 32           | 50    | 53                          | 151                                  | 268                                   |
|              | 80    | 83                          | 213                                  | 359 (331)                             |
|              | 100   | 96                          | 233                                  | 359 (331)                             |
|              | 120   | 96                          | 247                                  | 359 (331)                             |
| 40           | 50    | 96                          | 281                                  | 480                                   |
|              | 80    | 144                         | 364                                  | 685 (580)                             |
|              | 100   | 185                         | 398                                  | 694 (580)                             |
|              | 120   | 205                         | 432                                  | 694 (580)                             |
| 50           | 50    | 172                         | 500                                  | 1000                                  |
|              | 80    | 260                         | 659                                  | 1300                                  |
|              | 100   | 329                         | 686                                  | 1440 (1315)                           |
|              | 120   | 370                         | 756                                  | 1441                                  |

Note: Values in (parenthesis) are for Big Bore (BB) version

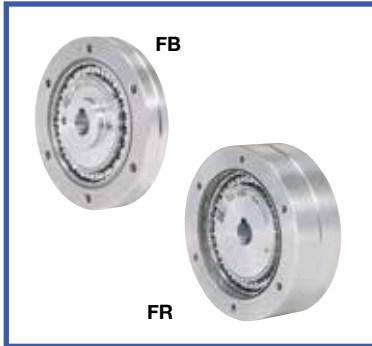


•Dimensions

Unit: mm

| Size<br>Symbol | 14 | 17   | 20 | 25 | 32  | 40  | 50  |
|----------------|----|------|----|----|-----|-----|-----|
| ø A            | 50 | 60   | 70 | 85 | 110 | 135 | 170 |
| B              | 11 | 12.5 | 14 | 17 | 22  | 27  | 33  |

# FB and FR Series



Pancake gears consist of four main parts: Wave Generator, Flexspline, Dynamic Spline, and Circular Spline. Extremely flat, these pancake gears offer the design engineer high ratios in extremely compact configurations.

- Flat profile
- Easily adapted to customer supplied assembly
- FB uses single wave generator bearing
- FR is heavy duty version of the FB
- FR uses double wave generator bearing

$L_{10}$  Life: 3,000 h

## •FB, FR Series Ratings

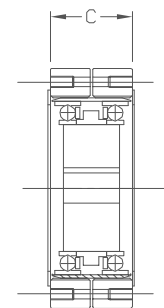
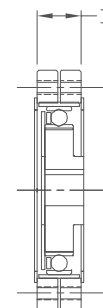
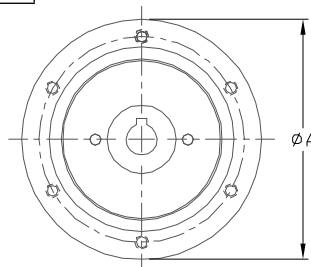
| Size | Ratio | Rated Torque at 2000 rpm |       |           |       |
|------|-------|--------------------------|-------|-----------|-------|
|      |       | FB Series                |       | FR Series |       |
|      |       | Nm                       | In-lb | Nm        | In-lb |
| 14   | 50    | 2.6                      | 23    | 4.4       | 39    |
|      | 88    | 4.9                      | 43    | 5.9       | 52    |
|      | 100   | 5.9                      | 52    | 7.8       | 69    |
|      | 110   | 5.9                      | 52    | 7.8       | 69    |
| 20   | 50    | 14                       | 124   | 25        | 221   |
|      | 80    | 17                       | 150   | 34        | 301   |
|      | 100   | 22                       | 195   | 40        | 354   |
|      | 128   | 24                       | 212   | 40        | 354   |
|      | 160   | 24                       | 212   | 40        | 354   |
| 25   | 50    | 23                       | 204   | 39        | 345   |
|      | 80    | 31                       | 274   | 56        | 496   |
|      | 100   | 39                       | 345   | 67        | 593   |
|      | 120   | 39                       | 345   | 67        | 593   |
|      | 160   | 39                       | 345   | 67        | 593   |
|      | 200   | -                        | -     | 67        | 593   |
| 32   | 50    | 44                       | 389   | 76        | 673   |
|      | 78    | 63                       | 558   | 108       | 956   |
|      | 100   | 82                       | 726   | 137       | 1212  |
|      | 131   | 82                       | 726   | 137       | 1212  |
|      | 157   | 82                       | 726   | 137       | 1212  |
|      | 200   | -                        | -     | 137       | 1212  |
|      | 260   | -                        | -     | 137       | 1212  |
|      | 260   | -                        | -     | 137       | 1212  |
| 40   | 50    | 88                       | 779   | 137       | 1212  |
|      | 80    | 118                      | 1044  | 196       | 1735  |
|      | 100   | 157                      | 1389  | 255       | 2257  |
|      | 128   | 167                      | 1478  | 294       | 2602  |
|      | 160   | 167                      | 1478  | 294       | 2602  |
|      | 200   | -                        | -     | 294       | 2602  |
|      | 258   | -                        | -     | 294       | 2602  |
|      | 258   | -                        | -     | 294       | 2602  |

| Size | Ratio | Rated Torque at 2000 rpm |       |           |       |
|------|-------|--------------------------|-------|-----------|-------|
|      |       | FB Series                |       | FR Series |       |
|      |       | Nm                       | In-lb | Nm        | In-lb |
| 50   | 80    | 216                      | 1912  | 363       | 3213  |
|      | 100   | 284                      | 2513  | 470       | 4160  |
|      | 120   | 304                      | 2690  | 559       | 4947  |
|      | 160   | 304                      | 2690  | 559       | 4947  |
|      | 200   | -                        | -     | 559       | 4947  |
|      | 242   | -                        | -     | 559       | 4947  |
| 65   | 78    | -                        | -     | 745       | 6593  |
|      | 104   | -                        | -     | 1070      | 9470  |
|      | 132   | -                        | -     | 1070      | 9470  |
|      | 158   | -                        | -     | 1070      | 9470  |
|      | 208   | -                        | -     | 1070      | 9470  |
|      | 260   | -                        | -     | 1070      | 9470  |
| 80   | 80    | -                        | -     | 1320      | 11682 |
|      | 96    | -                        | -     | 1660      | 14691 |
|      | 128   | -                        | -     | 2300      | 20355 |
|      | 160   | -                        | -     | 2350      | 20798 |
|      | 194   | -                        | -     | 2350      | 20798 |
|      | 258   | -                        | -     | 2350      | 20798 |
| 100  | 320   | -                        | -     | 2350      | 20798 |
|      | 80    | -                        | -     | 2330      | 20621 |
|      | 100   | -                        | -     | 3200      | 28320 |
|      | 120   | -                        | -     | 3890      | 34427 |
|      | 160   | -                        | -     | 4470      | 39560 |
|      | 200   | -                        | -     | 4470      | 39560 |
|      | 242   | -                        | -     | 4470      | 39560 |
|      | 320   | -                        | -     | 4470      | 39560 |

## •Dimensions

Unit: mm

| Size | Symbol | FB   | FR  |
|------|--------|------|-----|
|      | ØA     | B    | C   |
| 14   | 50     | 10.5 | 18  |
| 20   | 70     | 12.5 | 25  |
| 25   | 85     | 16.5 | 29  |
| 32   | 110    | 20.5 | 37  |
| 40   | 135    | 27.0 | 43  |
| 50   | 170    | 33.0 | 53  |
| 65   | 215    | -    | 71  |
| 80   | 265    | -    | 83  |
| 100  | 330    | -    | 101 |



FB

FR

## Silk Hat SHF Series



SHF is a silk hat, component set gear available with a large hollow through bore. It provides exceptional positioning accuracy in a compact design.

- Zero backlash
- Hollow bore units available
- Compact and simple design
- High torque capacity
- High positioning accuracy
- High torsional stiffness
- Housed version of this component set is available (see p. 50)

$L_{10}$  Life: 7,000 h

### •SHF Series Ratings

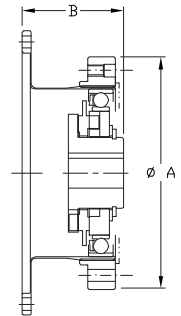
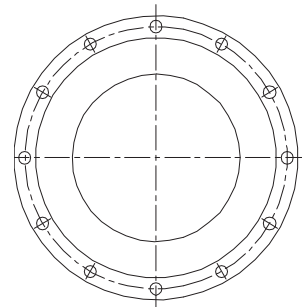
| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 14           | 30    | 4.0                     | 35    | 9.0                            | 80    | 17                              | 150   |
|              | 50    | 5.4                     | 48    | 18                             | 159   | 35                              | 310   |
|              | 80    | 7.8                     | 69    | 23                             | 204   | 47                              | 416   |
|              | 100   | 7.8                     | 69    | 28                             | 248   | 54                              | 478   |
| 17           | 30    | 8.8                     | 78    | 16                             | 142   | 30                              | 266   |
|              | 50    | 16                      | 142   | 34                             | 301   | 70                              | 620   |
|              | 80    | 22                      | 195   | 43                             | 381   | 87                              | 770   |
|              | 100   | 24                      | 212   | 54                             | 478   | 110                             | 974   |
| 20           | 30    | 15                      | 133   | 27                             | 239   | 50                              | 443   |
|              | 50    | 25                      | 221   | 56                             | 496   | 98                              | 867   |
|              | 80    | 34                      | 301   | 74                             | 655   | 127                             | 1124  |
|              | 100   | 40                      | 354   | 82                             | 726   | 147                             | 1301  |
| 25           | 30    | 27                      | 239   | 50                             | 443   | 95                              | 841   |
|              | 50    | 39                      | 345   | 98                             | 867   | 86                              | 1646  |
|              | 80    | 63                      | 558   | 137                            | 1212  | 255                             | 2257  |
|              | 100   | 67                      | 593   | 157                            | 1389  | 284                             | 2513  |
| 32           | 30    | 54                      | 478   | 100                            | 885   | 200                             | 1770  |
|              | 50    | 76                      | 673   | 216                            | 1912  | 382                             | 3381  |
|              | 80    | 118                     | 1044  | 230                            | 2036  | 568                             | 5027  |
|              | 100   | 137                     | 1212  | 333                            | 2947  | 647                             | 5726  |
| 40           | 30    | 137                     | 1212  | 333                            | 2947  | 647                             | 5726  |
|              | 50    | 137                     | 1212  | 353                            | 3124  | 686                             | 6071  |
|              | 80    | 137                     | 1212  | 372                            | 3292  | 686                             | 6071  |
|              | 100   | 137                     | 1212  | 372                            | 3292  | 686                             | 6071  |

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 40           | 50    | 137                     | 1212  | 402                            | 3558  | 686                             | 6071  |
|              | 80    | 206                     | 1823  | 519                            | 4593  | 980                             | 8673  |
|              | 100   | 265                     | 2345  | 568                            | 5027  | 1080                            | 9558  |
|              | 120   | 294                     | 2602  | 617                            | 5460  | 1180                            | 10443 |
| 45           | 50    | 176                     | 1558  | 500                            | 4425  | 950                             | 8408  |
|              | 80    | 313                     | 2770  | 706                            | 6248  | 1270                            | 11240 |
|              | 100   | 353                     | 3124  | 755                            | 6682  | 1570                            | 13895 |
|              | 120   | 402                     | 3558  | 823                            | 7284  | 1760                            | 15576 |
| 50           | 50    | 245                     | 2168  | 715                            | 6328  | 1430                            | 12656 |
|              | 80    | 372                     | 3292  | 941                            | 8328  | 1860                            | 16461 |
|              | 100   | 470                     | 4160  | 980                            | 8673  | 2060                            | 18231 |
|              | 120   | 529                     | 4682  | 1080                           | 9558  | 2060                            | 18231 |
| 58           | 50    | 353                     | 3124  | 1020                           | 9027  | 1960                            | 17346 |
|              | 80    | 549                     | 4859  | 1480                           | 13098 | 2450                            | 21683 |
|              | 100   | 696                     | 6160  | 1590                           | 14072 | 3180                            | 28143 |
|              | 120   | 745                     | 6593  | 1720                           | 15222 | 3330                            | 29471 |
| 64           | 50    | 478                     | 4240  | 1370                           | 12120 | 2660                            | 23576 |
|              | 80    | 717                     | 6360  | 2080                           | 18480 | 4000                            | 35431 |
|              | 100   | 896                     | 7920  | 2600                           | 23040 | 5000                            | 44386 |
|              | 120   | 1000                    | 8800  | 2900                           | 25680 | 5600                            | 49141 |

### •Dimensions

Unit: mm

| Size     | 14   | 17   | 20   | 25 | 32  | 40  | 45   | 50  | 58   |
|----------|------|------|------|----|-----|-----|------|-----|------|
| Symbol   |      |      |      |    |     |     |      |     |      |
| $\phi A$ | 50   | 60   | 70   | 85 | 110 | 135 | 155  | 170 | 195  |
| B        | 28.5 | 32.5 | 33.5 | 37 | 44  | 53  | 58.5 | 64  | 75.5 |





Silk Hat - High Torque  
**SHG Series**

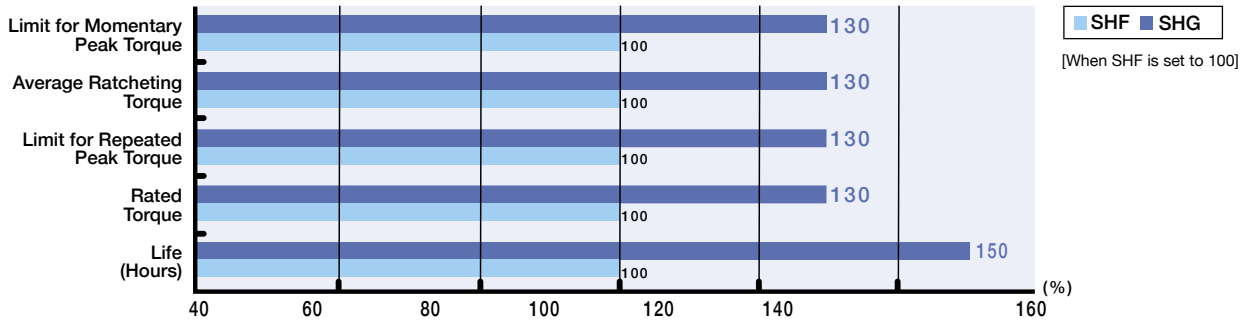


SHG is a high torque, silk hat, component set gear available with a large hollow through bore. It provides exceptional positioning accuracy in a compact design.

- Zero backlash
- Hollow bore units available
- Excellent positioning accuracy
- Compact and simple design
- High torque capacity
- High torsional stiffness
- 30% higher torque rating than SHF series

$L_{10}$  Life: 10,000 h

•Performance comparison of SHF and SHG Series Harmonic Drive® gearing



•SHG Series Ratings

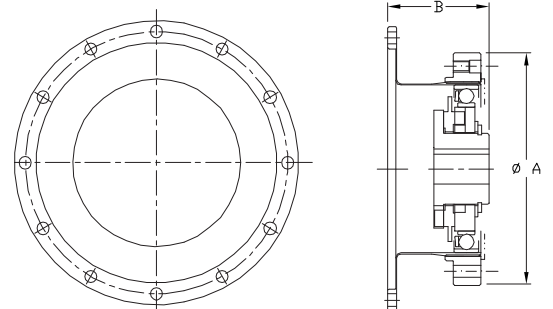
| Item | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|      |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 14   | 50    | 7.0                     | 62    | 23                             | 204   | 46                              | 407   |
|      | 80    | 10                      | 89    | 30                             | 266   | 61                              | 540   |
|      | 100   | 10                      | 89    | 36                             | 319   | 70                              | 620   |
| 17   | 50    | 21                      | 186   | 44                             | 389   | 91                              | 805   |
|      | 80    | 29                      | 257   | 56                             | 496   | 113                             | 1000  |
|      | 100   | 31                      | 274   | 70                             | 620   | 143                             | 1266  |
| 20   | 50    | 33                      | 292   | 73                             | 646   | 127                             | 1124  |
|      | 80    | 44                      | 389   | 96                             | 850   | 165                             | 1460  |
|      | 100   | 52                      | 460   | 107                            | 947   | 191                             | 1690  |
| 25   | 50    | 51                      | 451   | 127                            | 1124  | 242                             | 2142  |
|      | 80    | 82                      | 726   | 178                            | 1575  | 332                             | 2938  |
|      | 100   | 87                      | 770   | 204                            | 1805  | 369                             | 3266  |
| 32   | 50    | 99                      | 876   | 281                            | 2487  | 497                             | 4398  |
|      | 80    | 153                     | 1354  | 395                            | 3496  | 738                             | 6531  |
|      | 100   | 178                     | 1575  | 433                            | 3832  | 841                             | 7443  |

| Item | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|      |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 40   | 50    | 178                     | 1575  | 523                            | 4629  | 892                             | 7894  |
|      | 80    | 268                     | 2372  | 675                            | 5974  | 1270                            | 11240 |
|      | 100   | 345                     | 3053  | 738                            | 6531  | 1400                            | 12390 |
|      | 120   | 382                     | 3381  | 802                            | 7098  | 1530                            | 13541 |
| 45   | 50    | 229                     | 2027  | 650                            | 5753  | 1235                            | 10930 |
|      | 80    | 407                     | 3602  | 918                            | 8124  | 1651                            | 14611 |
|      | 100   | 459                     | 4062  | 982                            | 8691  | 2041                            | 18063 |
|      | 120   | 523                     | 4629  | 1070                           | 9470  | 2288                            | 20249 |
| 50   | 50    | 229                     | 2027  | 650                            | 5753  | 1235                            | 10930 |
|      | 80    | 484                     | 4283  | 1223                           | 10824 | 2418                            | 21399 |
|      | 100   | 611                     | 5407  | 1274                           | 11275 | 2678                            | 23700 |
|      | 120   | 688                     | 6089  | 1404                           | 12425 | 2678                            | 23700 |
| 58   | 50    | 229                     | 2027  | 650                            | 5753  | 1235                            | 10930 |
|      | 80    | 714                     | 6319  | 1924                           | 17027 | 3185                            | 28187 |
|      | 100   | 905                     | 8009  | 2067                           | 18293 | 4134                            | 36586 |
|      | 120   | 969                     | 8576  | 2236                           | 19789 | 4329                            | 38312 |
| 65   | 50    | 229                     | 2027  | 650                            | 5753  | 1235                            | 10930 |
|      | 80    | 969                     | 8576  | 2743                           | 24276 | 4836                            | 42799 |
|      | 100   | 1236                    | 10939 | 2990                           | 26462 | 6175                            | 54649 |
|      | 120   | 1236                    | 10939 | 3263                           | 28878 | 6175                            | 54649 |

•Dimensions

Unit: mm

| Size     | 14   | 17   | 20   | 25 | 32  | 40  | 45   | 50  | 58   | 65  |
|----------|------|------|------|----|-----|-----|------|-----|------|-----|
| Symbol   |      |      |      |    |     |     |      |     |      |     |
| $\phi A$ | 50   | 60   | 70   | 85 | 110 | 135 | 155  | 170 | 195  | 215 |
| B        | 28.5 | 32.5 | 33.5 | 37 | 44  | 53  | 58.5 | 64  | 75.5 | 83  |



Gear Unit

CSF-2UH Series



CSF-2UH is a housed component gear set combined with a precision cross roller output bearing & flange. It is a very compact, robust and easy to use gearhead solution.

- Zero backlash
- Compact and simple design
- High torque capacity
- High torsional stiffness
- High positioning accuracy

$L_{10}$  Life: 7,000h

•CSF Series Ratings

| Item | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|      |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 14   | 30    | 4.0                     | 35    | 9.0                            | 80    | 17                              | 150   |
|      | 50    | 5.4                     | 48    | 18                             | 159   | 35                              | 310   |
|      | 100   | 7.8                     | 69    | 23                             | 204   | 47                              | 416   |
| 17   | 30    | 8.8                     | 78    | 6                              | 142   | 30                              | 266   |
|      | 50    | 16                      | 142   | 34                             | 301   | 70                              | 620   |
|      | 100   | 22                      | 195   | 43                             | 381   | 87                              | 770   |
| 20   | 30    | 15                      | 133   | 27                             | 239   | 50                              | 443   |
|      | 50    | 25                      | 221   | 56                             | 496   | 98                              | 867   |
|      | 100   | 34                      | 301   | 74                             | 655   | 127                             | 1124  |
| 25   | 30    | 15                      | 133   | 27                             | 239   | 50                              | 443   |
|      | 50    | 25                      | 221   | 56                             | 496   | 98                              | 867   |
|      | 100   | 34                      | 301   | 74                             | 655   | 127                             | 1124  |
| 32   | 30    | 54                      | 478   | 100                            | 885   | 200                             | 1770  |
|      | 50    | 76                      | 673   | 216                            | 1912  | 382                             | 3381  |
|      | 100   | 118                     | 1044  | 304                            | 2036  | 568                             | 5027  |

| Item | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|      |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 40   | 50    | 137                     | 1212  | 402                            | 3558  | 686                             | 6072  |
|      | 80    | 206                     | 1823  | 519                            | 4593  | 980                             | 8674  |
|      | 100   | 265                     | 2345  | 588                            | 5027  | 1080                            | 9559  |
| 45   | 50    | 176                     | 1558  | 500                            | 4425  | 950                             | 8408  |
|      | 80    | 313                     | 2770  | 706                            | 6248  | 1270                            | 11240 |
|      | 100   | 353                     | 3124  | 755                            | 6682  | 1570                            | 13896 |
| 50   | 50    | 245                     | 2168  | 715                            | 6328  | 1430                            | 12657 |
|      | 80    | 372                     | 3292  | 941                            | 8328  | 1860                            | 16462 |
|      | 100   | 470                     | 4160  | 980                            | 8673  | 2060                            | 18233 |
| 58   | 50    | 353                     | 3124  | 1020                           | 9027  | 1960                            | 17347 |
|      | 80    | 549                     | 4859  | 1480                           | 13098 | 2450                            | 21684 |
|      | 100   | 686                     | 6160  | 1590                           | 14072 | 3180                            | 28145 |
| 65   | 50    | 490                     | 4337  | 1420                           | 12567 | 2830                            | 25048 |
|      | 80    | 745                     | 6593  | 2110                           | 18674 | 3720                            | 32925 |
|      | 100   | 951                     | 8416  | 2300                           | 20355 | 4750                            | 42041 |

•Cross Roller Bearing Specification

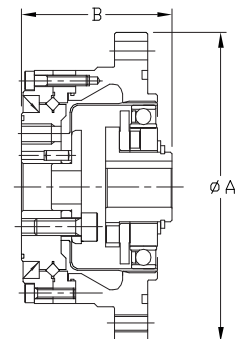
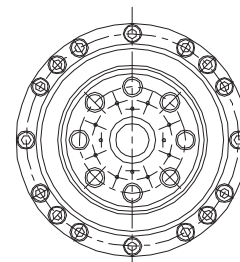
| Item | Basic Rated Load           |                            |                          |                     | Allowable Moment Load Mc |       | Moment Stiffness Km       |               |
|------|----------------------------|----------------------------|--------------------------|---------------------|--------------------------|-------|---------------------------|---------------|
|      | Basic Dynamic Rated Load C | Basic Static Rated Load Co | Allowable Moment Load Mc | Moment Stiffness Km | Nm                       | In-lb | x 10 <sup>4</sup> Nm /rad | In-lb/arc-min |
| 14   | 47                         | 1057                       | 41                       | 4.38                | 41                       | 363   | 4.38                      | 113           |
| 17   | 52.9                       | 1189                       | 64                       | 7.75                | 64                       | 566   | 7.75                      | 200           |
| 20   | 57.8                       | 1299                       | 91                       | 12.8                | 91                       | 805   | 12.8                      | 330           |
| 25   | 96.0                       | 2158                       | 156                      | 24.2                | 156                      | 1381  | 24.2                      | 623           |
| 32   | 150                        | 3372                       | 313                      | 53.9                | 313                      | 2770  | 53.9                      | 1388          |
| 40   | 213                        | 4788                       | 450                      | 91.0                | 450                      | 3983  | 91.0                      | 2343          |
| 45   | 230                        | 5170                       | 686                      | 141                 | 686                      | 6071  | 141                       | 3631          |
| 50   | 348                        | 7823                       | 759                      | 171                 | 759                      | 6717  | 171                       | 4403          |
| 58   | 518                        | 11645                      | 1180                     | 283                 | 1180                     | 10443 | 283                       | 7287          |
| 65   | 556                        | 12499                      | 1860                     | 404                 | 1860                     | 16461 | 404                       | 10403         |

- "Basic dynamic rated load" is a constant stationary radial load that achieves a basic dynamic rated life of the bearing of one million revolutions.
- "Basic static rated load" is a static load that achieves a contact stress of a constant level (408kN/mm<sup>2</sup>) at the center of a contact zone between the rolling element receiving a maximum load and track.
- The moment stiffnesses are mean values.


•Dimensions

| Size   | 14 | 17 | 20   | 25  | 32  | 40   | 45   | 50  | 58    | 65  |
|--------|----|----|------|-----|-----|------|------|-----|-------|-----|
| Symbol |    |    |      |     |     |      |      |     |       |     |
| øA     | 73 | 79 | 93   | 107 | 138 | 160  | 180  | 190 | 226   | 260 |
| B      | 41 | 45 | 45.5 | 52  | 62  | 72.5 | 79.5 | 90  | 104.5 | 115 |

Unit: mm



# CSF-2UH-LW Series



LW indicates lightweight, the CSF-2UH is a housed component gear set combined with a precision cross roller output bearing & flange.

- Zero Backlash
- 30% average lower weight than Standard Series
- High Torque to Weight ratio
- Accuracy <1 arc-min
- High torsional stiffness
- High efficiency
- Robust cross roller output bearing
- Output flange for direct mounting of load

**L<sub>10</sub> Life: 7,000h**

## •CSF-LW Series Ratings

| Item | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|      |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 14   | 30    | 4.0                     | 35    | 9.0                            | 80    | 17                              | 150   |
|      | 50    | 5.4                     | 48    | 18                             | 159   | 35                              | 310   |
|      | 80    | 7.8                     | 69    | 23                             | 204   | 47                              | 416   |
|      | 100   | 7.8                     | 69    | 28                             | 248   | 54                              | 478   |
| 17   | 30    | 8.8                     | 78    | 16                             | 142   | 30                              | 266   |
|      | 50    | 16                      | 142   | 34                             | 301   | 70                              | 620   |
|      | 80    | 22                      | 195   | 43                             | 381   | 87                              | 770   |
|      | 100   | 24                      | 212   | 54                             | 478   | 108                             | 956   |
| 20   | 30    | 15                      | 133   | 27                             | 239   | 50                              | 443   |
|      | 50    | 25                      | 221   | 56                             | 496   | 98                              | 867   |
|      | 80    | 34                      | 301   | 74                             | 655   | 127                             | 1,124 |
|      | 100   | 40                      | 354   | 82                             | 726   | 147                             | 1,301 |
| 25   | 30    | 27                      | 239   | 50                             | 443   | 95                              | 841   |
|      | 50    | 39                      | 345   | 98                             | 867   | 186                             | 1,646 |
|      | 80    | 63                      | 558   | 137                            | 1,213 | 255                             | 2,257 |
|      | 100   | 67                      | 593   | 157                            | 1,390 | 284                             | 2,514 |
| 32   | 30    | 27                      | 239   | 50                             | 443   | 95                              | 841   |
|      | 50    | 39                      | 345   | 98                             | 867   | 186                             | 1,646 |
|      | 80    | 63                      | 558   | 137                            | 1,213 | 255                             | 2,257 |
|      | 100   | 67                      | 593   | 157                            | 1,390 | 284                             | 2,514 |

| Item | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |        | Limit for Momentary Peak Torque |        |
|------|-------|-------------------------|-------|--------------------------------|--------|---------------------------------|--------|
|      |       | Nm                      | In-lb | Nm                             | In-lb  | Nm                              | In-lb  |
| 40   | 50    | 137                     | 1,213 | 402                            | 3,558  | 686                             | 6,072  |
|      | 80    | 206                     | 1,823 | 519                            | 4,594  | 980                             | 8,674  |
|      | 100   | 265                     | 2,345 | 568                            | 5,027  | 1,080                           | 9,559  |
|      | 120   | 294                     | 2,602 | 617                            | 5,461  | 1,180                           | 10,444 |
|      | 160   | 294                     | 2,602 | 647                            | 5,726  | 1,180                           | 10,444 |
| 45   | 50    | 176                     | 1,558 | 500                            | 4,425  | 950                             | 8,408  |
|      | 80    | 313                     | 2,770 | 706                            | 6,249  | 1,270                           | 11,240 |
|      | 100   | 353                     | 3,124 | 755                            | 6,682  | 1,570                           | 13,896 |
|      | 120   | 402                     | 3,558 | 823                            | 7,284  | 1,760                           | 15,577 |
| 50   | 50    | 245                     | 2,168 | 715                            | 6,328  | 1,430                           | 12,657 |
|      | 80    | 372                     | 3,292 | 941                            | 8,329  | 1,860                           | 16,462 |
|      | 100   | 470                     | 4,160 | 980                            | 8,674  | 2,060                           | 18,233 |
|      | 120   | 529                     | 4,682 | 1,080                          | 9,559  | 2,060                           | 18,233 |
| 58   | 50    | 529                     | 4,682 | 1,180                          | 10,444 | 2,450                           | 21,684 |
|      | 80    | 549                     | 4,859 | 1,480                          | 13,099 | 2,450                           | 21,684 |
|      | 100   | 696                     | 6,160 | 1,590                          | 14,073 | 3,180                           | 28,145 |
|      | 120   | 745                     | 6,594 | 1,720                          | 15,223 | 3,330                           | 29,473 |
| 65   | 50    | 745                     | 6,594 | 1,840                          | 16,285 | 3,430                           | 30,358 |
|      | 80    | 490                     | 4,337 | 1,420                          | 12,568 | 2,830                           | 25,048 |
|      | 100   | 951                     | 8,417 | 2,300                          | 20,357 | 4,750                           | 42,041 |
|      | 120   | 951                     | 8,417 | 2,510                          | 22,215 | 4,750                           | 42,041 |

## •Cross Roller Bearing Specification

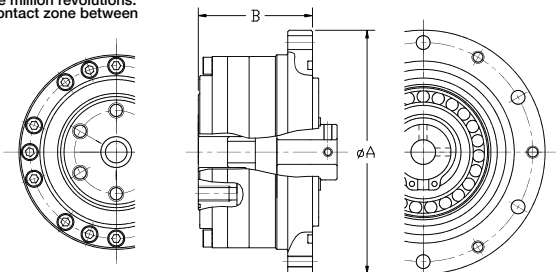
| Item | Basic Rated Load           |        |                            |        | Allowable Moment Load Mc |        | Moment Stiffness Km        |               |
|------|----------------------------|--------|----------------------------|--------|--------------------------|--------|----------------------------|---------------|
|      | Basic Dynamic Rated Load C |        | Basic Static Rated Load Co |        | Nm                       | In-lb  | x 10 <sup>4</sup> Nm / rad | In-lb/arc-min |
|      | x 10 <sup>2</sup> N        | lb     | x 10 <sup>2</sup> N        | lb     |                          |        |                            |               |
| 14   | 47                         | 1,057  | 60.7                       | 1,365  | 33.6                     | 297    | 3.6                        | 32            |
| 17   | 52.9                       | 1,189  | 75.5                       | 1,697  | 52.5                     | 465    | 6.4                        | 57            |
| 20   | 57.8                       | 1,299  | 90.0                       | 2,023  | 74.6                     | 660    | 10.5                       | 93            |
| 25   | 96.0                       | 2,158  | 151                        | 3,395  | 128                      | 1,133  | 19.8                       | 175           |
| 32   | 150                        | 3,372  | 250                        | 5,620  | 257                      | 2,275  | 44.2                       | 391           |
| 40   | 213                        | 4,788  | 365                        | 8,206  | 369                      | 3,266  | 74.6                       | 660           |
| 45   | 230                        | 5,171  | 426                        | 9,577  | 563                      | 4,983  | 116                        | 1,027         |
| 50   | 348                        | 7,823  | 602                        | 13,534 | 622                      | 5,505  | 140                        | 1,239         |
| 58   | 518                        | 11,645 | 904                        | 20,323 | 838                      | 7,417  | 201                        | 1,779         |
| 65   | 556                        | 12,499 | 1030                       | 23,155 | 1,525                    | 13,497 | 331                        | 2,930         |

• "Basic dynamic rated load" is a constant stationary radial load that achieves a basic dynamic rated life of the bearing of one million revolutions.  
 • "Basic static rated load" is a static load that achieves a contact stress of a constant level (408kN/mm<sup>2</sup>) at the center of a contact zone between the rolling element receiving a maximum load and track.  
 • The moment stiffnesses are mean values.

## •Dimensions

| Size   | 14 | 17 | 20   | 25  | 32  | 40   | 45   | 50  | 58    | 65  |
|--------|----|----|------|-----|-----|------|------|-----|-------|-----|
| Symbol |    |    |      |     |     |      |      |     |       |     |
| øA     | 73 | 79 | 93   | 107 | 138 | 160  | 180  | 190 | 226   | 260 |
| B      | 41 | 45 | 45.5 | 52  | 62  | 72.5 | 79.5 | 90  | 104.5 | 115 |

Unit: mm



# High Torque Gear Unit CSG-2UH Series



CSG-2UH is a high torque housed component gear set combined with a precision cross roller output bearing & flange. It is a very compact, robust and easy to use gearhead solution.

- Zero backlash
- High torque capacity
- High torsional stiffness
- Compact and simple design
- High positioning accuracy
- 30% higher torque than a CSF unit

**L<sub>10</sub> Life: 10,000 h**

## •CSG Series Ratings

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 14           | 50    | 7.0                     | 62    | 23                             | 204   | 46                              | 407   |
|              | 80    | 10                      | 89    | 30                             | 266   | 61                              | 540   |
|              | 100   | 10                      | 89    | 36                             | 319   | 70                              | 620   |
| 17           | 50    | 21                      | 186   | 44                             | 389   | 91                              | 805   |
|              | 80    | 29                      | 257   | 56                             | 496   | 113                             | 1000  |
|              | 100   | 31                      | 274   | 70                             | 620   | 143                             | 1266  |
| 20           | 120   | 31                      | 274   | 70                             | 620   | 112                             | 991   |
|              | 50    | 33                      | 292   | 73                             | 646   | 127                             | 1124  |
|              | 80    | 44                      | 389   | 96                             | 850   | 165                             | 1460  |
|              | 100   | 52                      | 460   | 107                            | 947   | 191                             | 1690  |
| 25           | 120   | 52                      | 460   | 113                            | 1000  | 191                             | 1690  |
|              | 160   | 52                      | 460   | 120                            | 1062  | 191                             | 1690  |
|              | 50    | 51                      | 451   | 127                            | 1124  | 242                             | 2142  |
|              | 80    | 82                      | 726   | 178                            | 1575  | 332                             | 2938  |
| 32           | 100   | 87                      | 770   | 204                            | 1805  | 369                             | 3266  |
|              | 120   | 87                      | 770   | 217                            | 1920  | 395                             | 3496  |
|              | 160   | 87                      | 770   | 229                            | 2027  | 408                             | 3611  |
|              | 50    | 99                      | 876   | 281                            | 2487  | 497                             | 4399  |
| 40           | 80    | 153                     | 1354  | 395                            | 3496  | 738                             | 6532  |
|              | 100   | 178                     | 1575  | 433                            | 3832  | 841                             | 7443  |
|              | 120   | 178                     | 1575  | 459                            | 4062  | 892                             | 7895  |
|              | 160   | 178                     | 1575  | 484                            | 4283  | 892                             | 7895  |

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 40           | 50    | 178                     | 1575  | 523                            | 4629  | 892                             | 7895  |
|              | 80    | 268                     | 2372  | 675                            | 5974  | 1270                            | 11240 |
|              | 100   | 345                     | 3053  | 738                            | 6531  | 1400                            | 12391 |
|              | 120   | 382                     | 3381  | 802                            | 7098  | 1530                            | 13542 |
| 45           | 160   | 382                     | 3381  | 841                            | 7443  | 1530                            | 13542 |
|              | 50    | 229                     | 2027  | 650                            | 5753  | 1235                            | 10931 |
|              | 80    | 407                     | 3602  | 918                            | 8124  | 1651                            | 14613 |
|              | 100   | 459                     | 4062  | 982                            | 8691  | 2041                            | 18064 |
| 50           | 120   | 523                     | 4629  | 1070                           | 9470  | 2288                            | 20250 |
|              | 160   | 523                     | 4629  | 1147                           | 10151 | 2483                            | 21976 |
|              | 80    | 484                     | 4283  | 1223                           | 10824 | 2418                            | 21401 |
|              | 100   | 611                     | 5407  | 1274                           | 11275 | 2678                            | 23702 |
| 58           | 120   | 688                     | 6089  | 1404                           | 12425 | 2678                            | 23702 |
|              | 160   | 688                     | 6089  | 1534                           | 13576 | 3185                            | 28190 |
|              | 80    | 714                     | 6319  | 1924                           | 17027 | 3185                            | 28190 |
|              | 100   | 905                     | 8009  | 2067                           | 18293 | 4134                            | 36589 |
| 65           | 120   | 969                     | 8576  | 2236                           | 19789 | 4329                            | 38315 |
|              | 160   | 969                     | 8576  | 2392                           | 21169 | 4459                            | 39465 |
|              | 80    | 969                     | 8576  | 2743                           | 24276 | 4836                            | 42802 |
|              | 100   | 1236                    | 10939 | 2990                           | 26462 | 6175                            | 54653 |
| 65           | 120   | 1236                    | 10939 | 3263                           | 28878 | 6175                            | 54653 |
|              | 160   | 1236                    | 10939 | 3419                           | 30258 | 6175                            | 54653 |

## •Cross Roller Bearing Specification

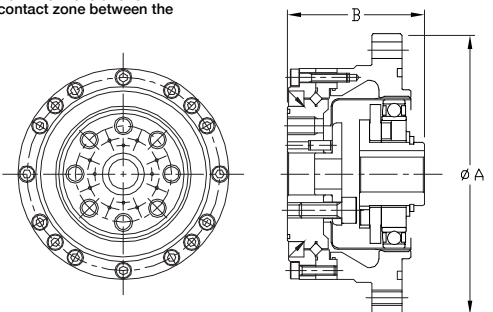
| Item<br>Size | Basic Rated Load           |       |                            |       | Allowable Moment Load Mc |       | Moment Stiffness Km      |               |
|--------------|----------------------------|-------|----------------------------|-------|--------------------------|-------|--------------------------|---------------|
|              | Basic Dynamic Rated Load C |       | Basic Static Rated Load Co |       | Nm                       | In-lb | x 10 <sup>4</sup> Nm/rad | In-lb/arc-min |
|              | x 10 <sup>3</sup> N        | lb    | x 10 <sup>3</sup> N        | lb    |                          |       |                          |               |
| 14           | 47                         | 1057  | 60.7                       | 1365  | 41                       | 363   | 4.38                     | 113           |
| 17           | 52.9                       | 1189  | 75.5                       | 1697  | 64                       | 566   | 7.75                     | 200           |
| 20           | 57.8                       | 1299  | 90.0                       | 2023  | 91                       | 805   | 12.8                     | 330           |
| 25           | 96.0                       | 2158  | 151                        | 3394  | 156                      | 1381  | 24.2                     | 623           |
| 32           | 150                        | 3372  | 250                        | 5620  | 313                      | 2770  | 53.9                     | 1388          |
| 40           | 213                        | 4788  | 365                        | 8205  | 450                      | 3983  | 91.0                     | 2343          |
| 45           | 230                        | 5170  | 426                        | 9576  | 686                      | 6071  | 141                      | 3631          |
| 50           | 348                        | 7823  | 602                        | 13533 | 759                      | 6717  | 171                      | 4403          |
| 58           | 518                        | 11645 | 904                        | 20322 | 1180                     | 10443 | 283                      | 7287          |
| 65           | 556                        | 12499 | 1030                       | 23154 | 1860                     | 16461 | 404                      | 10403         |

- "Basic dynamic rated load" is a constant stationary radial load that achieves a basic dynamic rated life of the bearing of one million revolutions.
- "Basic static rated load" is a static load that achieves a contact stress of a constant level (408kN/mm<sup>2</sup>) at the center of a contact zone between the rolling element receiving a maximum load and track.
- The moment stiffnesses are mean values.

## •Dimensions

| Size   | 14 | 17 | 20   | 25  | 32  | 40   | 45   | 50  | 58    | 65  |
|--------|----|----|------|-----|-----|------|------|-----|-------|-----|
| Symbol |    |    |      |     |     |      |      |     |       |     |
| øA     | 73 | 79 | 93   | 107 | 138 | 160  | 180  | 190 | 226   | 260 |
| B      | 41 | 45 | 45.5 | 52  | 62  | 72.5 | 79.5 | 90  | 104.5 | 115 |

Unit: mm



# High Torque, Lightweight Gear Unit

## CSG-2UH-LW Series



LW indicates lightweight. CSG-2UH is a high torque housed component gear set combined with a precision cross roller output bearing & flange. It is a very compact, robust and easy to use gearhead solution.

- Zero Backlash
- 30% average lower weight than Standard Series
- High Torque to Weight ratio
- Accuracy <1 arc-min
- High torsional stiffness
- High efficiency
- Robust cross roller output bearing
- Output flange for direct mounting of load

L<sub>10</sub> Life: 10,000 h

### •CSG-LW Series Ratings

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 14           | 50    | 7                       | 62    | 23                             | 204   | 46                              | 407   |
|              | 80    | 10                      | 89    | 30                             | 266   | 61                              | 540   |
|              | 100   | 10                      | 89    | 36                             | 319   | 70                              | 620   |
| 17           | 50    | 21                      | 186   | 44                             | 389   | 91                              | 805   |
|              | 80    | 29                      | 257   | 56                             | 496   | 113                             | 1,000 |
|              | 100   | 31                      | 274   | 70                             | 620   | 143                             | 1,266 |
| 20           | 50    | 33                      | 292   | 73                             | 646   | 127                             | 1,124 |
|              | 80    | 44                      | 389   | 96                             | 850   | 165                             | 1,460 |
|              | 100   | 52                      | 460   | 107                            | 947   | 191                             | 1,690 |
| 25           | 50    | 51                      | 451   | 127                            | 1,124 | 242                             | 2,142 |
|              | 80    | 82                      | 726   | 178                            | 1,575 | 332                             | 2,938 |
|              | 100   | 87                      | 770   | 204                            | 1,806 | 369                             | 3,266 |
| 32           | 50    | 99                      | 876   | 281                            | 2,487 | 497                             | 4,399 |
|              | 80    | 153                     | 1,354 | 395                            | 3,496 | 738                             | 6,532 |
|              | 100   | 178                     | 1,575 | 433                            | 3,832 | 841                             | 7,443 |

| Item<br>Size | Ratio | Rated Torque at 2000rpm |        | Limit for Repeated Peak Torque |        | Limit for Momentary Peak Torque |        |
|--------------|-------|-------------------------|--------|--------------------------------|--------|---------------------------------|--------|
|              |       | Nm                      | In-lb  | Nm                             | In-lb  | Nm                              | In-lb  |
| 40           | 50    | 178                     | 1,575  | 523                            | 4,629  | 892                             | 7,895  |
|              | 80    | 268                     | 2,372  | 675                            | 5,974  | 1,270                           | 11,240 |
|              | 100   | 345                     | 3,054  | 738                            | 6,532  | 1,400                           | 12,391 |
|              | 120   | 382                     | 3,381  | 802                            | 7,098  | 1,530                           | 13,542 |
| 45           | 50    | 229                     | 2,027  | 650                            | 5,753  | 1,235                           | 10,931 |
|              | 80    | 407                     | 3,602  | 918                            | 8,125  | 1,651                           | 14,613 |
|              | 100   | 459                     | 4,062  | 982                            | 8,691  | 2,041                           | 18,064 |
| 50           | 50    | 523                     | 4,629  | 1,070                          | 9,470  | 2,288                           | 20,250 |
|              | 80    | 484                     | 4,284  | 1,223                          | 10,824 | 2,418                           | 21,401 |
|              | 100   | 611                     | 5,408  | 1,274                          | 11,276 | 2,678                           | 23,702 |
|              | 120   | 688                     | 6,089  | 1,404                          | 12,426 | 2,678                           | 23,702 |
| 58           | 50    | 688                     | 6,089  | 1,534                          | 13,577 | 3,185                           | 28,190 |
|              | 80    | 714                     | 6,319  | 1,924                          | 17,029 | 3,185                           | 28,190 |
|              | 100   | 905                     | 8,010  | 2,067                          | 18,294 | 4,134                           | 36,589 |
|              | 120   | 969                     | 8,576  | 2,236                          | 19,790 | 4,329                           | 38,315 |
| 65           | 50    | 969                     | 8,576  | 2,392                          | 21,171 | 4,459                           | 39,465 |
|              | 80    | 969                     | 8,576  | 2,743                          | 24,278 | 4,836                           | 42,802 |
|              | 100   | 1,236                   | 10,940 | 2,990                          | 26,464 | 6,175                           | 54,653 |
|              | 120   | 1,236                   | 10,940 | 3,263                          | 28,880 | 6,175                           | 54,653 |

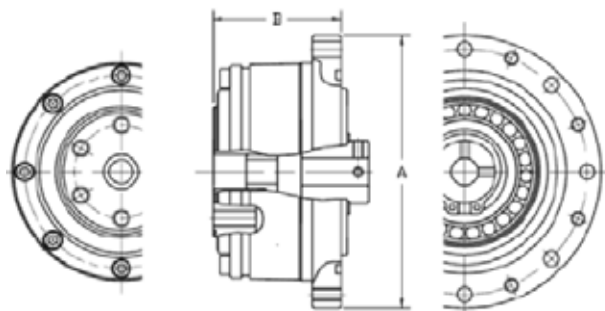
### •Cross Roller Bearing Specification

| Item<br>Size | Basic Rated Load           |        |                            |        | Allowable Moment Load |        | Moment Stiffness Km       |               |
|--------------|----------------------------|--------|----------------------------|--------|-----------------------|--------|---------------------------|---------------|
|              | Basic Dynamic Rated Load C |        | Basic Static Rated Load Co |        |                       |        |                           |               |
|              | x 10 <sup>3</sup> N        | lb     | x 10 <sup>3</sup> N        | lb     | Nm                    | In-lb  | x 10 <sup>4</sup> Nm /rad | In-lb/arc-min |
| 14           | 47                         | 1,057  | 60.7                       | 1,365  | 33.6                  | 297    | 3.6                       | 32            |
| 17           | 52.9                       | 1,189  | 75.5                       | 1,697  | 52.5                  | 465    | 6.4                       | 57            |
| 20           | 57.8                       | 1,299  | 90.0                       | 2,023  | 74.6                  | 660    | 10.5                      | 93            |
| 25           | 96.0                       | 2,158  | 151                        | 3,395  | 128                   | 1,133  | 19.8                      | 175           |
| 32           | 150                        | 3,372  | 250                        | 5,620  | 257                   | 2,275  | 44.2                      | 391           |
| 40           | 213                        | 4,788  | 365                        | 8,206  | 369                   | 3,266  | 74.6                      | 660           |
| 45           | 230                        | 5,170  | 426                        | 9,577  | 563                   | 4,983  | 116                       | 1,027         |
| 50           | 348                        | 7,823  | 602                        | 13,534 | 622                   | 5,505  | 140                       | 1,239         |
| 58           | 518                        | 11,645 | 904                        | 20,323 | 838                   | 7,417  | 201                       | 1,779         |
| 65           | 556                        | 12,499 | 1030                       | 23,155 | 1,525                 | 13,497 | 331                       | 2,930         |

### •Dimensions

Unit: mm

| Size   | 14 | 17 | 20   | 25  | 32  | 40   | 45   | 50  | 58    | 65  |
|--------|----|----|------|-----|-----|------|------|-----|-------|-----|
| Symbol |    |    |      |     |     |      |      |     |       |     |
| øA     | 73 | 79 | 93   | 107 | 138 | 160  | 180  | 190 | 226   | 260 |
| B      | 41 | 45 | 45.5 | 52  | 62  | 72.5 | 79.5 | 90  | 104.5 | 115 |



## High Torque Gear Unit CSG-2UK Series



CSG-2UK is a high torque fully sealed, high accuracy gear reducer ideally suited for machine tool applications.

- Zero backlash
- Compatible with Fanuc motors
- High torque capacity
- High torsional stiffness
- High positioning accuracy

**L<sub>10</sub> Life: 10,000 h**

### •CSG Series Ratings

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 25           | 50    | 51                      | 451   | 127                            | 1124  | 242                             | 2142  |
|              | 80    | 82                      | 726   | 178                            | 1575  | 332                             | 2938  |
|              | 100   | 87                      | 770   | 204                            | 1805  | 369                             | 3266  |
|              | 120   | 87                      | 770   | 217                            | 1920  | 395                             | 3496  |
|              | 160   | 87                      | 770   | 229                            | 2027  | 408                             | 3611  |
| 32           | 50    | 99                      | 876   | 281                            | 2487  | 497                             | 4399  |
|              | 80    | 153                     | 1354  | 395                            | 3496  | 738                             | 6532  |
|              | 100   | 178                     | 1575  | 433                            | 3832  | 841                             | 7443  |
|              | 120   | 178                     | 1575  | 459                            | 4062  | 892                             | 7895  |
|              | 160   | 178                     | 1575  | 484                            | 4283  | 892                             | 7895  |
| 40           | 50    | 178                     | 1575  | 523                            | 4629  | 892                             | 7895  |
|              | 80    | 268                     | 2372  | 675                            | 5974  | 1270                            | 11240 |
|              | 100   | 345                     | 3053  | 738                            | 6531  | 1400                            | 12391 |
|              | 120   | 382                     | 3381  | 802                            | 7098  | 1530                            | 13542 |
|              | 160   | 382                     | 3381  | 841                            | 7443  | 1530                            | 13542 |

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 45           | 50    | 229                     | 2027  | 650                            | 5753  | 1235                            | 10931 |
|              | 80    | 407                     | 3602  | 918                            | 8124  | 1651                            | 14613 |
|              | 100   | 459                     | 4062  | 982                            | 8691  | 2041                            | 18064 |
|              | 120   | 523                     | 4629  | 1070                           | 9470  | 2288                            | 20250 |
|              | 160   | 523                     | 4629  | 1147                           | 10151 | 2483                            | 21976 |
| 58           | 80    | 714                     | 6319  | 1924                           | 17027 | 3185                            | 28190 |
|              | 100   | 905                     | 8009  | 2067                           | 18293 | 4134                            | 36589 |
|              | 120   | 969                     | 8576  | 2236                           | 19789 | 4329                            | 38315 |
|              | 160   | 969                     | 8576  | 2392                           | 21169 | 4459                            | 39465 |
| 65           | 80    | 969                     | 8576  | 2743                           | 24276 | 4836                            | 42802 |
|              | 100   | 1236                    | 10939 | 2990                           | 26462 | 6175                            | 54653 |
|              | 120   | 1236                    | 10939 | 3263                           | 28878 | 6175                            | 54653 |
|              | 160   | 1236                    | 10939 | 3419                           | 30258 | 6175                            | 54653 |

### •Cross Roller Bearing Specification

| Item<br>Size | Basic Rated Load           |       |                            |       | Permissible Moment Load Mc |       | Moment Stiffness Km       |               |
|--------------|----------------------------|-------|----------------------------|-------|----------------------------|-------|---------------------------|---------------|
|              | Basic Dynamic Rated Load C |       | Basic Static Rated Load Co |       | Nm                         | In-lb | x 10 <sup>4</sup> Nm /rad | In-lb/arc-min |
|              | x 10 <sup>3</sup> N        | lb    | x 10 <sup>3</sup> N        | lb    |                            |       |                           |               |
| 25           | 96.0                       | 2158  | 151                        | 3394  | 128                        | 1133  | 19.8                      | 512           |
| 32           | 150                        | 3372  | 250                        | 5620  | 257                        | 2274  | 44.2                      | 1137          |
| 40           | 213                        | 4788  | 365                        | 8205  | 369                        | 3266  | 74.6                      | 1918          |
| 45           | 230                        | 5170  | 426                        | 9576  | 563                        | 4983  | 116                       | 2986          |
| 58           | 518                        | 11645 | 904                        | 20322 | 838                        | 7416  | 201                       | 5173          |
| 65           | 556                        | 12499 | 1030                       | 23154 | 1525                       | 13496 | 331                       | 9374          |

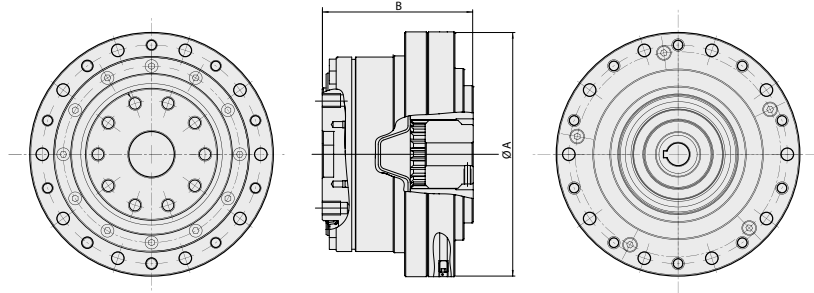
- "Basic dynamic rated load" is a constant stationary radial load that achieves a basic dynamic rated life of the bearing of one million revolutions.
- "Basic static rated load" is a static load that achieves a contact stress of a constant level (408kN/mm<sup>2</sup>) at the center of a contact zone between the rolling element receiving a maximum load and track.

• The moment stiffnesses are mean values.

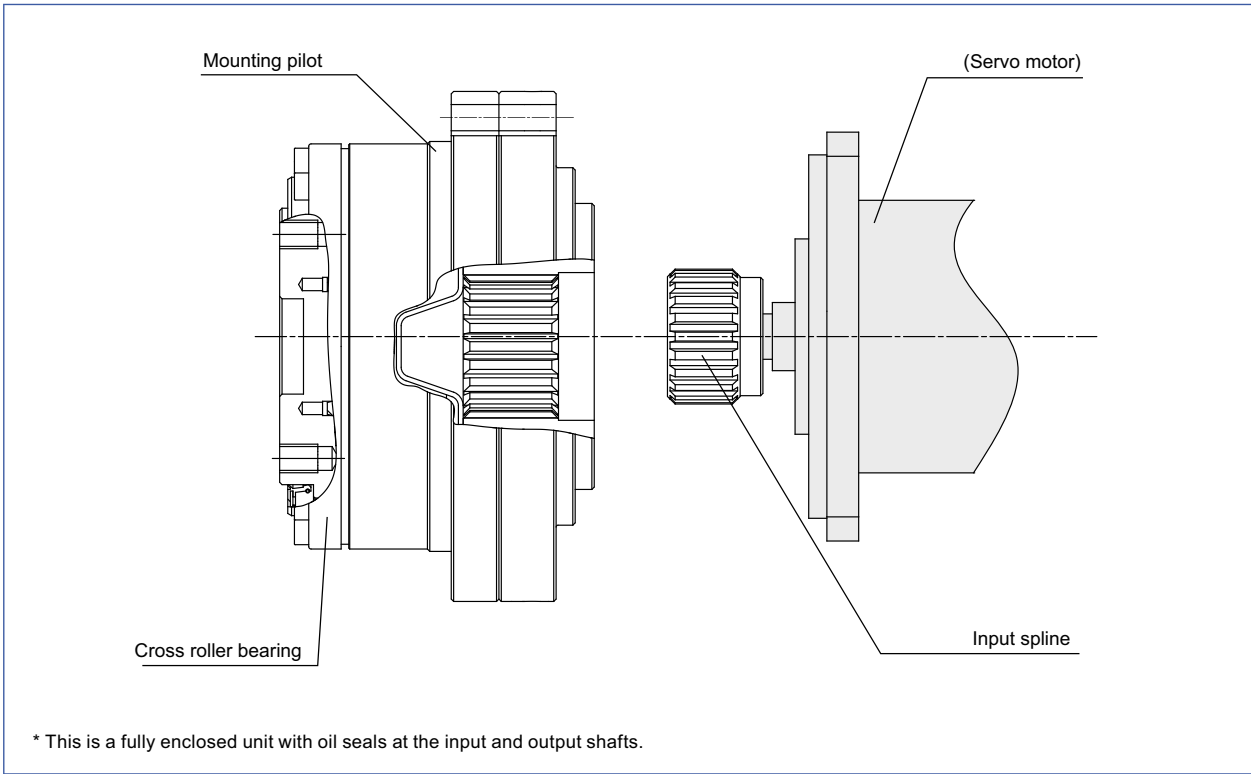
### •Dimensions

Unit: mm

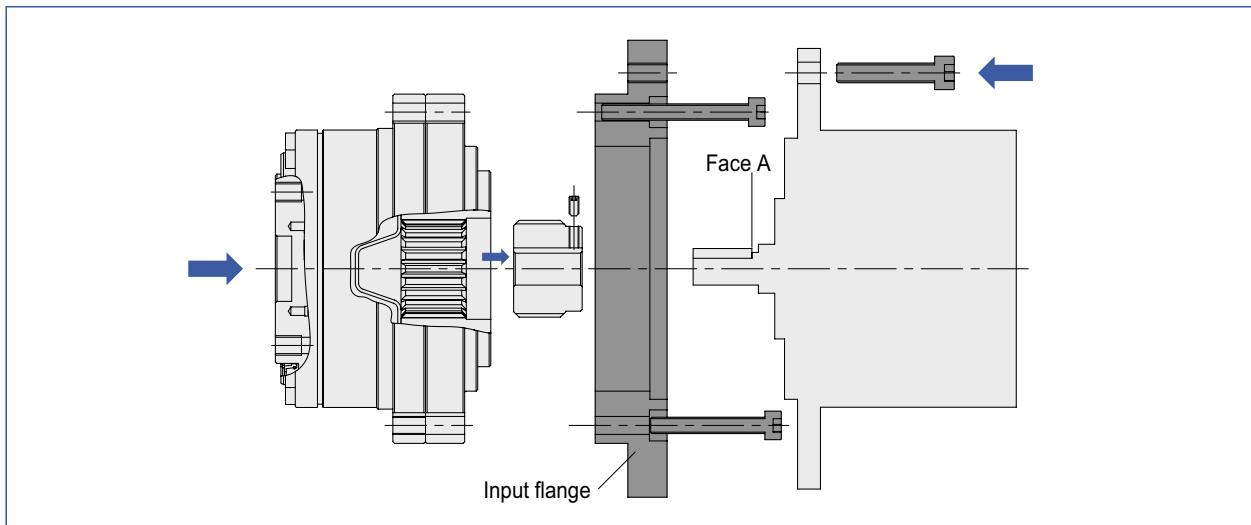
| Size   | 25  | 32  | 40  | 45  | 58  | 65  |
|--------|-----|-----|-----|-----|-----|-----|
| Symbol |     |     |     |     |     |     |
| øA     | 107 | 138 | 160 | 180 | 226 | 260 |
| B      | 66  | 75  | 85  | 102 | 120 | 129 |



•Overview Drawing



•Typical Assembly



# Ultra-Flat Gear Unit CSD-2UH Series



Available in 7 sizes with ratios 50:1 to 160:1, CSD-2UH is an ultra-thin and compact housed gear component unit.

- Zero Backlash
- Lightweight
- Ultra-flat
- Compact and simple design

$L_{10}$  Life: 7,000 h

## •CSD-2UH Series Ratings

| Size | Ratio | Rated Torque at 2000rpm | Limit for Repeated Peak Torque | Limit for Average Torque | Limit for Momentary Peak Torque |
|------|-------|-------------------------|--------------------------------|--------------------------|---------------------------------|
|      |       | Nm                      | Nm                             | Nm                       | Nm                              |
| 14   | 50    | 3.7                     | 12                             | 4.8                      | 24                              |
|      | 80    | 5.4                     | 16                             | 7.7                      | 35                              |
|      | 100   | 5.4                     | 19                             | 7.7                      | 35                              |
| 17   | 50    | 11                      | 23                             | 18                       | 48                              |
|      | 80    | 15                      | 29                             | 19                       | 61                              |
|      | 100   | 16                      | 37                             | 27                       | 71                              |
| 20   | 120   | 16                      | 37                             | 27                       | 71                              |
|      | 50    | 17                      | 39                             | 24                       | 69                              |
|      | 80    | 24                      | 51                             | 33                       | 89                              |
| 25   | 100   | 28                      | 57                             | 34                       | 95                              |
|      | 120   | 28                      | 60                             | 34                       | 95                              |
|      | 50    | 27                      | 69                             | 38                       | 127                             |
| 32   | 80    | 44                      | 96                             | 60                       | 179                             |
|      | 100   | 47                      | 110                            | 75                       | 184                             |
|      | 120   | 47                      | 117                            | 75                       | 204                             |

| Size | Ratio | Rated Torque at 2000rpm | Limit for Repeated Peak Torque | Limit for Average Torque | Limit for Momentary Peak Torque |
|------|-------|-------------------------|--------------------------------|--------------------------|---------------------------------|
|      |       | Nm                      | Nm                             | Nm                       | Nm                              |
| 32   | 50    | 53                      | 151                            | 75                       | 268                             |
|      | 80    | 83                      | 213                            | 117                      | 398                             |
|      | 100   | 96                      | 233                            | 151                      | 420                             |
| 40   | 120   | 96                      | 247                            | 151                      | 445                             |
|      | 50    | 96                      | 281                            | 137                      | 480                             |
|      | 80    | 144                     | 364                            | 198                      | 686                             |
| 50   | 100   | 185                     | 398                            | 260                      | 700                             |
|      | 120   | 205                     | 432                            | 315                      | 765                             |
|      | 50    | 172                     | 500                            | 247                      | 1000                            |
| 50   | 80    | 260                     | 659                            | 363                      | 1300                            |
|      | 100   | 329                     | 686                            | 466                      | 1440                            |
|      | 120   | 370                     | 756                            | 569                      | 1565                            |

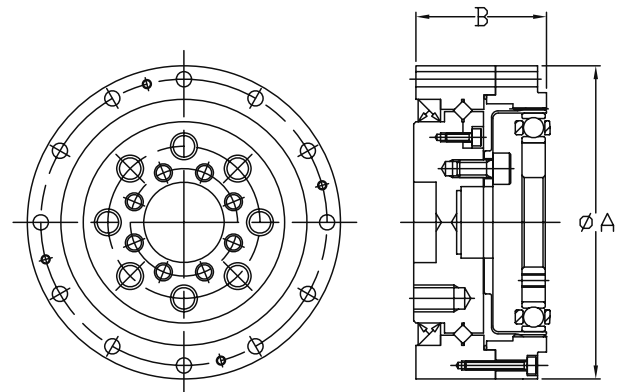
## •Cross Roller Bearing Specification

| Size | Item | Basic Rated Load           |      |                            |       | Permissible Moment Load Mc |       | Moment Stiffness Km     |               |
|------|------|----------------------------|------|----------------------------|-------|----------------------------|-------|-------------------------|---------------|
|      |      | Basic Dynamic Rated Load C |      | Basic Static Rated Load Co |       | Nm                         | In-lb | x10 <sup>6</sup> Nm/rad | In-lb/arc.min |
|      |      | x10 <sup>2</sup> N         | lb   | x10 <sup>2</sup> N         | lb    |                            |       |                         |               |
| 14   |      | 47                         | 1057 | 60.7                       | 1365  | 41                         | 363   | 3.48                    | 90            |
| 17   |      | 52.9                       | 1189 | 75.5                       | 1697  | 64                         | 566   | 7.75                    | 200           |
| 20   |      | 57.8                       | 1299 | 90                         | 2023  | 91                         | 805   | 12.8                    | 330           |
| 25   |      | 96                         | 2158 | 151                        | 3394  | 156                        | 1381  | 24.2                    | 623           |
| 32   |      | 150                        | 3372 | 250                        | 5620  | 313                        | 2770  | 53.9                    | 1388          |
| 40   |      | 213                        | 4788 | 365                        | 8205  | 450                        | 3983  | 91                      | 2343          |
| 50   |      | 348                        | 7823 | 602                        | 13533 | 759                        | 6717  | 171                     | 4403          |

## •Dimensions

Unit: mm

| Symbol | Size | 14 | 17   | 20   | 25   | 32  | 40   | 50   |
|--------|------|----|------|------|------|-----|------|------|
| øA h7  |      | 55 | 62   | 70   | 85   | 112 | 126  | 157  |
| B      |      | 25 | 26.5 | 29.5 | 37.1 | 43  | 51.7 | 62.5 |





# Ultra-Flat, Hollow Shaft Gear Unit CSD-2UF Series



Available in 6 sizes with ratios 50:1 to 160:1, CSD-2UF is an ultra-thin and compact housed gear component unit with a hollow through bore.

- Zero Backlash
- Hollow shaft
- High load capacity
- Lightweight
- Ultra-flat
- Compact and simple design

$L_{10}$  Life: 7,000h

## •CSD-2UF Series Ratings

| Size | Ratio | Rated Torque at 2000rpm | Limit for Repeated Peak Torque | Limit for Average Torque | Limit for Momentary Peak Torque |
|------|-------|-------------------------|--------------------------------|--------------------------|---------------------------------|
|      |       | Nm                      | Nm                             | Nm                       | Nm                              |
| 14   | 50    | 3.7                     | 12                             | 4.8                      | 24                              |
|      | 80    | 5.4                     | 16                             | 7.7                      | 35                              |
|      | 100   | 5.4                     | 19                             | 7.7                      | 35                              |
| 17   | 50    | 11                      | 23                             | 18                       | 48                              |
|      | 80    | 15                      | 29                             | 19                       | 61                              |
|      | 100   | 16                      | 37                             | 27                       | 71                              |
|      | 120   | 16                      | 37                             | 27                       | 71                              |
| 20   | 50    | 17                      | 39                             | 24                       | 69                              |
|      | 80    | 24                      | 51                             | 33                       | 89                              |
|      | 100   | 28                      | 57                             | 34                       | 95                              |
|      | 120   | 28                      | 60                             | 34                       | 95                              |
| 25   | 50    | 27                      | 69                             | 38                       | 127                             |
|      | 80    | 44                      | 96                             | 60                       | 179                             |
|      | 100   | 47                      | 110                            | 75                       | 184                             |
|      | 120   | 47                      | 117                            | 75                       | 204                             |

| Size | Ratio | Rated Torque at 2000rpm | Limit for Repeated Peak Torque | Limit for Average Torque | Limit for Momentary Peak Torque |
|------|-------|-------------------------|--------------------------------|--------------------------|---------------------------------|
|      |       | Nm                      | Nm                             | Nm                       | Nm                              |
| 32   | 50    | 53                      | 151                            | 75                       | 268                             |
|      | 80    | 83                      | 213                            | 117                      | 398                             |
|      | 100   | 96                      | 233                            | 151                      | 420                             |
|      | 120   | 96                      | 247                            | 151                      | 445                             |
| 40   | 50    | 96                      | 281                            | 137                      | 480                             |
|      | 80    | 144                     | 364                            | 198                      | 686                             |
|      | 100   | 185                     | 398                            | 260                      | 700                             |
|      | 120   | 205                     | 432                            | 315                      | 765                             |
| 50   | 50    | 172                     | 500                            | 247                      | 1000                            |
|      | 80    | 260                     | 659                            | 363                      | 1300                            |
|      | 100   | 329                     | 686                            | 466                      | 1440                            |
|      | 120   | 370                     | 756                            | 569                      | 1565                            |

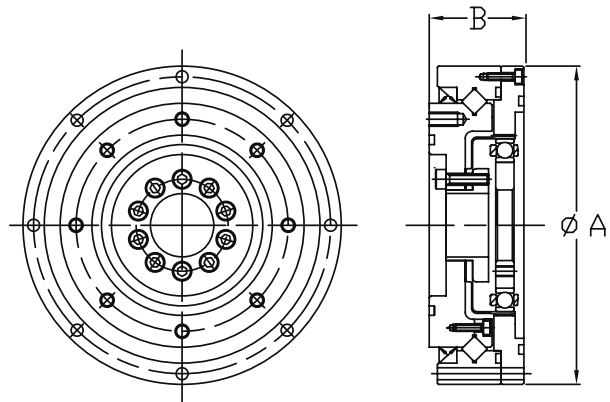
## •Cross Roller Bearing Specification

| Size | Item | Basic Rated Load           |      |                            |       | Permissible Moment Load Mc |       | Moment Stiffness Km     |               |
|------|------|----------------------------|------|----------------------------|-------|----------------------------|-------|-------------------------|---------------|
|      |      | Basic Dynamic Rated Load C |      | Basic Static Rated Load Co |       | Nm                         | In-lb | x10 <sup>3</sup> Nm/rad | In-lb/arc.min |
|      |      | x10 <sup>2</sup> N         | lb   | x10 <sup>2</sup> N         | lb    |                            |       |                         |               |
| 14   |      | 57.8                       | 1299 | 90                         | 2023  | 91                         | 805   | 12.8                    | 330           |
| 17   |      | 104                        | 2338 | 163                        | 3664  | 124                        | 1097  | 15.4                    | 397           |
| 20   |      | 146                        | 3282 | 220                        | 4946  | 187                        | 1655  | 25.2                    | 649           |
| 25   |      | 218                        | 4901 | 358                        | 8048  | 258                        | 2283  | 39.2                    | 1009          |
| 32   |      | 382                        | 8587 | 654                        | 14702 | 580                        | 5133  | 100                     | 2575          |
| 40   |      | 433                        | 9734 | 816                        | 18344 | 849                        | 7514  | 179                     | 4609          |


## •Dimensions

Unit: mm


| Size   | 14 | 17   | 20   | 25   | 32  | 40  |
|--------|----|------|------|------|-----|-----|
| Symbol |    |      |      |      |     |     |
| øA h7  | 70 | 80   | 90   | 110  | 142 | 170 |
| B      | 22 | 22.7 | 26.8 | 31.5 | 37  | 45  |



## Compact Gearhead/Double Shaft CSF Mini and Supermini Series



CSF-1U



CSF-2XH

CSF mini gearheads provide high positioning accuracy in a super-compact package. Compact 4-point contact ball bearing is mounted in the main shaft. Available in five sizes and four ratios, the CSF mini gearheads feature shaft or flange outputs.

- Zero backlash
- High positioning accuracy
- Compact and lightweight
- High torque capacity
- High radial, axial, and moment load capacity
- 4 point contact bearing
- Ratios: 30:1 to 100:1
- Flange output, shaft output, shaft input and output

**L<sub>10</sub> Life: 7,000 h**

### •CSF Mini and Supermini Series Ratings

| Size | Item | Ratio | Rated Torque at 2000 rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|------|------|-------|--------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|      |      |       | Nm                       | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 3    |      | 30    | 0.06                     | 0.53  | 0.13                           | 1.15  | 0.22                            | 1.95  |
|      |      | 50    | 0.11                     | 0.97  | 0.21                           | 1.86  | 0.41                            | 3.63  |
|      |      | 100   | 0.16                     | 1.42  | 0.3                            | 2.66  | 0.57                            | 5.04  |
| 5    |      | 30    | 0.25                     | 2.2   | 0.5                            | 4.4   | 0.9                             | 8.0   |
|      |      | 50    | 0.4                      | 3.5   | 0.9                            | 8.0   | 1.8                             | 16    |
|      |      | 100   | 0.6                      | 5.3   | 1.4                            | 12.4  | 2.7                             | 24    |
| 8    |      | 30    | 0.9                      | 8.0   | 1.8                            | 16    | 3.3                             | 29    |
|      |      | 50    | 1.8                      | 16    | 3.3                            | 29    | 6.6                             | 58    |
|      |      | 100   | 2.4                      | 21    | 4.8                            | 42    | 9                               | 80    |
| 11   |      | 30    | 2.2                      | 19    | 4.5                            | 40    | 8.5                             | 75    |
|      |      | 50    | 3.5                      | 31    | 8.3                            | 73    | 17                              | 150   |
|      |      | 100   | 5                        | 44    | 11                             | 97    | 25                              | 221   |
| 14   |      | 30    | 4                        | 35    | 9                              | 80    | 17                              | 150   |
|      |      | 50    | 5.4                      | 48    | 18                             | 159   | 35                              | 310   |
|      |      | 80    | 7.8                      | 69    | 23                             | 204   | 47                              | 416   |
|      |      | 100   | 7.8                      | 69    | 28                             | 248   | 54                              | 478   |

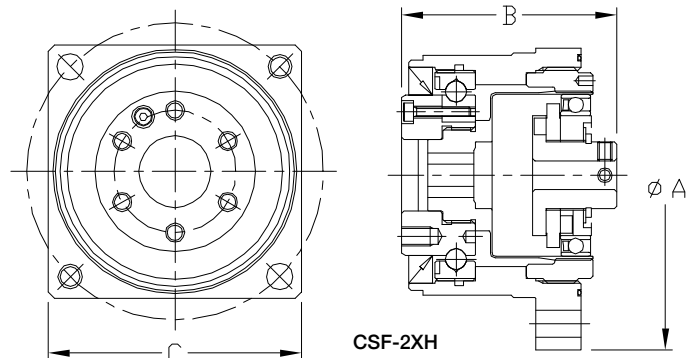
### •4Point Contact Bearing Specification

| Size | Item | Basic Rated Load           |      |                            |      | Permissible Moment Load Mc |       | Moment Stiffness Km  |               |
|------|------|----------------------------|------|----------------------------|------|----------------------------|-------|----------------------|---------------|
|      |      | Basic Dynamic Rated Load C |      | Basic Static Rated Load Co |      | Nm                         | In-lb | Nm/rad               | In-lb/arc.min |
|      |      | x10 <sup>3</sup> N         | lb   | x10 <sup>3</sup> N         | lb   |                            |       |                      |               |
| 3    |      | 6.65                       | 149  | 4.24                       | 95   | 0.27                       | 2     | 0.9x10 <sup>2</sup>  | 0.2           |
| 5    |      | 9.14                       | 205  | 7.63                       | 172  | 0.89                       | 8     | 7.41x10 <sup>2</sup> | 1.9           |
| 8    |      | 21.6                       | 486  | 19.0                       | 427  | 3.46                       | 31    | 2.76x10 <sup>3</sup> | 1.7           |
| 11   |      | 38.9                       | 874  | 35.4                       | 796  | 6.6                        | 58    | 7.41x10 <sup>3</sup> | 19.0          |
| 14   |      | 61.2                       | 1376 | 58.5                       | 1315 | 13.2                       | 117   | 1.34x10 <sup>4</sup> | 34.5          |

### •Dimensions

Unit: mm

| Size   | 3    | 5  | 8    | 11   | 14 |
|--------|------|----|------|------|----|
| Symbol |      |    |      |      |    |
| øA     | 17.5 | 29 | 43.5 | 58   | 73 |
| B      | 20.5 | 17 | 28.7 | 38.3 | 45 |
| C      | 13   | 22 | 32   | 43   | 53 |



# Ultra-Flat Compact Gearhead CSF-2UP Mini Series



The CSF-2UP gear units have an ultra-flat configuration with high-moment stiffness. The new models are lightweight and extremely flat. Thanks to a cross roller bearing used at the output flange, the CSF-2UP gearheads offer high-moment stiffness.

- Zero backlash
- High positioning accuracy
- Compact and lightweight
- High torque capacity
- High radial, axial, and moment load capacity
- Cross roller bearing
- Ratios: 30:1 to 100:1

$L_{10}$  Life: 7,000 h

## •CSF Mini Series Ratings

| Item<br>Size | Ratio | Rated Torque at 2000 rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|--------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                       | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 8            | 30    | 0.9                      | 8.0   | 1.8                            | 16    | 3.3                             | 29    |
|              | 50    | 1.8                      | 16    | 3.3                            | 29    | 6.6                             | 58    |
|              | 100   | 2.4                      | 21    | 4.8                            | 42    | 9                               | 80    |
| 11           | 30    | 2.2                      | 19    | 4.5                            | 40    | 8.5                             | 75    |
|              | 50    | 3.5                      | 31    | 8.3                            | 73    | 17                              | 150   |
|              | 100   | 5                        | 44    | 11                             | 97    | 25                              | 221   |
| 14           | 30    | 4                        | 35    | 9                              | 80    | 17                              | 150   |
|              | 50    | 5.4                      | 48    | 18                             | 159   | 35                              | 310   |
|              | 100   | 7.8                      | 69    | 28                             | 248   | 54                              | 478   |

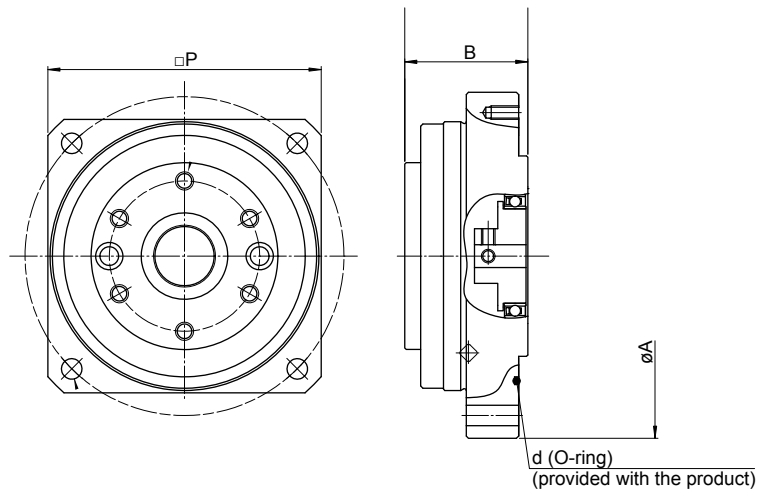
## •Cross Roller Bearing Specification

| Item<br>Size | Basic Rated Load           |      |                            |      | Permissible Moment Load Mc |       | Moment Stiffness Km   |               |
|--------------|----------------------------|------|----------------------------|------|----------------------------|-------|-----------------------|---------------|
|              | Basic Dynamic Rated Load C |      | Basic Static Rated Load Co |      | Nm                         | In-lb | Nm/rad                | In-lb/arc.min |
|              | x10 <sup>2</sup> N         | lb   | x10 <sup>2</sup> N         | lb   |                            |       |                       |               |
| 8            | 58                         | 1305 | 80                         | 1800 | 15                         | 133   | 2.0 x 10 <sup>4</sup> | 52            |
| 11           | 65                         | 1462 | 99                         | 2228 | 40                         | 354   | 4.0 x 10 <sup>4</sup> | 104           |
| 14           | 74                         | 1665 | 128                        | 2880 | 75                         | 664   | 8.0 x 10 <sup>4</sup> | 208           |

## •Dimensions


Unit: mm

| Size   | 8    | 11   | 14   |
|--------|------|------|------|
| Symbol |      |      |      |
| øA     | 66   | 80   | 100  |
| B      | 24.8 | 27   | 33.5 |
| P      | 50±1 | 60±1 | 75±1 |



## Gear unit with hollow shaft or solid input shaft

## SHF-2UH/2UJ Series



SHF-2UH

SHF-2UJ

Incorporating a Harmonic Drive® gear component into an integral housing, the SHF-2UH is a compact hollow shaft gearhead with zero backlash.

- Zero backlash
- Large hollow thru bore
- High positioning accuracy
- Compact and simple design
- High torque capacity
- High torsional stiffness
- Shaft input units available (SHF-2UJ)

**L<sub>10</sub> Life: 7,000h**

## •SHF Series Ratings

| Item | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|      |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 11   | 50    | 3.5                     | 31    | 8.3                            | 73    | 17                              | 150   |
|      | 100   | 5                       | 44    | 11                             | 97    | 25                              | 221   |
| 14   | 30    | 4.0                     | 35    | 9.0                            | 80    | 17                              | 150   |
|      | 50    | 5.4                     | 48    | 18                             | 159   | 35                              | 310   |
|      | 80    | 7.8                     | 69    | 23                             | 204   | 47                              | 416   |
|      | 100   | 7.8                     | 69    | 28                             | 248   | 54                              | 478   |
| 17   | 30    | 8.8                     | 78    | 6                              | 142   | 30                              | 266   |
|      | 50    | 16                      | 142   | 34                             | 301   | 70                              | 620   |
|      | 80    | 22                      | 195   | 43                             | 381   | 87                              | 770   |
|      | 100   | 24                      | 212   | 54                             | 478   | 110                             | 974   |
| 20   | 120   | 24                      | 212   | 54                             | 478   | 86                              | 761   |
|      | 30    | 15                      | 133   | 27                             | 239   | 50                              | 443   |
|      | 50    | 25                      | 221   | 56                             | 496   | 98                              | 867   |
|      | 80    | 34                      | 301   | 74                             | 655   | 127                             | 1124  |
|      | 100   | 40                      | 354   | 82                             | 726   | 147                             | 1301  |
|      | 120   | 40                      | 354   | 87                             | 770   | 147                             | 1301  |
| 25   | 160   | 40                      | 354   | 92                             | 814   | 147                             | 1301  |
|      | 30    | 27                      | 239   | 50                             | 443   | 95                              | 841   |
|      | 50    | 39                      | 345   | 98                             | 867   | 186                             | 1646  |
|      | 80    | 63                      | 558   | 137                            | 1212  | 255                             | 2257  |
|      | 100   | 67                      | 593   | 157                            | 1389  | 284                             | 2514  |
|      | 120   | 67                      | 593   | 167                            | 1478  | 304                             | 2691  |

| Item | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|      |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 32   | 30    | 54                      | 478   | 100                            | 885   | 200                             | 1770  |
|      | 50    | 76                      | 673   | 216                            | 1912  | 382                             | 3381  |
|      | 80    | 118                     | 1044  | 230                            | 2036  | 568                             | 5027  |
|      | 100   | 137                     | 1212  | 333                            | 2947  | 647                             | 5726  |
|      | 120   | 137                     | 1212  | 353                            | 3124  | 686                             | 6072  |
|      | 160   | 137                     | 1212  | 372                            | 3292  | 686                             | 6072  |
| 40   | 50    | 137                     | 1212  | 402                            | 3558  | 686                             | 6072  |
|      | 80    | 206                     | 1823  | 519                            | 4593  | 980                             | 8674  |
|      | 100   | 265                     | 2345  | 568                            | 5027  | 1080                            | 9559  |
|      | 120   | 294                     | 2602  | 617                            | 5460  | 1180                            | 10444 |
|      | 160   | 294                     | 2602  | 647                            | 5726  | 1180                            | 10444 |
|      | 50    | 176                     | 1558  | 500                            | 4425  | 950                             | 8408  |
| 45   | 80    | 313                     | 2770  | 706                            | 6248  | 1270                            | 11240 |
|      | 100   | 353                     | 3124  | 755                            | 6682  | 1570                            | 13896 |
|      | 120   | 402                     | 3558  | 823                            | 7284  | 1760                            | 15577 |
|      | 160   | 402                     | 3558  | 882                            | 7806  | 1910                            | 16905 |
|      | 50    | 245                     | 2168  | 715                            | 6328  | 1430                            | 12657 |
|      | 80    | 372                     | 3292  | 941                            | 8328  | 1860                            | 16462 |
| 50   | 100   | 470                     | 4160  | 980                            | 8673  | 2060                            | 18233 |
|      | 120   | 529                     | 4682  | 1080                           | 9558  | 2060                            | 18233 |
|      | 160   | 529                     | 4682  | 1180                           | 10443 | 2450                            | 21684 |
|      | 50    | 353                     | 3124  | 1020                           | 9027  | 1960                            | 17347 |
| 58   | 80    | 549                     | 4859  | 1480                           | 13098 | 2450                            | 21684 |
|      | 100   | 686                     | 6160  | 1590                           | 14072 | 3180                            | 28145 |
|      | 120   | 745                     | 6593  | 1720                           | 15222 | 3330                            | 29473 |
|      | 160   | 745                     | 6593  | 1840                           | 16284 | 3430                            | 30358 |

## •Cross Roller Bearing Specification

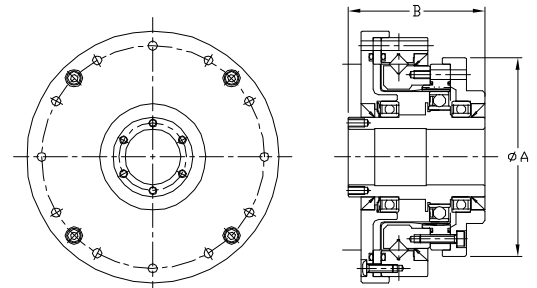
| Item | Basic Rated Load           |       |                            |       | Permissible Moment Load Mc |       | Moment Stiffness Km       |               |
|------|----------------------------|-------|----------------------------|-------|----------------------------|-------|---------------------------|---------------|
|      | Basic Dynamic Rated Load C |       | Basic Static Rated Load Co |       | Nm                         | In-lb | x 10 <sup>6</sup> Nm /rad | In-lb/arc-min |
| 11   | x 10 <sup>2</sup> N        | lb    | x 10 <sup>2</sup> N        | lb    |                            |       |                           |               |
| 11   | 52.9                       | 1189  | 75.5                       | 1697  | 74                         | 655   | 6.5                       | 167           |
| 14   | 58                         | 1304  | 86                         | 1933  | 74                         | 655   | 8.5                       | 219           |
| 17   | 104                        | 2338  | 163                        | 3664  | 124                        | 1097  | 15.1                      | 389           |
| 20   | 146                        | 3282  | 220                        | 4946  | 187                        | 1655  | 25.2                      | 649           |
| 25   | 218                        | 4901  | 358                        | 8048  | 258                        | 2283  | 39.2                      | 1009          |
| 32   | 382                        | 8587  | 654                        | 14702 | 580                        | 5133  | 100                       | 2575          |
| 40   | 433                        | 9734  | 816                        | 18344 | 849                        | 7514  | 179                       | 4609          |
| 45   | 776                        | 17444 | 1350                       | 30348 | 1127                       | 9974  | 257                       | 6618          |
| 50   | 816                        | 18344 | 1490                       | 33495 | 1487                       | 13160 | 351                       | 9038          |
| 58   | 874                        | 19648 | 1710                       | 38441 | 2180                       | 19293 | 531                       | 13673         |

• "Basic dynamic rated load" is a constant stationary radial load that achieves a basic dynamic rated life of the bearing of one million revolutions. "Basic static rated load" is a static load that achieves a contact stress of a constant level (408kN/mm<sup>2</sup>) at the center of a contact zone between the rolling element receiving a maximum load and track.


## •Dimensions

Unit: mm

| Size   | 11   | 14   | 17   | 20   | 25   | 32   | 40  | 45  | 50  | 58  |
|--------|------|------|------|------|------|------|-----|-----|-----|-----|
| Symbol |      |      |      |      |      |      |     |     |     |     |
| ∅A     | 45.3 | 54   | 64   | 75   | 90   | 115  | 140 | 160 | 172 | 201 |
| B      | 48   | 52.5 | 56.5 | 51.5 | 55.5 | 65.5 | 79  | 85  | 93  | 106 |



# SHF-2UH-LW Series



LW indicates lightweight. Incorporating a Harmonic Drive® gear component into an integral housing, the SHF-2UH-LW is a lightweight, compact hollow shaft gearhead with zero backlash.

- Zero backlash
- 20% lighter than standard unit
- Large hollow through bore
- High positioning accuracy
- High torque capacity
- High torsional stiffness

**L<sub>10</sub> Life: 7,000h**

## •SHF-LW Series Ratings

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|----------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                         | In-lb |
| 14           | 30    | 4.0                     | 35    | 9.0                            | 80    | 17                         | 150   |
|              | 50    | 5.4                     | 48    | 18                             | 159   | 35                         | 310   |
|              | 80    | 7.8                     | 69    | 23                             | 204   | 47                         | 416   |
|              | 100   | 7.8                     | 69    | 28                             | 248   | 54                         | 478   |
| 17           | 30    | 8.8                     | 78    | 16                             | 142   | 30                         | 266   |
|              | 50    | 16                      | 142   | 34                             | 301   | 70                         | 620   |
|              | 80    | 22                      | 195   | 43                             | 381   | 87                         | 770   |
|              | 100   | 24                      | 212   | 54                             | 478   | 108                        | 956   |
| 20           | 120   | 24                      | 212   | 54                             | 478   | 86                         | 761   |
|              | 30    | 15                      | 133   | 27                             | 239   | 50                         | 443   |
|              | 50    | 25                      | 221   | 56                             | 496   | 98                         | 867   |
|              | 80    | 34                      | 301   | 74                             | 655   | 127                        | 1,124 |
| 25           | 100   | 40                      | 354   | 82                             | 726   | 147                        | 1,301 |
|              | 120   | 40                      | 354   | 87                             | 770   | 147                        | 1,301 |
|              | 160   | 40                      | 354   | 92                             | 814   | 147                        | 1,301 |
|              | 30    | 27                      | 239   | 50                             | 443   | 95                         | 841   |
| 32           | 50    | 39                      | 345   | 98                             | 867   | 186                        | 1,646 |
|              | 80    | 63                      | 558   | 137                            | 1,213 | 255                        | 2,257 |
|              | 100   | 67                      | 593   | 157                            | 1,390 | 284                        | 2,514 |
|              | 120   | 67                      | 593   | 167                            | 1,478 | 304                        | 2,691 |
| 40           | 160   | 67                      | 593   | 176                            | 1,558 | 314                        | 2,779 |
|              | 30    | 54                      | 478   | 100                            | 885   | 200                        | 1,770 |
|              | 50    | 76                      | 673   | 216                            | 1,912 | 382                        | 3,381 |
|              | 80    | 118                     | 1,044 | 304                            | 2,691 | 568                        | 5,027 |
| 50           | 100   | 137                     | 1,213 | 333                            | 2,947 | 647                        | 5,726 |
|              | 120   | 137                     | 1,213 | 353                            | 3,124 | 686                        | 6,072 |
|              | 160   | 137                     | 1,213 | 372                            | 3,292 | 686                        | 6,072 |

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |        | Limit for Momentary Torque |        |
|--------------|-------|-------------------------|-------|--------------------------------|--------|----------------------------|--------|
|              |       | Nm                      | In-lb | Nm                             | In-lb  | Nm                         | In-lb  |
| 40           | 50    | 137                     | 1,213 | 402                            | 3,558  | 686                        | 6,072  |
|              | 80    | 206                     | 1,823 | 519                            | 4,594  | 980                        | 8,674  |
|              | 100   | 265                     | 2,345 | 568                            | 5,027  | 1,080                      | 9,559  |
|              | 120   | 294                     | 2,602 | 617                            | 5,461  | 1,180                      | 10,444 |
| 45           | 160   | 294                     | 2,602 | 647                            | 5,726  | 1,180                      | 10,444 |
|              | 50    | 176                     | 1,558 | 500                            | 4,425  | 950                        | 8,408  |
|              | 80    | 313                     | 2,770 | 706                            | 6,249  | 1,270                      | 11,240 |
|              | 100   | 353                     | 3,124 | 755                            | 6,682  | 1,570                      | 13,896 |
| 50           | 120   | 402                     | 3,558 | 823                            | 7,284  | 1,760                      | 15,577 |
|              | 160   | 402                     | 3,558 | 882                            | 7,806  | 1,910                      | 16,905 |
|              | 50    | 245                     | 2,168 | 715                            | 6,328  | 1,430                      | 12,657 |
|              | 80    | 372                     | 3,292 | 941                            | 8,329  | 1,860                      | 16,462 |
| 58           | 100   | 470                     | 4,160 | 980                            | 8,674  | 2,060                      | 18,233 |
|              | 120   | 529                     | 4,682 | 1,080                          | 9,559  | 2,060                      | 18,233 |
|              | 160   | 529                     | 4,682 | 1,180                          | 10,444 | 2,450                      | 21,684 |
|              | 50    | 353                     | 3,124 | 1,020                          | 9,028  | 1,960                      | 17,347 |
| 58           | 80    | 549                     | 4,859 | 1,480                          | 13,099 | 2,450                      | 21,684 |
|              | 100   | 696                     | 6,160 | 1,590                          | 14,073 | 3,180                      | 28,145 |
|              | 120   | 745                     | 6,594 | 1,720                          | 15,223 | 3,330                      | 29,473 |
|              | 160   | 745                     | 6,594 | 1,840                          | 16,285 | 3,430                      | 30,358 |

## •Cross Roller Bearing Specification

| Item<br>Size | Basic Rated Load           |        |                            |        | Allowable Moment Load Mc |        | Moment Stiffness Km      |               |
|--------------|----------------------------|--------|----------------------------|--------|--------------------------|--------|--------------------------|---------------|
|              | Basic Dynamic Rated Load C |        | Basic Static Rated Load Co |        |                          |        |                          |               |
|              | x 10 <sup>3</sup> N        | lb     | x 10 <sup>3</sup> N        | lb     | Nm                       | In-lb  | x 10 <sup>4</sup> Nm/rad | In-lb/arc-min |
| 14           | 58                         | 1,304  | 86                         | 1,933  | 74                       | 655    | 8.5                      | 75            |
| 17           | 104                        | 2,338  | 163                        | 3,664  | 124                      | 1,097  | 15.4                     | 136           |
| 20           | 146                        | 3,282  | 220                        | 4,946  | 187                      | 1,655  | 25.2                     | 223           |
| 25           | 218                        | 4,901  | 358                        | 8,048  | 258                      | 2,283  | 39.2                     | 347           |
| 32           | 382                        | 8,588  | 654                        | 14,703 | 580                      | 5,133  | 100                      | 885           |
| 40           | 433                        | 9,734  | 816                        | 18,344 | 849                      | 7,514  | 179                      | 1,584         |
| 45           | 776                        | 17,445 | 1,350                      | 30,349 | 1,127                    | 9,975  | 257                      | 2,275         |
| 50           | 816                        | 18,344 | 1,490                      | 33,497 | 1,487                    | 13,161 | 351                      | 3,107         |
| 58           | 874                        | 19,648 | 1,710                      | 38,442 | 2,180                    | 19,295 | 531                      | 4,700         |

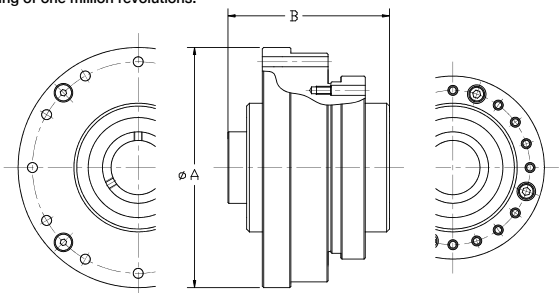
\*\*1: "Basic dynamic rated load" is a constant stationary radial load that achieves a basic dynamic rated life of the bearing of one million revolutions.

\*\*2: "Basic static rated load" is a static load that achieves a contact stress of a constant level (408kN/mm<sup>2</sup>) at the center of a contact zone between the rolling element receiving a maximum load and track.

## •Dimensions

Unit: mm

| Size<br>Symbol | 14   | 17   | 20   | 25   | 32   | 40  | 45  | 50  | 58  |
|----------------|------|------|------|------|------|-----|-----|-----|-----|
| øA             | 52   | 62   | 73   | 88   | 115  | 140 | 160 | 168 | 195 |
| B              | 52.5 | 56.5 | 51.5 | 55.5 | 65.5 | 79  | 85  | 93  | 106 |



## High torque gear unit with hollow shaft or solid input shaft

## SHG-2UH /2UJ Series



The SHG-2UH series with a hollow shaft is a high torque, compact, precision gearhead with zero backlash and exceptional accuracy and repeatability.

- Zero backlash
- Large hollow through bore
- High positioning accuracy
- High torque capacity
- High torsional stiffness
- Shaft input units available (SHG-2UJ)
- 30% increased torque compared to SHF Units

$L_{10}$  Life: 10,000 h

## •SHG Series Ratings

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 14           | 50    | 7.0                     | 62    | 23                             | 204   | 46                              | 407   |
|              | 80    | 10                      | 89    | 30                             | 266   | 61                              | 540   |
|              | 100   | 10                      | 89    | 36                             | 319   | 70                              | 620   |
| 17           | 50    | 21                      | 186   | 44                             | 389   | 91                              | 805   |
|              | 80    | 29                      | 257   | 56                             | 496   | 113                             | 1000  |
|              | 100   | 31                      | 274   | 70                             | 620   | 143                             | 1266  |
|              | 120   | 31                      | 274   | 70                             | 620   | 112                             | 991   |
| 20           | 50    | 33                      | 292   | 73                             | 646   | 127                             | 1124  |
|              | 80    | 44                      | 389   | 96                             | 850   | 165                             | 1460  |
|              | 100   | 52                      | 460   | 107                            | 947   | 191                             | 1690  |
|              | 120   | 52                      | 460   | 113                            | 1000  | 191                             | 1690  |
|              | 160   | 52                      | 460   | 120                            | 1062  | 191                             | 1690  |
| 25           | 50    | 51                      | 451   | 127                            | 1124  | 242                             | 2142  |
|              | 80    | 82                      | 726   | 178                            | 1575  | 332                             | 2938  |
|              | 100   | 87                      | 770   | 204                            | 1805  | 369                             | 3266  |
|              | 120   | 87                      | 770   | 217                            | 1920  | 395                             | 3496  |
|              | 160   | 87                      | 770   | 229                            | 2027  | 408                             | 3611  |
| 32           | 50    | 99                      | 876   | 281                            | 2487  | 497                             | 4399  |
|              | 80    | 153                     | 1354  | 395                            | 3496  | 738                             | 6532  |
|              | 100   | 178                     | 1575  | 433                            | 3832  | 841                             | 7443  |
|              | 120   | 178                     | 1575  | 459                            | 4062  | 892                             | 7895  |
|              | 160   | 178                     | 1575  | 484                            | 4283  | 892                             | 7895  |

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 40           | 50    | 178                     | 1575  | 523                            | 4629  | 892                             | 7895  |
|              | 80    | 268                     | 2372  | 675                            | 5974  | 1270                            | 11240 |
|              | 100   | 345                     | 3053  | 738                            | 6531  | 1400                            | 12391 |
|              | 120   | 382                     | 3381  | 802                            | 7098  | 1530                            | 13542 |
| 45           | 50    | 229                     | 2027  | 650                            | 5753  | 1235                            | 10931 |
|              | 80    | 407                     | 3602  | 918                            | 8124  | 1651                            | 14613 |
|              | 100   | 459                     | 4062  | 982                            | 8691  | 2041                            | 18064 |
|              | 120   | 523                     | 4629  | 1070                           | 9470  | 2288                            | 20250 |
| 50           | 50    | 523                     | 4629  | 1147                           | 10151 | 2483                            | 21976 |
|              | 80    | 484                     | 4283  | 1223                           | 10824 | 2418                            | 21401 |
|              | 100   | 611                     | 5407  | 1274                           | 11275 | 2678                            | 23702 |
|              | 120   | 688                     | 6089  | 1404                           | 12425 | 2678                            | 23702 |
| 58           | 50    | 688                     | 6089  | 1534                           | 13576 | 3185                            | 28190 |
|              | 80    | 714                     | 6319  | 1924                           | 17027 | 3185                            | 28190 |
|              | 100   | 905                     | 8009  | 2067                           | 18293 | 4134                            | 36589 |
|              | 120   | 969                     | 8576  | 2236                           | 19789 | 4329                            | 38315 |
| 65           | 50    | 969                     | 8576  | 2392                           | 21169 | 4459                            | 39465 |
|              | 80    | 969                     | 8576  | 2743                           | 24276 | 4836                            | 42802 |
|              | 100   | 1236                    | 10939 | 2990                           | 26462 | 6175                            | 54653 |
|              | 120   | 1236                    | 10939 | 3263                           | 28878 | 6175                            | 54653 |
|              | 160   | 1236                    | 10939 | 3419                           | 30258 | 6175                            | 54653 |

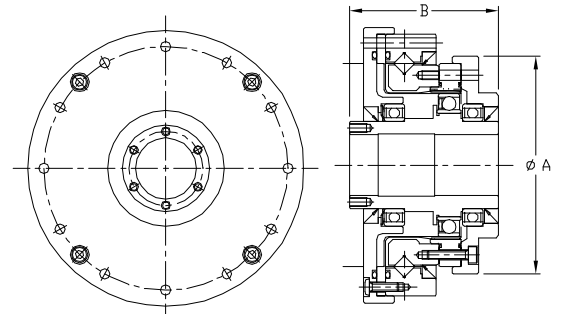
## •Cross Roller Bearing Specification

| Item<br>Size | Basic Rated Load           |       |                            |       | Permissible Moment Load Mc |       | Moment Stiffness Km       |               |
|--------------|----------------------------|-------|----------------------------|-------|----------------------------|-------|---------------------------|---------------|
|              | Basic Dynamic Rated Load C |       | Basic Static Rated Load Co |       | Nm                         | In-lb | x 10 <sup>4</sup> Nm /rad | In-lb/arc-min |
|              | x 10 <sup>2</sup> N        | lb    | x 10 <sup>2</sup> N        | lb    |                            |       |                           |               |
| 14           | 58                         | 1304  | 86                         | 1933  | 74                         | 655   | 8.5                       | 219           |
| 17           | 104                        | 2338  | 163                        | 3664  | 124                        | 1097  | 15.1                      | 389           |
| 20           | 146                        | 3282  | 220                        | 4946  | 187                        | 1655  | 25.2                      | 649           |
| 25           | 218                        | 4901  | 358                        | 8048  | 258                        | 2283  | 39.2                      | 1009          |
| 32           | 382                        | 8587  | 654                        | 14702 | 580                        | 5133  | 100                       | 2575          |
| 40           | 433                        | 9734  | 816                        | 18344 | 849                        | 7514  | 179                       | 4609          |
| 45           | 776                        | 17444 | 1350                       | 30348 | 1127                       | 9974  | 257                       | 6618          |
| 50           | 816                        | 18344 | 1490                       | 33495 | 1487                       | 13160 | 351                       | 9038          |
| 58           | 874                        | 19648 | 1710                       | 38441 | 2180                       | 19293 | 531                       | 13673         |
| 65           | 1300                       | 29224 | 2230                       | 50130 | 2740                       | 24249 | 741                       | 19081         |

• "Basic dynamic rated load" is a constant stationary radial load that achieves a basic dynamic rated life of the bearing of one million revolutions.  
 "Basic static rated load" is a static load that achieves a contact stress of a constant level (408kN/mm<sup>2</sup>) at the center of a contact zone between the rolling element receiving a maximum load and track.

## •Dimensions

|      |        | Unit: mm |      |      |      |      |     |     |     |     |     |
|------|--------|----------|------|------|------|------|-----|-----|-----|-----|-----|
| Size | Symbol | 14       | 17   | 20   | 25   | 32   | 40  | 45  | 50  | 58  | 65  |
| øA   |        | 54       | 64   | 75   | 90   | 115  | 140 | 160 | 175 | 201 | 221 |
| B    |        | 52.5     | 56.5 | 51.5 | 55.5 | 65.5 | 79  | 85  | 93  | 106 | 128 |



# SHG-2UH-LW Series



Incorporating a Harmonic Drive® gear component into an integral housing, the SHF-2UH-LW is a lightweight compact hollow shaft gearhead with zero backlash.

- Zero backlash
- 20% lighter than standard unit
- Large hollow through bore
- High positioning accuracy
- High torque capacity
- High torsional stiffness
- 30% increased torque compared to SHF Units

$L_{10}$  Life: 10,000 h

## •SHG-LW Series Ratings

| Item | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Torque |       |
|------|-------|-------------------------|-------|--------------------------------|-------|----------------------------|-------|
|      |       | Nm                      | In-lb | Nm                             | In-lb | Nm                         | In-lb |
| 14   | 50    | 7                       | 62    | 23                             | 204   | 46                         | 407   |
|      | 80    | 10                      | 89    | 30                             | 266   | 61                         | 540   |
|      | 100   | 10                      | 89    | 36                             | 319   | 70                         | 620   |
| 17   | 50    | 21                      | 186   | 44                             | 389   | 91                         | 805   |
|      | 80    | 29                      | 257   | 56                             | 496   | 113                        | 1,000 |
|      | 100   | 31                      | 274   | 70                             | 620   | 143                        | 1,266 |
| 20   | 50    | 33                      | 292   | 73                             | 646   | 127                        | 1,124 |
|      | 80    | 44                      | 389   | 96                             | 850   | 165                        | 1,460 |
|      | 100   | 52                      | 460   | 107                            | 947   | 191                        | 1,690 |
| 25   | 50    | 51                      | 451   | 127                            | 1,124 | 242                        | 2,142 |
|      | 80    | 82                      | 726   | 178                            | 1,575 | 332                        | 2,938 |
|      | 100   | 87                      | 770   | 204                            | 1,806 | 369                        | 3,266 |
| 32   | 50    | 99                      | 876   | 281                            | 2,487 | 497                        | 4,399 |
|      | 80    | 153                     | 1,354 | 395                            | 3,496 | 738                        | 6,532 |
|      | 100   | 178                     | 1,575 | 433                            | 3,832 | 841                        | 7,443 |

| Item | Ratio | Rated Torque at 2000rpm |        | Limit for Repeated Peak Torque |        | Limit for Momentary Torque |        |
|------|-------|-------------------------|--------|--------------------------------|--------|----------------------------|--------|
|      |       | Nm                      | In-lb  | Nm                             | In-lb  | Nm                         | In-lb  |
| 40   | 50    | 178                     | 1,575  | 523                            | 4,629  | 892                        | 7,895  |
|      | 80    | 268                     | 2,372  | 675                            | 5,974  | 1,270                      | 11,240 |
|      | 100   | 345                     | 3,054  | 738                            | 6,532  | 1,400                      | 12,391 |
|      | 120   | 382                     | 3,381  | 802                            | 7,098  | 1,530                      | 13,542 |
| 45   | 50    | 229                     | 2,027  | 650                            | 5,753  | 1,235                      | 10,931 |
|      | 80    | 407                     | 3,602  | 918                            | 8,125  | 1,651                      | 14,613 |
|      | 100   | 459                     | 4,062  | 982                            | 8,691  | 2,041                      | 18,064 |
|      | 120   | 523                     | 4,629  | 1,070                          | 9,470  | 2,288                      | 20,250 |
| 50   | 50    | 229                     | 2,027  | 650                            | 5,753  | 1,235                      | 10,931 |
|      | 80    | 484                     | 4,284  | 1,223                          | 10,824 | 2,418                      | 21,401 |
|      | 100   | 611                     | 5,408  | 1,274                          | 11,276 | 2,678                      | 23,702 |
|      | 120   | 688                     | 6,089  | 1,404                          | 12,426 | 2,678                      | 23,702 |
| 58   | 50    | 229                     | 2,027  | 650                            | 5,753  | 1,235                      | 10,931 |
|      | 80    | 969                     | 8,576  | 2,236                          | 19,790 | 4,329                      | 38,315 |
|      | 100   | 969                     | 8,576  | 2,392                          | 21,171 | 4,459                      | 39,465 |
|      | 120   | 969                     | 8,576  | 2,743                          | 24,278 | 4,836                      | 42,802 |
| 65   | 50    | 229                     | 2,027  | 650                            | 5,753  | 1,235                      | 10,931 |
|      | 80    | 1,236                   | 10,940 | 2,990                          | 26,464 | 6,175                      | 54,653 |
|      | 100   | 1,236                   | 10,940 | 3,263                          | 28,880 | 6,175                      | 54,653 |
|      | 120   | 1,236                   | 10,940 | 3,419                          | 30,261 | 6,175                      | 54,653 |

## •Cross Roller Bearing Specification

| Size | Item | Basic Rated Load           |        |                            |        | Allowable Moment Load Mc |        | Moment Stiffness Km         |               |
|------|------|----------------------------|--------|----------------------------|--------|--------------------------|--------|-----------------------------|---------------|
|      |      | Basic Dynamic Rated Load C |        | Basic Static Rated Load Co |        | Nm                       | In-lb  | $\times 10^4 \text{Nm/rad}$ | In-lb/arc-min |
|      |      | $\times 10^3 \text{N}$     | lb     | $\times 10^3 \text{N}$     | lb     |                          |        |                             |               |
| 14   |      | 58                         | 1,304  | 86                         | 1,933  | 74                       | 655    | 8.5                         | 75            |
| 17   |      | 104                        | 2,338  | 163                        | 3,664  | 124                      | 1,097  | 15.4                        | 136           |
| 20   |      | 146                        | 3,282  | 220                        | 4,946  | 187                      | 1,655  | 25.2                        | 223           |
| 25   |      | 218                        | 4,901  | 358                        | 8,048  | 258                      | 2,283  | 39.2                        | 347           |
| 32   |      | 382                        | 8,588  | 654                        | 14,703 | 580                      | 5,133  | 100                         | 885           |
| 40   |      | 433                        | 9,734  | 816                        | 18,344 | 849                      | 7,514  | 179                         | 1,584         |
| 45   |      | 776                        | 17,445 | 1,350                      | 30,349 | 1,127                    | 9,975  | 257                         | 2,275         |
| 50   |      | 816                        | 18,344 | 1,490                      | 33,497 | 1,487                    | 13,161 | 351                         | 3,107         |
| 58   |      | 874                        | 19,648 | 1,710                      | 38,442 | 2,180                    | 19,295 | 531                         | 4,700         |
| 65   |      | 1,300                      | 29,225 | 2,230                      | 50,132 | 2,740                    | 24,251 | 741                         | 6,558         |

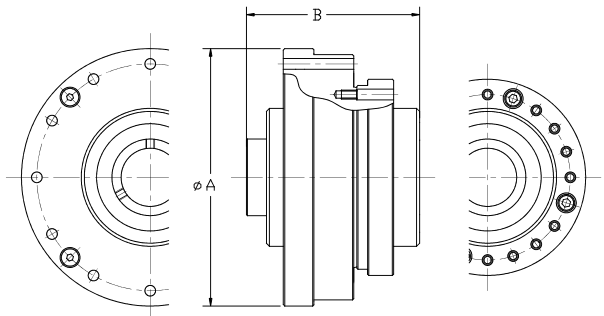
\*1: "Basic dynamic rated load" is a constant stationary radial load that achieves a basic dynamic rated life of the bearing of one million revolutions.

\*2: "Basic static rated load" is a static load that achieves a contact stress of a constant level (408kN/mm<sup>2</sup>) at the center of a contact zone between the rolling element receiving a maximum load and track.

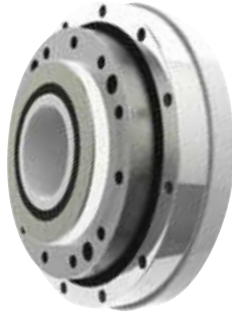
## •Dimensions

Unit: mm

| Symbol   | Size | 14   | 17   | 20   | 25   | 32   | 40  | 45  | 50  | 58  | 65  |
|----------|------|------|------|------|------|------|-----|-----|-----|-----|-----|
| $\phi A$ |      | 52   | 62   | 73   | 88   | 115  | 140 | 160 | 168 | 195 | 213 |
| B        |      | 52.5 | 56.5 | 51.5 | 55.5 | 65.5 | 79  | 85  | 93  | 106 | 128 |



## Lightweight, Hollow Shaft SHD-2UH-LW Series



LW indicates lightweight. Axially compact, these gear units feature a large hollow input shaft and a robust cross roller bearing so loads can be mounted directly to the unit without the need for additional support bearings.

- Zero Backlash
- Ultra-flat design
- Large Hollow Input Shaft
- Accuracy <1 arc-min (most sizes)
- Rigid cross roller output bearing
- Lightweight

$L_{10}$  Life: 7,000h

### •SHD-2UH-LW Series Ratings

| Size | Ratio | Rated Torque at 2000rpm | Limit for Repeated Peak Torque | Limit for Average Torque | Limit for Momentary Peak Torque |
|------|-------|-------------------------|--------------------------------|--------------------------|---------------------------------|
|      |       | Nm                      | Nm                             | Nm                       | Nm                              |
| 14   | 50    | 3.7                     | 12                             | 4.8                      | 23                              |
|      | 80    | 5.4                     | 16                             | 7.7                      | 35                              |
|      | 100   | 5.4                     | 19                             | 7.7                      | 35                              |
| 17   | 50    | 11                      | 23                             | 18                       | 48                              |
|      | 80    | 15                      | 29                             | 19                       | 61                              |
|      | 100   | 16                      | 37                             | 27                       | 71                              |
| 20   | 120   | 16                      | 37                             | 27                       | 71                              |
|      | 50    | 17                      | 39                             | 24                       | 69                              |
|      | 80    | 24                      | 51                             | 33                       | 89                              |
| 25   | 100   | 28                      | 57                             | 34                       | 95                              |
|      | 120   | 28                      | 60                             | 34                       | 95                              |
|      | 50    | 27                      | 69                             | 38                       | 127                             |
| 32   | 80    | 44                      | 96                             | 60                       | 179                             |
|      | 100   | 47                      | 110                            | 75                       | 184                             |
|      | 120   | 47                      | 117                            | 75                       | 204                             |

| Size | Ratio | Rated Torque at 2000rpm | Limit for Repeated Peak Torque | Limit for Average Torque | Limit for Momentary Peak Torque |
|------|-------|-------------------------|--------------------------------|--------------------------|---------------------------------|
|      |       | Nm                      | Nm                             | Nm                       | Nm                              |
| 32   | 50    | 53                      | 151                            | 75                       | 268                             |
|      | 80    | 83                      | 213                            | 117                      | 398                             |
|      | 100   | 96                      | 233                            | 151                      | 420                             |
| 40   | 120   | 96                      | 247                            | 151                      | 445                             |
|      | 50    | 96                      | 281                            | 137                      | 480                             |
|      | 80    | 144                     | 364                            | 198                      | 686                             |
| 40   | 100   | 185                     | 398                            | 260                      | 700                             |
|      | 120   | 205                     | 432                            | 315                      | 765                             |

### • Cross Roller Bearing Specification

| Size | Item | Basic Rated Load           |       |                               |       | Allowable Moment Load $M_c$ |       | Moment Stiffness $K_m$       |               |
|------|------|----------------------------|-------|-------------------------------|-------|-----------------------------|-------|------------------------------|---------------|
|      |      | Basic Dynamic Rated Load C |       | Basic Static Rated Load $C_0$ |       | Nm                          | In-lb | $\times 10^4 \text{ Nm/rad}$ | In-lb/arc.min |
|      |      | $\times 10^2 \text{ N}$    | lb    | $\times 10^2 \text{ N}$       | lb    |                             |       |                              |               |
| 14   |      | 29                         | 652   | 43                            | 967   | 37                          | 327   | 7.08                         | 63            |
| 17   |      | 52                         | 1,169 | 81                            | 1,821 | 62                          | 549   | 12.7                         | 112           |
| 20   |      | 73                         | 1,641 | 110                           | 2,473 | 93                          | 823   | 21                           | 186           |
| 25   |      | 109                        | 2,450 | 179                           | 4,024 | 129                         | 1,142 | 31                           | 274           |
| 32   |      | 191                        | 4,294 | 327                           | 7,351 | 290                         | 2,567 | 82.1                         | 727           |
| 40   |      | 216                        | 4,856 | 408                           | 9,172 | 424                         | 3,753 | 145                          | 1,283         |

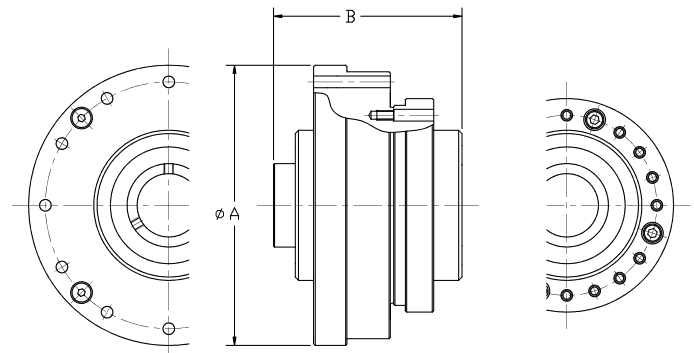
\*\*1: "Basic dynamic rated load" is a constant stationary radial load that achieves a basic dynamic rated life of the bearing of one million revolutions.

\*\*2: "Basic static rated load" is a static load that achieves a contact stress of a constant level (408kN/mm<sup>2</sup>) at the center of a contact zone between the rolling element receiving a maximum load and track.

### •Dimensions

Unit: mm

| Size     | 14   | 17 | 20 | 25   | 32  | 40  |
|----------|------|----|----|------|-----|-----|
| Symbol   |      |    |    |      |     |     |
| $\phi A$ | 74   | 84 | 95 | 115  | 147 | 175 |
| B        | 45.5 | 48 | 42 | 46.5 | 55  | 65  |





# Hollow Shaft, Simplicity Unit SHD-2SH Series



Axially compact, these gear units feature a large hollow input shaft and a robust cross roller bearing so loads can be mounted directly to the unit without the need for additional support bearings.

- Zero backlash
- Extremely flat profile
- Hollow through bore
- High positioning accuracy
- High stiffness cross roller bearing output
- High radial, axial, and moment load capacity

**L<sub>10</sub> Life: 7,000h**

## •SHD Series Ratings

| Size | Ratio | Rated Torque at 2000rpm | Limit for Repeated Peak Torque | Limit for Average Torque | Limit for Momentary Peak Torque |
|------|-------|-------------------------|--------------------------------|--------------------------|---------------------------------|
|      |       | Nm                      | Nm                             | Nm                       | Nm                              |
| 14   | 50    | 3.7                     | 12                             | 4.8                      | 23                              |
|      | 80    | 5.4                     | 16                             | 7.7                      | 35                              |
|      | 100   | 5.4                     | 19                             | 7.7                      | 35                              |
| 17   | 50    | 11                      | 23                             | 18                       | 48                              |
|      | 80    | 15                      | 29                             | 19                       | 61                              |
|      | 100   | 16                      | 37                             | 27                       | 71                              |
| 20   | 50    | 17                      | 39                             | 24                       | 69                              |
|      | 80    | 24                      | 51                             | 33                       | 89                              |
|      | 100   | 28                      | 57                             | 34                       | 95                              |
| 25   | 50    | 27                      | 69                             | 38                       | 127                             |
|      | 80    | 44                      | 96                             | 60                       | 179                             |
|      | 100   | 47                      | 110                            | 75                       | 184                             |
| 32   | 50    | 53                      | 151                            | 75                       | 268                             |
|      | 80    | 83                      | 213                            | 117                      | 398                             |
|      | 100   | 96                      | 233                            | 151                      | 420                             |
| 40   | 50    | 96                      | 247                            | 151                      | 445                             |
|      | 80    | 144                     | 364                            | 198                      | 686                             |
|      | 100   | 185                     | 398                            | 260                      | 700                             |
| 40   | 50    | 17                      | 39                             | 24                       | 69                              |
|      | 80    | 24                      | 51                             | 33                       | 89                              |
|      | 100   | 28                      | 57                             | 34                       | 95                              |
| 40   | 50    | 27                      | 69                             | 38                       | 127                             |
|      | 80    | 44                      | 96                             | 60                       | 179                             |
|      | 100   | 47                      | 110                            | 75                       | 184                             |
| 40   | 50    | 17                      | 39                             | 24                       | 69                              |
|      | 80    | 24                      | 51                             | 33                       | 89                              |
|      | 100   | 28                      | 57                             | 34                       | 95                              |
| 40   | 50    | 27                      | 69                             | 38                       | 127                             |
|      | 80    | 44                      | 96                             | 60                       | 179                             |
|      | 100   | 47                      | 110                            | 75                       | 184                             |

| Size | Ratio | Rated Torque at 2000rpm | Limit for Repeated Peak Torque | Limit for Average Torque | Limit for Momentary Peak Torque |
|------|-------|-------------------------|--------------------------------|--------------------------|---------------------------------|
|      |       | Nm                      | Nm                             | Nm                       | Nm                              |
| 32   | 50    | 53                      | 151                            | 75                       | 268                             |
|      | 80    | 83                      | 213                            | 117                      | 398                             |
|      | 100   | 96                      | 233                            | 151                      | 420                             |
| 40   | 50    | 96                      | 247                            | 151                      | 445                             |
|      | 80    | 144                     | 364                            | 198                      | 686                             |
|      | 100   | 185                     | 398                            | 260                      | 700                             |
| 40   | 50    | 17                      | 39                             | 24                       | 69                              |
|      | 80    | 24                      | 51                             | 33                       | 89                              |
|      | 100   | 28                      | 57                             | 34                       | 95                              |
| 40   | 50    | 27                      | 69                             | 38                       | 127                             |
|      | 80    | 44                      | 96                             | 60                       | 179                             |
|      | 100   | 47                      | 110                            | 75                       | 184                             |

## •Cross Roller Bearing Specification

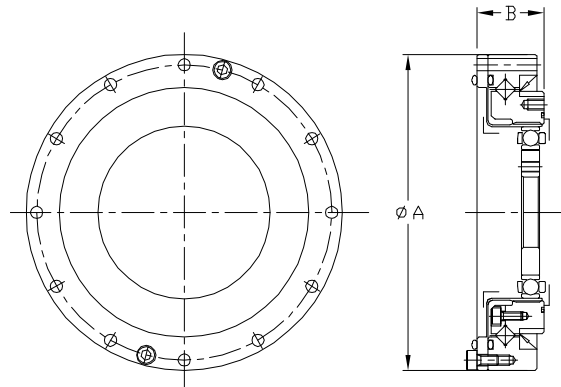
| Item | Basic Rated Load           |      |                            |      | Allowable Moment Load Mc |       | Moment Stiffness Km     |                |
|------|----------------------------|------|----------------------------|------|--------------------------|-------|-------------------------|----------------|
|      | Basic Dynamic Rated Load C |      | Basic Static Rated Load Co |      | Nm                       | In-lb | x10 <sup>4</sup> Nm/rad | In-lb /arc-min |
|      | x10 <sup>3</sup> N         | lb   | x10 <sup>3</sup> N         | lb   |                          |       |                         |                |
| 14   | 29                         | 652  | 43                         | 967  | 37                       | 327   | 7.08                    | 182            |
| 17   | 52                         | 1169 | 81                         | 1821 | 62                       | 549   | 12.7                    | 327            |
| 20   | 73                         | 1641 | 110                        | 2473 | 93                       | 823   | 21                      | 541            |
| 25   | 109                        | 2450 | 179                        | 4024 | 129                      | 1142  | 31                      | 798            |
| 32   | 191                        | 4294 | 327                        | 7351 | 290                      | 2567  | 82.1                    | 2114           |
| 40   | 216                        | 4856 | 408                        | 9172 | 424                      | 3752  | 145                     | 3734           |

• "Basic dynamic rated load" is a constant stationary radial load that achieves a basic dynamic rated life of the bearing of one million revolutions.  
 "Basic static rated load" is a static load that achieves a contact stress of a constant level (4kN/mm<sup>2</sup>) at the center of a contact zone between the rolling element receiving a maximum load and track.

## •Dimensions

Unit: mm

| Size   | 14   | 17   | 20 | 25  | 32   | 40  |
|--------|------|------|----|-----|------|-----|
| Symbol |      |      |    |     |      |     |
| øA     | 70   | 80   | 90 | 110 | 142  | 170 |
| B      | 17.5 | 18.5 | 19 | 22  | 27.9 | 33  |



## Simplicity gear unit

## SHF-2SH/2SO Series



Simplicity Gear Units are Non-housed component gears combined with a precision cross roller output bearing. Simplicity Gear Units do not include the housing and output flange, which allows for even tighter integration into the customer's housing or machine structure.

- Zero backlash
- High positioning accuracy
- Compact and simple design
- High torque capacity
- High torsional stiffness

$L_{10}$  Life: 7,000h

## •SHF Series Ratings

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 14           | 30    | 4.0                     | 35    | 9.0                            | 80    | 17                              | 150   |
|              | 50    | 5.4                     | 48    | 18                             | 159   | 35                              | 310   |
|              | 80    | 7.8                     | 69    | 23                             | 204   | 47                              | 416   |
|              | 100   | 7.8                     | 69    | 28                             | 248   | 54                              | 478   |
| 17           | 30    | 8.8                     | 78    | 6                              | 142   | 30                              | 266   |
|              | 50    | 16                      | 142   | 34                             | 301   | 70                              | 620   |
|              | 80    | 22                      | 195   | 43                             | 381   | 87                              | 770   |
|              | 100   | 24                      | 212   | 54                             | 478   | 110                             | 974   |
| 20           | 120   | 24                      | 212   | 54                             | 478   | 86                              | 761   |
|              | 30    | 15                      | 133   | 27                             | 239   | 50                              | 443   |
|              | 50    | 25                      | 221   | 56                             | 496   | 98                              | 867   |
|              | 80    | 34                      | 301   | 74                             | 655   | 127                             | 1124  |
| 25           | 100   | 40                      | 354   | 82                             | 726   | 147                             | 1301  |
|              | 120   | 40                      | 354   | 87                             | 770   | 147                             | 1301  |
|              | 160   | 40                      | 354   | 92                             | 814   | 147                             | 1301  |
|              | 30    | 27                      | 239   | 50                             | 443   | 95                              | 841   |
| 50           | 50    | 39                      | 345   | 98                             | 867   | 186                             | 1646  |
|              | 80    | 63                      | 558   | 137                            | 1212  | 255                             | 2257  |
|              | 100   | 67                      | 593   | 157                            | 1389  | 284                             | 2514  |
|              | 120   | 67                      | 593   | 167                            | 1478  | 304                             | 2691  |
| 160          | 67    | 593                     | 176   | 1558                           | 314   | 2779                            |       |

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 32           | 30    | 54                      | 478   | 100                            | 885   | 200                             | 1770  |
|              | 50    | 76                      | 673   | 216                            | 1912  | 382                             | 3381  |
|              | 80    | 118                     | 1044  | 230                            | 2036  | 568                             | 5027  |
|              | 100   | 137                     | 1212  | 333                            | 2947  | 647                             | 5726  |
|              | 120   | 137                     | 1212  | 353                            | 3124  | 686                             | 6072  |
|              | 160   | 137                     | 1212  | 372                            | 3292  | 686                             | 6072  |
| 40           | 50    | 137                     | 1212  | 402                            | 3558  | 686                             | 6072  |
|              | 80    | 206                     | 1823  | 519                            | 4593  | 980                             | 8674  |
|              | 100   | 265                     | 2345  | 568                            | 5027  | 1080                            | 9559  |
|              | 120   | 294                     | 2602  | 617                            | 5460  | 1180                            | 10444 |
| 45           | 160   | 294                     | 2602  | 647                            | 5726  | 1180                            | 10444 |
|              | 50    | 176                     | 1558  | 500                            | 4425  | 950                             | 8408  |
|              | 80    | 313                     | 2770  | 706                            | 6248  | 1270                            | 11240 |
|              | 100   | 353                     | 3124  | 755                            | 6682  | 1570                            | 13896 |
| 50           | 120   | 402                     | 3558  | 823                            | 7284  | 1760                            | 15577 |
|              | 160   | 402                     | 3558  | 882                            | 7806  | 1910                            | 16905 |
|              | 50    | 245                     | 2168  | 715                            | 6328  | 1430                            | 12657 |
|              | 80    | 372                     | 3292  | 941                            | 8328  | 1860                            | 16462 |
| 58           | 100   | 470                     | 4160  | 980                            | 8673  | 2060                            | 18233 |
|              | 120   | 529                     | 4682  | 1080                           | 9558  | 2060                            | 18233 |
|              | 160   | 529                     | 4682  | 1180                           | 10443 | 2450                            | 21684 |
|              | 50    | 353                     | 3124  | 1020                           | 9027  | 1960                            | 17347 |
| 58           | 80    | 549                     | 4859  | 1480                           | 13098 | 2450                            | 21684 |
|              | 100   | 686                     | 6160  | 1590                           | 14072 | 3180                            | 28145 |
|              | 120   | 745                     | 6593  | 1720                           | 15222 | 3330                            | 29473 |
|              | 160   | 745                     | 6593  | 1840                           | 16284 | 3430                            | 30358 |

## •Cross Roller Bearing Specification

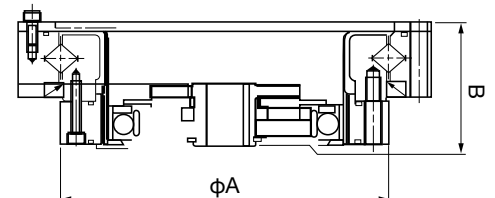
| Item<br>Size | Basic Rated Load           |       |                            |       | Allowable Moment Load Mc |       | Moment Stiffness Km       |               |
|--------------|----------------------------|-------|----------------------------|-------|--------------------------|-------|---------------------------|---------------|
|              | Basic Dynamic Rated Load C |       | Basic Static Rated Load Co |       | Nm                       | In-lb | x 10 <sup>3</sup> Nm /rad | In-lb/arc-min |
|              | x 10 <sup>3</sup> N        | lb    | x 10 <sup>3</sup> N        | lb    |                          |       |                           |               |
| 14           | 58                         | 1304  | 86                         | 1933  | 74                       | 655   | 8.5                       | 219           |
| 17           | 104                        | 2338  | 163                        | 3664  | 124                      | 1097  | 15.1                      | 389           |
| 20           | 146                        | 3282  | 220                        | 4946  | 187                      | 1655  | 25.2                      | 649           |
| 25           | 218                        | 4901  | 358                        | 8048  | 258                      | 2283  | 39.2                      | 1009          |
| 32           | 382                        | 8587  | 654                        | 14702 | 580                      | 5133  | 100                       | 2575          |
| 40           | 433                        | 9734  | 816                        | 18344 | 849                      | 7514  | 179                       | 4609          |
| 45           | 776                        | 17444 | 1350                       | 30348 | 1127                     | 9974  | 257                       | 6618          |
| 50           | 816                        | 18344 | 1490                       | 33495 | 1487                     | 13160 | 351                       | 9038          |
| 58           | 874                        | 19648 | 1710                       | 38441 | 2180                     | 19293 | 531                       | 13673         |

• "Basic dynamic rated load" is a constant stationary radial load that achieves a basic dynamic rated life of the bearing of one million revolutions. "Basic static rated load" is a static load that achieves a contact stress of a constant level (408kN/mm<sup>2</sup>) at the center of a contact zone between the rolling element receiving a maximum load and track.

## •Dimensions (2SO)

| Size   | 14   | 17   | 20   | 25 | 32  | 40  | 45  | 50  | 58   |
|--------|------|------|------|----|-----|-----|-----|-----|------|
| Symbol |      |      |      |    |     |     |     |     |      |
| φA     | 50   | 60   | 70   | 85 | 110 | 135 | 155 | 170 | 195  |
| B      | 28.5 | 32.5 | 33.5 | 37 | 44  | 53  | 58  | 64  | 75.5 |

\*SHG only



# SHG-2SH/2SO Series



High Torque versions of our Simplicity Gear Units. Simplicity Gear Units do not include the housing and output flange, which allows for even tighter integration into the customer's housing or machine structure.

- Zero backlash
- High positioning accuracy
- High torque capacity
- High torsional stiffness
- 30% increased torque compared to SHF Units

**L<sub>10</sub> Life: 10,000h**

## •SHG Series Ratings

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 14           | 50    | 7.0                     | 62    | 23                             | 204   | 46                              | 407   |
|              | 80    | 10                      | 89    | 30                             | 266   | 61                              | 540   |
|              | 100   | 10                      | 89    | 36                             | 319   | 70                              | 620   |
| 17           | 50    | 21                      | 186   | 44                             | 389   | 91                              | 805   |
|              | 80    | 29                      | 257   | 56                             | 496   | 113                             | 1000  |
|              | 100   | 31                      | 274   | 70                             | 620   | 143                             | 1266  |
| 20           | 50    | 33                      | 292   | 73                             | 646   | 127                             | 1124  |
|              | 80    | 44                      | 389   | 96                             | 850   | 165                             | 1460  |
|              | 100   | 52                      | 460   | 107                            | 947   | 191                             | 1690  |
| 25           | 50    | 51                      | 451   | 127                            | 1124  | 242                             | 2142  |
|              | 80    | 82                      | 726   | 178                            | 1575  | 332                             | 2938  |
|              | 100   | 87                      | 770   | 204                            | 1805  | 369                             | 3266  |
| 32           | 50    | 99                      | 876   | 281                            | 2487  | 497                             | 4399  |
|              | 80    | 153                     | 1354  | 395                            | 3496  | 738                             | 6532  |
|              | 100   | 178                     | 1575  | 433                            | 3832  | 841                             | 7443  |

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 40           | 50    | 178                     | 1575  | 523                            | 4629  | 892                             | 7895  |
|              | 80    | 268                     | 2372  | 675                            | 5974  | 1270                            | 11240 |
|              | 100   | 345                     | 3053  | 738                            | 6531  | 1400                            | 12391 |
|              | 120   | 382                     | 3381  | 802                            | 7098  | 1530                            | 13542 |
| 45           | 50    | 229                     | 2027  | 650                            | 5753  | 1235                            | 10931 |
|              | 80    | 407                     | 3602  | 918                            | 8124  | 1651                            | 14613 |
|              | 100   | 459                     | 4062  | 982                            | 8691  | 2041                            | 18064 |
|              | 120   | 523                     | 4629  | 1070                           | 9470  | 2288                            | 20250 |
| 50           | 50    | 229                     | 2027  | 650                            | 5753  | 1235                            | 10931 |
|              | 80    | 407                     | 3602  | 918                            | 8124  | 1651                            | 14613 |
|              | 100   | 459                     | 4062  | 982                            | 8691  | 2041                            | 18064 |
|              | 120   | 523                     | 4629  | 1070                           | 9470  | 2288                            | 20250 |
| 58           | 50    | 229                     | 2027  | 650                            | 5753  | 1235                            | 10931 |
|              | 80    | 407                     | 3602  | 918                            | 8124  | 1651                            | 14613 |
|              | 100   | 459                     | 4062  | 982                            | 8691  | 2041                            | 18064 |
|              | 120   | 523                     | 4629  | 1070                           | 9470  | 2288                            | 20250 |
| 65           | 50    | 229                     | 2027  | 650                            | 5753  | 1235                            | 10931 |
|              | 80    | 407                     | 3602  | 918                            | 8124  | 1651                            | 14613 |
|              | 100   | 459                     | 4062  | 982                            | 8691  | 2041                            | 18064 |
|              | 120   | 523                     | 4629  | 1070                           | 9470  | 2288                            | 20250 |

## •Cross Roller Bearing Specification

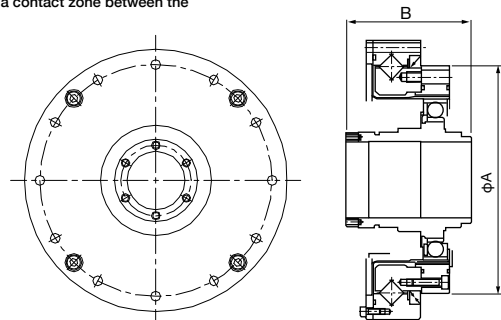
| Size | Item | Basic Rated Load           |       |                            |       | Allowable Moment Load Mc |       | Moment Stiffness Km       |               |
|------|------|----------------------------|-------|----------------------------|-------|--------------------------|-------|---------------------------|---------------|
|      |      | Basic Dynamic Rated Load C |       | Basic Static Rated Load Co |       | Nm                       | In-lb | x 10 <sup>4</sup> Nm /rad | In-lb/arc-min |
|      |      | x 10 <sup>2</sup> N        | lb    | x 10 <sup>2</sup> N        | lb    |                          |       |                           |               |
| 14   |      | 58                         | 1304  | 86                         | 1933  | 74                       | 655   | 8.5                       | 219           |
| 17   |      | 104                        | 2338  | 163                        | 3664  | 124                      | 1097  | 15.1                      | 389           |
| 20   |      | 146                        | 3282  | 220                        | 4946  | 187                      | 1655  | 25.2                      | 649           |
| 25   |      | 218                        | 4901  | 358                        | 8048  | 258                      | 2283  | 39.2                      | 1009          |
| 32   |      | 382                        | 8587  | 654                        | 14702 | 580                      | 5133  | 100                       | 2575          |
| 40   |      | 433                        | 9734  | 816                        | 18344 | 849                      | 7514  | 179                       | 4609          |
| 45   |      | 776                        | 17444 | 1350                       | 30348 | 1127                     | 9974  | 257                       | 6618          |
| 50   |      | 816                        | 18344 | 1490                       | 33495 | 1487                     | 13160 | 351                       | 9038          |
| 58   |      | 874                        | 19648 | 1710                       | 38441 | 2180                     | 19293 | 531                       | 13673         |
| 65   |      | 1300                       | 29224 | 2230                       | 50130 | 2740                     | 24249 | 741                       | 19081         |

• "Basic dynamic rated load" is a constant stationary radial load that achieves a basic dynamic rated life of the bearing of one million revolutions.  
 "Basic static rated load" is a static load that achieves a contact stress of a constant level (408kN/mm<sup>2</sup>) at the center of a contact zone between the rolling element receiving a maximum load and track.

## •Dimensions (2SH)

Unit: mm

| Size   | 14   | 17   | 20   | 25   | 32   | 40  | 45  | 50  | 58  | 65  |
|--------|------|------|------|------|------|-----|-----|-----|-----|-----|
| Symbol |      |      |      |      |      |     |     |     |     |     |
| øA     | 50   | 60   | 70   | 85   | 110  | 135 | 155 | 175 | 195 | 215 |
| B      | 52.5 | 56.5 | 51.5 | 55.5 | 65.5 | 79  | 85  | 93  | 106 | 128 |



# Phasing Differential FD Series Component



The FD series is an extremely compact differential unit that allows you to fine-tune the phase and timing during operation.

- Pancake
- Ultra compact differential unit
- Backlash is very small and unit requires no assembly adjustment

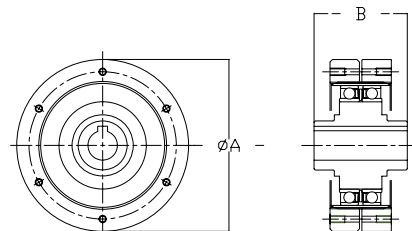
## •FD Series Ratings

| Size | Ratio | Rotational Speed rpm |       |          |       |          |       |         |       |         |       |
|------|-------|----------------------|-------|----------|-------|----------|-------|---------|-------|---------|-------|
|      |       | 3500 rpm             |       | 2850 rpm |       | 1450 rpm |       | 960 rpm |       | 500 rpm |       |
|      |       | Nm                   | In-lb | Nm       | In-lb | Nm       | In-lb | Nm      | In-lb | Nm      | In-lb |
| 20   | 80    | 29                   | 257   | 30       | 266   | 30       | 266   | 30      | 266   | 30      | 266   |
|      | 100   | 30                   | 266   | 31       | 274   | 36       | 319   | 36      | 319   | 36      | 319   |
|      | 128   | 31                   | 274   | 34       | 301   | 43       | 381   | 43      | 381   | 43      | 381   |
|      | 160   | 32                   | 283   | 35       | 310   | 45       | 398   | 49      | 434   | 49      | 434   |
| 25   | 80    | 46                   | 407   | 50       | 443   | 57       | 504   | 57      | 504   | 57      | 504   |
|      | 100   | 49                   | 434   | 53       | 469   | 67       | 593   | 79      | 699   | 79      | 699   |
|      | 120   | 52                   | 460   | 55       | 487   | 70       | 620   | 82      | 726   | 96      | 850   |
|      | 160   | 54                   | 478   | 57       | 504   | 73       | 646   | 83      | 735   | 108     | 956   |
| 32   | 200   | 55                   | 487   | 59       | 522   | 74       | 655   | 84      | 743   | 108     | 956   |
|      | 78    | 98                   | 867   | 108      | 956   | 108      | 656   | 108     | 956   | 108     | 956   |
|      | 100   | 108                  | 956   | 118      | 1044  | 147      | 1301  | 157     | 1389  | 157     | 1389  |
|      | 131   | 108                  | 956   | 118      | 1044  | 157      | 1389  | 176     | 1558  | 206     | 1823  |
| 40   | 157   | 108                  | 956   | 118      | 1044  | 157      | 1389  | 176     | 1558  | 216     | 1912  |
|      | 200   | 108                  | 956   | 118      | 1044  | 157      | 1389  | 176     | 1558  | 216     | 1912  |
|      | 260   | 108                  | 956   | 118      | 1044  | 157      | 1389  | 176     | 1558  | 216     | 1912  |
|      | 80    | 196                  | 1735  | 196      | 1735  | 196      | 1735  | 196     | 1735  | 196     | 1735  |
| 50   | 100   | 235                  | 2080  | 245      | 2168  | 265      | 2345  | 265     | 2345  | 265     | 2345  |
|      | 128   | 235                  | 2080  | 245      | 2168  | 314      | 2779  | 363     | 3213  | 372     | 3292  |
|      | 160   | 235                  | 2080  | 245      | 2168  | 314      | 2779  | 363     | 3213  | 451     | 3991  |
|      | 200   | 235                  | 2080  | 245      | 2168  | 314      | 2779  | 363     | 3213  | 451     | 3991  |
| 65   | 258   | 235                  | 2080  | 245      | 2168  | 314      | 2779  | 363     | 3213  | 451     | 3991  |
|      | 80    | 353                  | 3124  | 353      | 3124  | 353      | 3124  | 353     | 3124  | 353     | 3124  |
|      | 100   | 441                  | 3903  | 470      | 4160  | 559      | 4947  | 559     | 4947  | 559     | 4947  |
|      | 120   | 441                  | 3903  | 470      | 4160  | 588      | 5204  | 666     | 5894  | 666     | 5894  |
| 80   | 160   | 441                  | 3903  | 470      | 4160  | 588      | 5204  | 676     | 5983  | 843     | 7461  |
|      | 200   | 441                  | 3903  | 470      | 4160  | 588      | 5204  | 676     | 5983  | 843     | 7461  |
|      | 242   | 441                  | 3903  | 470      | 4160  | 588      | 5204  | 676     | 5983  | 843     | 7461  |
|      | 78    | -                    | -     | -        | -     | 764      | 6761  | 764     | 6761  | 764     | 6761  |
| 100  | 104   | -                    | -     | -        | -     | 1100     | 9735  | 1190    | 10532 | 1190    | 10532 |
|      | 132   | -                    | -     | -        | -     | 1100     | 9735  | 1250    | 11063 | 1570    | 13895 |
|      | 158   | -                    | -     | -        | -     | 1100     | 9735  | 1250    | 11063 | 1570    | 13895 |
|      | 208   | -                    | -     | -        | -     | 1100     | 9735  | 1250    | 11063 | 1570    | 13895 |
| 125  | 260   | -                    | -     | -        | -     | 1100     | 9735  | 1250    | 11063 | 1570    | 13895 |
|      | 80    | -                    | -     | -        | -     | 1370     | 12125 | 1370    | 12125 | 1370    | 12125 |
|      | 96    | -                    | -     | -        | -     | 1800     | 15930 | 1800    | 15930 | 1800    | 15930 |
|      | 128   | -                    | -     | -        | -     | 2180     | 19293 | 2490    | 22037 | 2710    | 23984 |
| 160  | 160   | -                    | -     | -        | -     | 2180     | 19293 | 2490    | 22037 | 3130    | 27701 |
|      | 194   | -                    | -     | -        | -     | 2180     | 19293 | 2490    | 22037 | 3130    | 27701 |
|      | 258   | -                    | -     | -        | -     | 2180     | 19293 | 2490    | 22037 | 3130    | 27701 |
|      | 320   | -                    | -     | -        | -     | 2180     | 19293 | 2490    | 22037 | 3130    | 27701 |
| 200  | 80    | -                    | -     | -        | -     | 2470     | 21860 | 2470    | 21860 | 2470    | 21860 |
|      | 100   | -                    | -     | -        | -     | 3720     | 32922 | 3720    | 32922 | 3720    | 32922 |
|      | 120   | -                    | -     | -        | -     | 3980     | 35223 | 4560    | 40356 | 4740    | 41949 |
|      | 160   | -                    | -     | -        | -     | 3980     | 35223 | 4560    | 40356 | 5720    | 50622 |
| 250  | 200   | -                    | -     | -        | -     | 3980     | 35223 | 4560    | 40356 | 5720    | 50622 |
|      | 242   | -                    | -     | -        | -     | 3980     | 35223 | 4560    | 40356 | 5720    | 50622 |
|      | 320   | -                    | -     | -        | -     | 3980     | 35223 | 4560    | 40356 | 5720    | 50622 |
|      | 320   | -                    | -     | -        | -     | 3980     | 35223 | 4560    | 40356 | 5720    | 50622 |

## •Dimensions

Unit: mm

| Size   | 20 | 25 | 32  | 40  | 50  | 65  | 80  | 100 |
|--------|----|----|-----|-----|-----|-----|-----|-----|
| Symbol |    |    |     |     |     |     |     |     |
| øA     | 70 | 85 | 110 | 135 | 170 | 215 | 265 | 330 |
| B      | 25 | 29 | 37  | 43  | 53  | 71  | 83  | 101 |



# FD Series Unit Type



The FD series is an extremely compact differential unit that allows you to fine-tune the phase and timing during operation. The unit type is provided with the housing so additional gears or pulleys required for the machine can be directly mounted onto it.

- Pancake
- Ultra compact differential unit
- Backlash is very small and unit requires no assembly adjustment

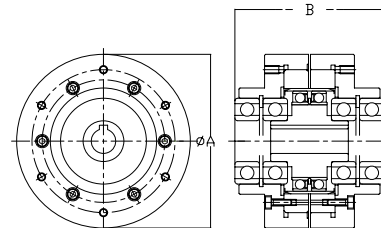
## •FD Series Ratings

| Size | Ratio | Rotational Speed rpm |       |          |       |          |       |         |       |         |       |
|------|-------|----------------------|-------|----------|-------|----------|-------|---------|-------|---------|-------|
|      |       | 3500 rpm             |       | 2850 rpm |       | 1450 rpm |       | 960 rpm |       | 500 rpm |       |
|      |       | Nm                   | In-lb | Nm       | In-lb | Nm       | In-lb | Nm      | In-lb | Nm      | In-lb |
| 20   | 80    | 29                   | 257   | 30       | 266   | 30       | 266   | 30      | 266   | 30      | 266   |
|      | 100   | 30                   | 266   | 31       | 274   | 36       | 319   | 36      | 319   | 36      | 319   |
|      | 128   | 31                   | 274   | 34       | 301   | 43       | 381   | 43      | 381   | 43      | 381   |
|      | 160   | 32                   | 283   | 35       | 310   | 45       | 398   | 49      | 434   | 49      | 434   |
| 25   | 80    | 46                   | 407   | 50       | 443   | 57       | 504   | 57      | 504   | 57      | 504   |
|      | 100   | 49                   | 434   | 53       | 469   | 67       | 593   | 79      | 699   | 79      | 699   |
|      | 120   | 52                   | 460   | 55       | 487   | 70       | 620   | 82      | 726   | 96      | 850   |
|      | 160   | 54                   | 478   | 57       | 504   | 73       | 646   | 83      | 735   | 108     | 956   |
| 32   | 200   | 55                   | 487   | 59       | 522   | 74       | 655   | 84      | 743   | 108     | 956   |
|      | 78    | 98                   | 867   | 108      | 956   | 108      | 656   | 108     | 956   | 108     | 956   |
|      | 100   | 108                  | 956   | 118      | 1044  | 147      | 1301  | 157     | 1389  | 157     | 1389  |
|      | 131   | 108                  | 956   | 118      | 1044  | 157      | 1389  | 176     | 1558  | 206     | 1823  |
| 40   | 157   | 108                  | 956   | 118      | 1044  | 157      | 1389  | 176     | 1558  | 216     | 1912  |
|      | 200   | 108                  | 956   | 118      | 1044  | 157      | 1389  | 176     | 1558  | 216     | 1912  |
|      | 260   | 108                  | 956   | 118      | 1044  | 157      | 1389  | 176     | 1558  | 216     | 1912  |
|      | 80    | 196                  | 1735  | 196      | 1735  | 196      | 1735  | 196     | 1735  | 196     | 1735  |
| 50   | 100   | 235                  | 2080  | 245      | 2168  | 265      | 2345  | 265     | 2345  | 265     | 2345  |
|      | 128   | 235                  | 2080  | 245      | 2168  | 314      | 2779  | 363     | 3213  | 372     | 3292  |
|      | 160   | 235                  | 2080  | 245      | 2168  | 314      | 2779  | 363     | 3213  | 451     | 3991  |
|      | 200   | 235                  | 2080  | 245      | 2168  | 314      | 2779  | 363     | 3213  | 451     | 3991  |
| 65   | 258   | 235                  | 2080  | 245      | 2168  | 314      | 2779  | 363     | 3213  | 451     | 3991  |
|      | 80    | 353                  | 3124  | 353      | 3124  | 353      | 3124  | 353     | 3124  | 353     | 3124  |
|      | 100   | 441                  | 3903  | 470      | 4160  | 559      | 4947  | 559     | 4947  | 559     | 4947  |
|      | 120   | 441                  | 3903  | 470      | 4160  | 588      | 5204  | 666     | 5894  | 666     | 5894  |
| 80   | 160   | 441                  | 3903  | 470      | 4160  | 588      | 5204  | 676     | 5983  | 843     | 7461  |
|      | 200   | 441                  | 3903  | 470      | 4160  | 588      | 5204  | 676     | 5983  | 843     | 7461  |
|      | 242   | 441                  | 3903  | 470      | 4160  | 588      | 5204  | 676     | 5983  | 843     | 7461  |
|      | 78    | -                    | -     | -        | -     | 764      | 6761  | 764     | 6761  | 764     | 6761  |
| 100  | 104   | -                    | -     | -        | -     | 1100     | 9735  | 1190    | 10532 | 1190    | 10532 |
|      | 132   | -                    | -     | -        | -     | 1100     | 9735  | 1250    | 11063 | 1570    | 13895 |
|      | 158   | -                    | -     | -        | -     | 1100     | 9735  | 1250    | 11063 | 1570    | 13895 |
|      | 208   | -                    | -     | -        | -     | 1100     | 9735  | 1250    | 11063 | 1570    | 13895 |
| 120  | 260   | -                    | -     | -        | -     | 1100     | 9735  | 1250    | 11063 | 1570    | 13895 |
|      | 80    | -                    | -     | -        | -     | 1370     | 12125 | 1370    | 12125 | 1370    | 12125 |
|      | 96    | -                    | -     | -        | -     | 1800     | 15930 | 1800    | 15930 | 1800    | 15930 |
|      | 128   | -                    | -     | -        | -     | 2180     | 19293 | 2490    | 22037 | 2710    | 23984 |
| 150  | 160   | -                    | -     | -        | -     | 2180     | 19293 | 2490    | 22037 | 3130    | 27701 |
|      | 194   | -                    | -     | -        | -     | 2180     | 19293 | 2490    | 22037 | 3130    | 27701 |
|      | 258   | -                    | -     | -        | -     | 2180     | 19293 | 2490    | 22037 | 3130    | 27701 |
|      | 320   | -                    | -     | -        | -     | 2180     | 19293 | 2490    | 22037 | 3130    | 27701 |
| 200  | 80    | -                    | -     | -        | -     | 2470     | 21860 | 2470    | 21860 | 2470    | 21860 |
|      | 100   | -                    | -     | -        | -     | 3720     | 32922 | 3720    | 32922 | 3720    | 32922 |
|      | 120   | -                    | -     | -        | -     | 3980     | 35223 | 4560    | 40356 | 4740    | 41949 |
|      | 160   | -                    | -     | -        | -     | 3980     | 35223 | 4560    | 40356 | 5720    | 50622 |
| 250  | 200   | -                    | -     | -        | -     | 3980     | 35223 | 4560    | 40356 | 5720    | 50622 |
|      | 242   | -                    | -     | -        | -     | 3980     | 35223 | 4560    | 40356 | 5720    | 50622 |
|      | 320   | -                    | -     | -        | -     | 3980     | 35223 | 4560    | 40356 | 5720    | 50622 |
|      | 320   | -                    | -     | -        | -     | 3980     | 35223 | 4560    | 40356 | 5720    | 50622 |

## •Dimensions

Unit: mm

| Size   | 20 | 25 | 32  | 40  | 50  | 65  | 80  | 100 |
|--------|----|----|-----|-----|-----|-----|-----|-----|
| Symbol |    |    |     |     |     |     |     |     |
| øA     | 85 | 95 | 120 | 145 | 185 | 235 | 290 | 360 |
| B      | 73 | 81 | 95  | 113 | 132 | 147 | 178 | 212 |



# Phasing Differential FBB Series



The FBB was developed as a versatile simple differential drive transmission for direct phasing of rotating elements while they are in motion. Offsetting internal gear ratios deliver a through ratio of 1:1 and trim adjustments can be applied through one or both of two wave generators.

- 1:1 phasing differential between input and output
- High ratio trim adjustment
- Compact, low backlash design for end roll mounting

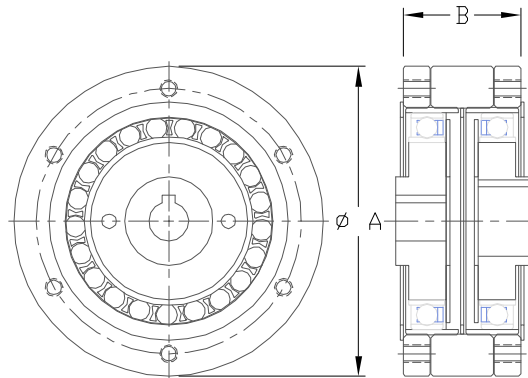
## •FBB Series Ratings

| Size | Ratio | Maximum Input Speed rpm |        | Rated Torque @1750 rpm | Maximum Output Torque | No Load Starting Torque | Input Inertia     |
|------|-------|-------------------------|--------|------------------------|-----------------------|-------------------------|-------------------|
|      |       | Oil                     | Grease | Nm                     | Nm                    | Ncm                     | kgcm <sup>2</sup> |
| 20   | 80    | 6000                    | 3500   | 28                     | 28                    | 3.2                     | 0.14              |
|      | 100   |                         |        | 28                     | 34                    | 3.2                     | 0.14              |
|      | 120   |                         |        | 28                     | 40                    | 3.2                     | 0.14              |
|      | 160   |                         |        | 28                     | 44                    | 3.2                     | 0.14              |
| 25   | 80    | 5000                    | 3500   | 46                     | 48                    | 4.2                     | 0.36              |
|      | 100   |                         |        | 46                     | 68                    | 4.2                     | 0.36              |
|      | 120   |                         |        | 46                     | 79                    | 4.2                     | 0.36              |
|      | 160   |                         |        | 46                     | 88                    | 4.2                     | 0.36              |
| 32   | 80    | 4500                    | 3500   | 92                     | 107                   | 5.7                     | 1.32              |
|      | 100   |                         |        | 92                     | 136                   | 5.7                     | 1.32              |
|      | 120   |                         |        | 92                     | 158                   | 5.7                     | 1.32              |
|      | 160   |                         |        | 92                     | 175                   | 5.7                     | 1.32              |
| 40   | 80    | 4000                    | 3000   | 193                    | 192                   | 19.1                    | 3.42              |
|      | 100   |                         |        | 193                    | 271                   | 19.1                    | 3.42              |
|      | 120   |                         |        | 193                    | 305                   | 19.1                    | 3.42              |
|      | 160   |                         |        | 193                    | 350                   | 19.1                    | 3.42              |
| 50   | 80    | 3500                    | 2500   | 359                    | 350                   | 35.3                    | 9.91              |
|      | 100   |                         |        | 359                    | 475                   | 35.3                    | 9.91              |
|      | 120   |                         |        | 359                    | 588                   | 35.3                    | 9.91              |
|      | 160   |                         |        | 359                    | 655                   | 35.3                    | 9.91              |

## •Dimensions

Unit: mm

| Size   | 20   | 25   | 32  | 40   | 50  |
|--------|------|------|-----|------|-----|
| Symbol |      |      |     |      |     |
| ø A    | 70   | 85   | 110 | 134  | 170 |
| B      | 26.5 | 34.8 | 42  | 56.5 | -   |



# HDI Infnit-Indexer® Phase Adjuster

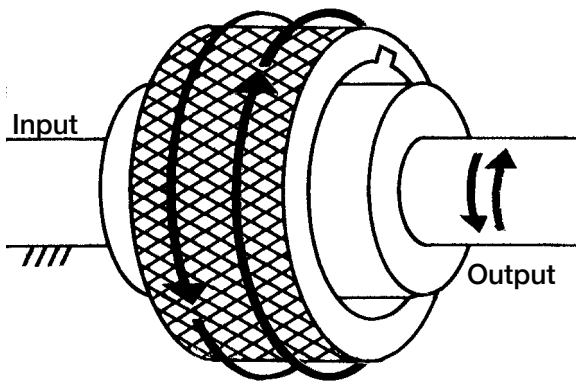


Infnit-Indexer® phase adjusters are available from immediate stock in the standard bore sizes shown with keyways, set screws, and tapped holes for face mounting of either hub. It is possible for the user to modify these configurations by disassembling the unit. The hub material is low carbon steel with suitable sizes shown in notes to the dimensional drawings. Additional sizes and configurations are available by special order.

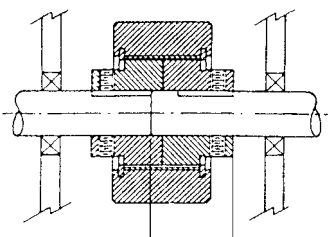
- Fine tune rotational position of shafts and machine parts
- Phase cams
- Adjust roll registration
- Take up backlash in spur and worm gears
- Synchronize indexing devices

## •3 Models, 6 Bore Sizes Available From Stock

| HDI Size | Bore Size            | O.D.                | Length              | Torque Capacity        |
|----------|----------------------|---------------------|---------------------|------------------------|
| -10      | 1/2"<br>5/8"<br>3/4" | 2 3/8"<br>(60.33mm) | 1 1/16"<br>(42.9mm) | 1000 lb-in<br>(113 Nm) |
| -25      | 3/4"<br>1"           | 3"<br>(76.2mm)      | 2 3/16"<br>(76.2mm) | 2500 lb-in<br>(283 Nm) |
| -50      | 1 1/4"               | 3 3/4"<br>(95.3mm)  | 2 3/8"<br>(95.3mm)  | 5000 lb-in<br>(565 Nm) |



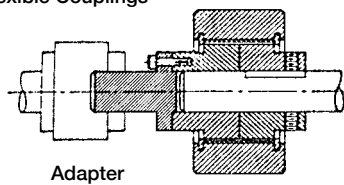
To operate, hand rotate the adjusting ring in either direction to produce a 100:1 reduction between the ring and the output. Adjust the friction adjustment/locking screw to desired resistance. For some applications, one adjustment will be sufficient for both shaft turning and phase adjusting modes. For more severe loading, such as hard stops or high peak torque situations, the friction adjustment/locking screw may be used to lock the adjusting ring in place to maintain phase.



IN-LINE SHAFT

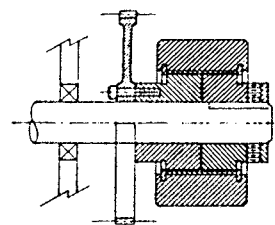
| HDI Size | L DIM |
|----------|-------|
| -10      | 1.09  |
| -25      | 1.34  |
| -50      | 1.43  |

Flexible Couplings



Adapter

IN-LINE SHAFT

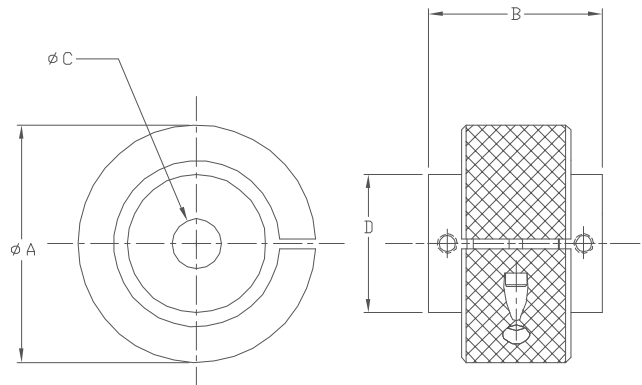


CONCENTRIC SHAFT

## •Dimensions

Unit: inch

| Size | 10    | 10    | 10    | 25    | 25    | 50    |
|------|-------|-------|-------|-------|-------|-------|
| øA   | 2.38  | 2.38  | 2.38  | 3.00  | 3.00  | 3.75  |
| B    | 1.69  | 1.69  | 1.69  | 2.19  | 2.19  | 2.37  |
| øC   | 0.500 | 0.625 | 0.750 | 0.750 | 1.000 | 1.250 |
| D    | 1.38  | 1.38  | 1.38  | 1.75  | 1.75  | 2.17  |



## Quick Connect® Gearhead for Servomotors CSF-GH Series



CSF-GH Quick Connect® gearheads with zero-backlash Harmonic Drive® gearing are available with high reduction ratios, 50:1 to 160:1. CSF-GH utilizes our proprietary S tooth profile and provides high precision positioning (repeatability  $\pm 4$  to  $\pm 10$  arc-sec).

- Zero Backlash
- Available in 5 Sizes
- Peak torque 18Nm ~ 2630Nm
- Ratios, 50:1 to 160:1
- Accuracy <1 arc-min
- High Efficiency
- High load capacity output bearing
- Motor size range 30W to 5,000W

$L_{10}$  Life: 7,000h

### •CSF-GH Series Ratings

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 14           | 50    | 5.4                     | 48    | 18                             | 159   | 35                              | 310   |
|              | 80    | 7.8                     | 69    | 23                             | 204   | 47                              | 416   |
|              | 100   | 7.8                     | 69    | 28                             | 248   | 54                              | 478   |
| 20           | 50    | 25                      | 221   | 56                             | 496   | 98                              | 867   |
|              | 80    | 34                      | 301   | 74                             | 655   | 127                             | 1124  |
|              | 100   | 40                      | 354   | 82                             | 726   | 147                             | 1301  |
|              | 120   | 40                      | 354   | 87                             | 770   | 147                             | 1301  |
|              | 160   | 40                      | 354   | 92                             | 814   | 147                             | 1301  |
| 32           | 50    | 76                      | 673   | 216                            | 1912  | 382                             | 3381  |
|              | 80    | 118                     | 1044  | 304                            | 2690  | 568                             | 5027  |
|              | 100   | 137                     | 1212  | 333                            | 2947  | 647                             | 5726  |
|              | 120   | 137                     | 1212  | 353                            | 3124  | 686                             | 6071  |
|              | 160   | 137                     | 1212  | 372                            | 3292  | 686                             | 6071  |
| 45           | 50    | 176                     | 1558  | 500                            | 4425  | 950                             | 8408  |
|              | 80    | 313                     | 2770  | 706                            | 6248  | 1270                            | 11240 |
|              | 100   | 353                     | 3124  | 755                            | 6682  | 1570                            | 13895 |
|              | 120   | 402                     | 3558  | 823                            | 7284  | 1760                            | 15576 |
|              | 160   | 402                     | 3558  | 882                            | 7806  | 1910                            | 16904 |
| 65           | 80    | 745                     | 6593  | 2110                           | 18674 | 3720                            | 32922 |
|              | 100   | 951                     | 8416  | 2300                           | 20355 | 4750                            | 42038 |
|              | 120   | 951                     | 8416  | 2510                           | 22214 | 4750                            | 42038 |
|              | 160   | 951                     | 8416  | 2630                           | 23276 | 4750                            | 42038 |

### •Cross Roller Bearing Specification

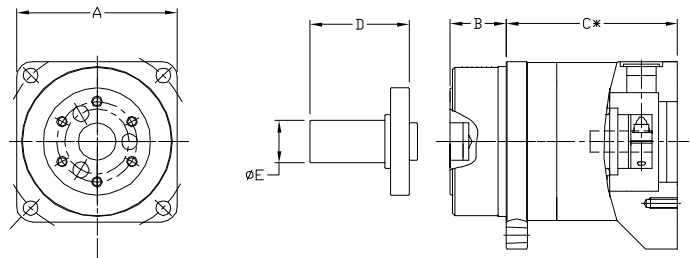
| Item<br>Size | Basic Rated Load           |       |                            |       | Allowable Moment Load Mc |       | Moment Stiffness Km     |                   |
|--------------|----------------------------|-------|----------------------------|-------|--------------------------|-------|-------------------------|-------------------|
|              | Basic Dynamic Rated Load C |       | Basic Static Rated Load Co |       | Nm                       | In-lb | $\times 10^4$<br>Nm/rad | In-lb/<br>arc.min |
|              | N                          | lb    | N                          | lb    |                          |       |                         |                   |
| 14           | 5110                       | 1149  | 7060                       | 1587  | 27                       | 239   | 3.0                     | 77                |
| 20           | 10600                      | 2383  | 17300                      | 3889  | 145                      | 1283  | 17                      | 438               |
| 32           | 20500                      | 4608  | 32800                      | 7373  | 258                      | 2283  | 42                      | 1082              |
| 45           | 41600                      | 9352  | 76000                      | 17085 | 797                      | 7054  | 100                     | 2575              |
| 65           | 81600                      | 18344 | 149000                     | 33495 | 2156                     | 19082 | 323                     | 8317              |

• "Basic dynamic rated load" is a constant stationary radial load that achieves a basic dynamic rated life of the bearing of one million revolutions.  
 • "Basic static rated load" is a static load that achieves a contact stress of a constant level (4kN/mm<sup>2</sup>) at the center of a contact zone between the rolling element receiving a maximum load and track.

### •Dimensions

Unit: mm

| Size<br>Symbol | 14 | 20 | 32    | 45  | 65  |
|----------------|----|----|-------|-----|-----|
| A              | 60 | 90 | 120   | 170 | 230 |
| B              | 21 | 27 | 35    | 53  | 57  |
| C (ref.)       | 55 | 72 | 105.5 | 128 | 157 |
| D              | 37 | 53 | 98    | 103 | 135 |
| øE             | 16 | 25 | 40    | 50  | 70  |



\* The length and shape of the motor adapter flange will depend upon the specific motor that is selected for use with the gearhead. Please contact Harmonic Drive LLC for a detailed drawing.



# CSG-GH Series



CSG-GH high-torque Quick Connect® gearheads with zero backlash Harmonic Drive® gearing are available with high reduction ratios, 50:1 to 160:1.

- Zero Backlash
- Available in 5 Sizes
- Peak torque 23Nm ~ 3419Nm
- Ratios, 50:1 to 160:1
- Repeatability as low as 4 arc-seconds
- Accuracy <1 arc-min
- High Efficiency
- High load capacity output bearing
- Motor size range 30W to 5,000W
- 30% higher rated torque, repeated peak torque & maximum momentary torque than CSF series products of the same size

**L<sub>10</sub> Life: 10,000 h**

## •CSG-GH Series Ratings

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 14           | 50    | 7.0                     | 62    | 23                             | 204   | 46                              | 407   |
|              | 80    | 10                      | 89    | 30                             | 266   | 61                              | 540   |
|              | 100   | 10                      | 89    | 36                             | 319   | 70                              | 620   |
| 20           | 50    | 33                      | 292   | 73                             | 646   | 127                             | 1124  |
|              | 80    | 44                      | 389   | 96                             | 850   | 165                             | 1460  |
|              | 100   | 52                      | 460   | 107                            | 947   | 191                             | 1690  |
|              | 120   | 52                      | 460   | 113                            | 1000  | 191                             | 1690  |
|              | 160   | 52                      | 460   | 120                            | 1062  | 191                             | 1690  |
| 32           | 50    | 99                      | 876   | 281                            | 2487  | 497                             | 4399  |
|              | 80    | 153                     | 1354  | 395                            | 3496  | 738                             | 6532  |
|              | 100   | 178                     | 1575  | 433                            | 3832  | 812                             | 7187  |
|              | 120   | 178                     | 1575  | 459                            | 4062  | 812                             | 7187  |
| 45           | 50    | 229                     | 2027  | 650                            | 5753  | 1235                            | 10931 |
|              | 80    | 407                     | 3602  | 918                            | 8125  | 1651                            | 14613 |
|              | 100   | 459                     | 4062  | 982                            | 8691  | 2033                            | 17994 |
|              | 120   | 523                     | 4629  | 1070                           | 9470  | 2033                            | 17994 |
| 65           | 50    | 523                     | 4629  | 1147                           | 10152 | 2033                            | 17994 |
|              | 80    | 969                     | 8576  | 2743                           | 24278 | 4836                            | 42802 |
|              | 100   | 1236                    | 10940 | 2990                           | 26464 | 5174                            | 45794 |
|              | 120   | 1236                    | 10940 | 3263                           | 28880 | 5174                            | 45794 |
|              | 160   | 1236                    | 10940 | 3419                           | 30261 | 5174                            | 45794 |

## •Cross Roller Bearing Specification

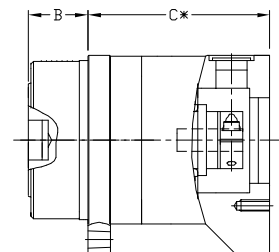
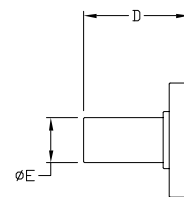
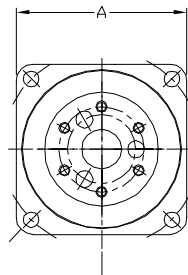
| Item<br>Size | Basic Rated Load           |       |                            |       | Allowable Moment Load Mc |       | Moment Stiffness Km        |                   |
|--------------|----------------------------|-------|----------------------------|-------|--------------------------|-------|----------------------------|-------------------|
|              | Basic Dynamic Rated Load C |       | Basic Static Rated Load Co |       | Nm                       | In-lb | x10 <sup>4</sup><br>Nm/rad | In-lb/<br>arc.min |
|              | N                          | lb    | N                          | lb    |                          |       |                            |                   |
| 14           | 5110                       | 1149  | 7060                       | 1587  | 27                       | 239   | 3.0                        | 77                |
| 20           | 10600                      | 2383  | 17300                      | 3889  | 145                      | 1283  | 17                         | 438               |
| 32           | 20500                      | 4608  | 32800                      | 7373  | 258                      | 2283  | 42                         | 1082              |
| 45           | 41600                      | 9352  | 76000                      | 17085 | 797                      | 7054  | 100                        | 2575              |
| 65           | 81600                      | 18344 | 149000                     | 33495 | 2156                     | 19082 | 323                        | 8317              |

• "Basic dynamic rated load" is a constant stationary radial load that achieves a basic dynamic rated life of the bearing of one million revolutions.  
 "Basic static rated load" is a static load that achieves a contact stress of a constant level (4kN/mm<sup>2</sup>) at the center of a contact zone between the rolling element receiving a maximum load and track.

## •Dimensions

Unit: mm

| Size<br>Symbol | 14 | 20 | 32    | 45  | 65  |
|----------------|----|----|-------|-----|-----|
| A              | 60 | 90 | 120   | 170 | 230 |
| B              | 21 | 27 | 35    | 53  | 57  |
| C (ref.)       | 55 | 72 | 105.5 | 128 | 157 |
| D              | 37 | 53 | 98    | 103 | 135 |
| øE             | 16 | 25 | 40    | 50  | 70  |



\* The length and shape of the motor adapter flange will depend upon the specific motor that is selected for use with the gearhead. Please contact Harmonic Drive LLC for a detailed drawing.

Harmonic Planetary® Gearhead  
Quick Connect® Coupling

HPG Series



Quick Connect® gearhead for high performance servo motors. Reduction ratios 3:1 to 50:1. Available with flange output, straight shaft (without key), straight shaft (with key) and center tapped hole.

- Low backlash: Less than 3 arc-min (less than 1 arc-min optional)
- Ratios, 3:1 to 50:1
- Quick Connect® coupling
- Peak torque 5Nm ~ 3200Nm
- High moment capacity cross roller output bearing
- High efficiency
- Sealed structure
- Motor size range 10W to 15,000W

L<sub>10</sub> Life: 20,000h

•HPG Series Ratings

| Size | Ratio | Rated Torque at 3000 rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|------|-------|--------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|      |       | Nm                       | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 11   | 5     | 2.5                      | 22    | 7.8                            | 69    | 20                              | 177   |
|      | 9     | 2.5                      | 22    | 3.9                            | 35    | 20                              | 177   |
|      | 21    | 3.4                      | 30    | 9.8                            | 87    | 20                              | 177   |
|      | 37    | 3.4                      | 30    | 9.8                            | 87    | 20                              | 177   |
|      | 45    | 3.4                      | 30    | 9.8                            | 87    | 20                              | 177   |
| 14   | 3     | 2.9                      | 26    | 15                             | 133   | 37                              | 327   |
|      | 5     | 5.9                      | 52    | 23                             | 204   | 56                              | 496   |
|      | 11    | 7.8                      | 69    | 23                             | 204   | 56                              | 496   |
|      | 15    | 9.0                      | 80    | 23                             | 204   | 56                              | 496   |
|      | 21    | 9                        | 78    | 23                             | 204   | 56                              | 496   |
|      | 33    | 10                       | 89    | 23                             | 204   | 56                              | 496   |
| 20   | 3     | 8.8                      | 78    | 64                             | 566   | 124                             | 1097  |
|      | 5     | 16                       | 142   | 100                            | 885   | 217                             | 1920  |
|      | 11    | 20                       | 177   | 100                            | 885   | 217                             | 1920  |
|      | 15    | 24                       | 212   | 100                            | 885   | 217                             | 1920  |
|      | 21    | 25                       | 221   | 100                            | 885   | 217                             | 1920  |
|      | 33    | 29                       | 257   | 100                            | 885   | 217                             | 1920  |

| Size | Ratio | Rated Torque at 3000 rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|------|-------|--------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|      |       | Nm                       | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 32   | 3     | 31                       | 274   | 225                            | 1991  | 507                             | 4487  |
|      | 5     | 66                       | 584   | 300                            | 2655  | 650                             | 5753  |
|      | 11    | 88                       | 779   | 300                            | 2655  | 650                             | 5753  |
|      | 15    | 92                       | 814   | 300                            | 2655  | 650                             | 5753  |
|      | 21    | 98                       | 867   | 300                            | 2655  | 650                             | 5753  |
|      | 33    | 108                      | 956   | 300                            | 2655  | 650                             | 5753  |
| 50   | 3     | 97                       | 858   | 657                            | 5814  | 1850                            | 16373 |
|      | 5     | 170                      | 1505  | 850                            | 7523  | 1850                            | 16373 |
|      | 11    | 200                      | 1770  | 850                            | 7523  | 1850                            | 16373 |
|      | 15    | 230                      | 2036  | 850                            | 7523  | 1850                            | 16373 |
|      | 21    | 260                      | 2301  | 850                            | 7523  | 1850                            | 16373 |
|      | 33    | 270                      | 2390  | 850                            | 7523  | 1850                            | 16373 |
| 65   | 4     | 500                      | 4425  | 2200                           | 19470 | 4500                            | 39825 |
|      | 5     | 530                      | 4691  | 2200                           | 19470 | 4500                            | 39825 |
|      | 12    | 600                      | 5310  | 2200                           | 19470 | 4500                            | 39825 |
|      | 15    | 730                      | 6461  | 2200                           | 19470 | 4500                            | 39825 |
|      | 20    | 800                      | 7080  | 2200                           | 19470 | 4500                            | 39825 |
|      | 25    | 850                      | 7523  | 2200                           | 19470 | 4500                            | 39825 |
|      | 40    | 640                      | 5664  | 1900                           | 16816 | 4500                            | 39825 |
|      | 50    | 750                      | 6638  | 2200                           | 19472 | 4500                            | 39825 |

•Cross Roller Bearing Specification

| Item | Basic Rated Load           |       |                            |       | Allowable Moment Load MC |       | Moment Stiffness Km     |               |
|------|----------------------------|-------|----------------------------|-------|--------------------------|-------|-------------------------|---------------|
|      | Basic Dynamic Rated Load C |       | Basic Static Rated Load Co |       | Nm                       | In-lb | x10 <sup>4</sup> Nm/rad | In-lb/arc-min |
|      | N                          | lb    | N                          | lb    |                          |       |                         |               |
| 11   | 3116                       | 700   | 4087                       | 919   | 9.50                     | 84    | 0.88                    | 23            |
| 14   | 5110                       | 1149  | 7060                       | 1587  | 32.3                     | 286   | 3.0                     | 77            |
| 20   | 10600                      | 2383  | 17300                      | 3889  | 183                      | 1620  | 16.8                    | 433           |
| 32   | 20600                      | 4631  | 32800                      | 7373  | 452                      | 4000  | 42.1                    | 1084          |
| 50   | 41600                      | 9352  | 76000                      | 17085 | 1076                     | 9523  | 100                     | 2575          |
| 65   | 90600                      | 20367 | 14800                      | 33270 | 3900                     | 34515 | 364                     | 9373          |

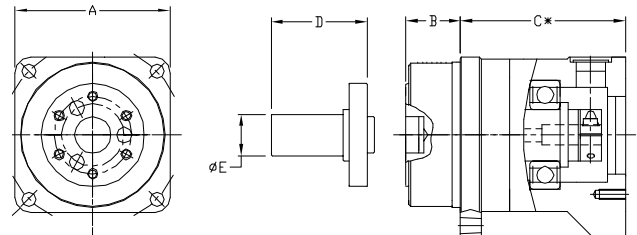
•Dimensions

Unit: mm

| Size     | 11   | 14 | 20 | 32  | 50  | 65    |
|----------|------|----|----|-----|-----|-------|
| Symbol   |      |    |    |     |     |       |
| A        | 40   | 60 | 90 | 120 | 170 | 230   |
| B        | 15   | 21 | 27 | 35  | 53  | 57    |
| C (ref.) | 30.5 | 64 | 71 | 104 | 123 | 184.5 |
| D        | 27   | 37 | 53 | 98  | 103 | -     |
| øE       | 8    | 16 | 25 | 40  | 50  | -     |

\* The length and shape of the motor adapter flange will depend upon the specific motor that is selected for use with the gearhead. Please contact Harmonic Drive LLC for a detailed drawing.

--- Size 65—Shaft is available as special request. ---



# HPG Helical Series



Quick Connect® gearhead for high performance servo motors. Reduction ratios 3:1 to 10:1. Available with flange output, straight shaft (without key), straight shaft (with key) and center tapped hole.

- Helical Gearing
- Available in four Frame Sizes
- Peak Torque: 5Nm to 400Nm
- Ratios: 3,4,5,6,7,8,9 and 10:1
- High Efficiency
- Backlash <3 arc-min (<1arc-min available as an option)
- Repeatability ±20 arc-sec
- High load capacity Cross Roller output bearing
- Quick Connect® coupling for easy mounting of any motor

L<sub>10</sub> Life: 20,000h

## •HPG Helical Series Ratings

| Size | Ratio | Rated Torque at 3000 rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|------|-------|--------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|      |       | Nm                       | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 11   | 4     | 2.8                      | 25    | 10                             | 89    | 20                              | 177   |
|      | 5     | 2.9                      | 26    | 10                             | 89    | 20                              | 177   |
|      | 6     | 2.9                      | 26    | 10                             | 89    | 20                              | 177   |
|      | 7     | 3.1                      | 27    | 9                              | 80    | 20                              | 177   |
|      | 8     | 3.1                      | 27    | 7                              | 62    | 20                              | 177   |
|      | 9     | 3.1                      | 27    | 6                              | 53    | 20                              | 177   |
|      | 10    | 3.4                      | 30    | 5                              | 44    | 20                              | 177   |
| 14   | 3     | 4.0                      | 35    | 20                             | 177   | 37                              | 327   |
|      | 4     | 7.0                      | 62    | 30                             | 266   | 56                              | 496   |
|      | 5     | 7.2                      | 64    | 30                             | 266   | 56                              | 496   |
|      | 6     | 7.3                      | 65    | 30                             | 266   | 56                              | 496   |
|      | 7     | 7.8                      | 69    | 26                             | 266   | 56                              | 496   |
|      | 8     | 7.8                      | 69    | 20                             | 177   | 56                              | 496   |
|      | 9     | 7.9                      | 70    | 17                             | 150   | 56                              | 496   |
|      | 10    | 8.5                      | 75    | 15                             | 133   | 56                              | 496   |

| Size | Ratio | Rated Torque at 3000 rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |      |
|------|-------|--------------------------|-------|--------------------------------|-------|---------------------------------|-------|------|
|      |       | Nm                       | In-lb | Nm                             | In-lb | Nm                              | In-lb |      |
| 20   | 3     | 11                       | 97    | 90                             | 797   | 124                             | 1097  |      |
|      | 4     | 23                       | 203   | 133                            | 1177  | 217                             | 1921  |      |
|      | 5     | 23                       | 203   | 133                            | 1177  | 217                             | 1921  |      |
|      | 6     | 23                       | 203   | 126                            | 1115  | 217                             | 1921  |      |
|      | 7     | 25                       | 221   | 108                            | 956   | 217                             | 1921  |      |
|      | 8     | 25                       | 221   | 84                             | 743   | 217                             | 1921  |      |
|      | 9     | 25                       | 221   | 73                             | 646   | 217                             | 1921  |      |
|      | 10    | 27                       | 239   | 65                             | 575   | 217                             | 1921  |      |
|      | 32    | 3                        | 50    | 443                            | 290   | 2567                            | 507   | 4487 |
|      |       | 4                        | 77    | 682                            | 400   | 3540                            | 650   | 5753 |
| 5    |       | 80                       | 708   | 400                            | 3540  | 650                             | 5753  |      |
| 6    |       | 80                       | 708   | 390                            | 3452  | 650                             | 5753  |      |
| 7    |       | 85                       | 867   | 330                            | 2921  | 650                             | 5753  |      |
| 8    |       | 85                       | 752   | 260                            | 2301  | 650                             | 5753  |      |
| 9    |       | 86                       | 752   | 220                            | 1947  | 650                             | 5753  |      |
| 10   |       | 92                       | 814   | 200                            | 1770  | 650                             | 5753  |      |

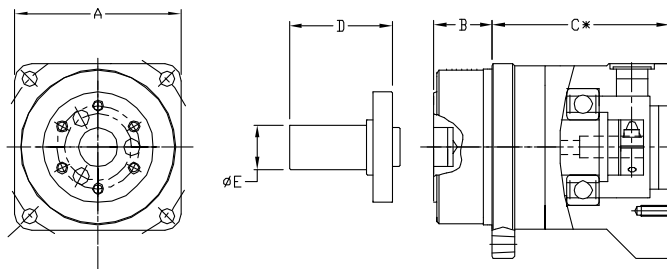
## •Cross Roller Bearing Specification

| Item | Basic Rated Load           |      |                            |      | Allowable Moment Load MC |       | Moment Stiffness Km        |                   |
|------|----------------------------|------|----------------------------|------|--------------------------|-------|----------------------------|-------------------|
|      | Basic Dynamic Rated Load C |      | Basic Static Rated Load Co |      | Nm                       | In-lb | x10 <sup>4</sup><br>Nm/rad | In-lb/<br>arc-min |
|      | N                          | lb   | N                          | lb   |                          |       |                            |                   |
| 11   | 3116                       | 700  | 4087                       | 919  | 9.50                     | 84    | 0.88                       | 23                |
| 14   | 5110                       | 1149 | 7060                       | 1587 | 32.3                     | 286   | 3.0                        | 77                |
| 20   | 10600                      | 2383 | 17300                      | 3889 | 183                      | 1620  | 16.8                       | 433               |
| 32   | 20600                      | 4631 | 32800                      | 7373 | 452                      | 4000  | 42.1                       | 1084              |

## •Dimensions

Unit: mm

| Size     | 11   | 14 | 20 | 32  |
|----------|------|----|----|-----|
| A        | 40   | 60 | 90 | 120 |
| B        | 15   | 21 | 27 | 35  |
| C (ref.) | 30.5 | 64 | 71 | 104 |
| D        | 27   | 37 | 53 | 98  |
| øE       | 8    | 16 | 25 | 40  |



\* The length and shape of the motor adapter flange will depend upon the specific motor that is selected for use with the gearhead. Please contact Harmonic Drive LLC for a detailed drawing.

**Harmonic Planetary® Gearhead**  
**Quick Connect® Coupling**  
**HPGP Series**



High torque Quick Connect® gearhead for high performance servo motors. Reduction ratios 3:1 to 50:1. Available with flange output, Straight shaft (without key), Straight shaft (with key) and center tapped hole.

- Peak torque 12Nm ~ 3940Nm
- High precision
- Backlash <1 arc-min is available (size #14-65) (Standard backlash specification is < 3 arc-min)
- Cross roller bearing for high load capacity and moment stiffness
- Quick Connect® coupling
- Ratios, Single Stage: 4:1 to 5:1, Two Stage: 11:1 to 45:1
- Motor size range 10W to 15,000W

**L<sub>10</sub> Life: 20,000h**

**•HPGP Series Ratings**

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 11           | 5     | 3.4                     | 30    | 10                             | 89    | 20                              | 177   |
|              | 21    | 4.6                     | 41    | 13                             | 115   |                                 |       |
|              | 37    |                         |       |                                |       |                                 |       |
|              | 45    |                         |       |                                |       |                                 |       |
| 14           | 5     | 7.8                     | 69    | 30                             | 266   | 56                              | 496   |
|              | 11    | 10                      | 89    |                                |       |                                 |       |
|              | 15    | 12                      | 106   |                                |       |                                 |       |
|              | 21    | 12                      | 106   |                                |       |                                 |       |
|              | 33    | 13                      | 115   |                                |       |                                 |       |
| 20           | 5     | 21                      | 186   | 133                            | 1177  | 217                             | 1921  |
|              | 11    | 26                      | 230   |                                |       |                                 |       |
|              | 15    | 32                      | 283   |                                |       |                                 |       |
|              | 21    | 33                      | 292   |                                |       |                                 |       |
|              | 33    | 39                      | 345   |                                |       |                                 |       |

| Item<br>Size | Ratio | Rated Torque at 2000rpm |       | Limit for Repeated Peak Torque |       | Limit for Momentary Peak Torque |       |
|--------------|-------|-------------------------|-------|--------------------------------|-------|---------------------------------|-------|
|              |       | Nm                      | In-lb | Nm                             | In-lb | Nm                              | In-lb |
| 32           | 5     | 87                      | 770   | 400                            | 3540  | 650                             | 5753  |
|              | 11    | 104                     | 920   |                                |       |                                 |       |
|              | 15    | 122                     | 1080  |                                |       |                                 |       |
|              | 21    | 130                     | 1151  |                                |       |                                 |       |
|              | 33    | 143                     | 1266  |                                |       |                                 |       |
| 50           | 5     | 226                     | 2000  | 1130                           | 10001 | 1850                            | 16374 |
|              | 11    | 266                     | 2354  |                                |       |                                 |       |
|              | 15    | 306                     | 2708  |                                |       |                                 |       |
|              | 21    | 346                     | 3062  |                                |       |                                 |       |
|              | 33    | 359                     | 3177  |                                |       |                                 |       |
| 65           | 4     | 665                     | 5886  | 2920                           | 25844 | 4500                            | 39828 |
|              | 5     | 705                     | 6240  |                                |       |                                 |       |
|              | 12    | 798                     | 7063  |                                |       |                                 |       |
|              | 15    | 971                     | 8594  |                                |       |                                 |       |
|              | 20    | 1060                    | 9382  |                                |       |                                 |       |
|              | 25    | 1130                    | 10001 |                                |       |                                 |       |

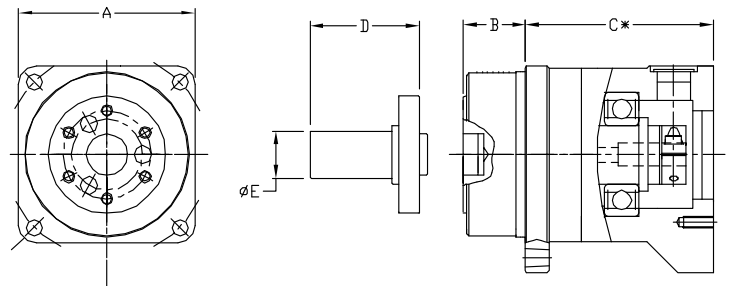
**•Cross Roller Bearing Specification**

| Item<br>Size | Basic Rated Load           |       |                            |       | Allowable Moment Load MC |       | Moment Stiffness Km        |                   |
|--------------|----------------------------|-------|----------------------------|-------|--------------------------|-------|----------------------------|-------------------|
|              | Basic Dynamic Rated Load C |       | Basic Static Rated Load Co |       | Nm                       | In-lb | x10 <sup>4</sup><br>Nm/rad | In-lb/<br>arc-min |
|              | N                          | lb    | N                          | lb    |                          |       |                            |                   |
| 11           | 3116                       | 700   | 4087                       | 919   | 9.50                     | 84    | 0.88                       | 23                |
| 14           | 5110                       | 1149  | 7060                       | 1587  | 32.3                     | 286   | 3.0                        | 77                |
| 20           | 10600                      | 2383  | 17300                      | 3889  | 183                      | 1620  | 16.8                       | 433               |
| 32           | 20600                      | 4631  | 32800                      | 7373  | 452                      | 4000  | 42.1                       | 1084              |
| 50           | 41600                      | 9352  | 76000                      | 17085 | 1076                     | 9523  | 100                        | 2575              |
| 65           | 90600                      | 20367 | 148000                     | 33270 | 3900                     | 34515 | 364                        | 9373              |

**•Dimensions**

Unit: mm

| Size     | 11   | 14 | 20 | 32  | 50  | 65    |
|----------|------|----|----|-----|-----|-------|
| A        | 40   | 60 | 90 | 120 | 170 | 230   |
| B        | 15   | 21 | 27 | 35  | 53  | 57    |
| C (ref.) | 30.5 | 64 | 71 | 104 | 123 | 184.5 |
| D        | 27   | 37 | 53 | 98  | 103 | -     |
| øE       | 10   | 16 | 25 | 40  | 50  | -     |



\* The length and shape of the motor adapter flange will depend upon the specific motor that is selected for use with the gearhead. Please contact Harmonic Drive LLC for a detailed drawing.

---- Size 65—Shaft is available as special request. ---

Right Angle Harmonic Planetary® Gearhead  
Quick Connect® Coupling  
**HPG RA Series**



Right angle, high precision, Harmonic Planetary® gearhead with low backlash.

- High precision Planetary gearhead
- Low backlash: Less than 3 arc-min (less than 1 arc-min optional)
- Quick Connect® coupling
- High torque capacity
- High moment capacity cross roller output bearing
- Right angle configuration allows for use in limited space

$L_{10}$  Life: 20,000 h

**•HPG RA Series Ratings**

| Size | Model | Ratio | Rated Torque | Limit for Average Load Torque <sup>1</sup> | Limit for Repeated Peak Torque <sup>2</sup> | Limit for Momentary Peak Torque <sup>3</sup> |
|------|-------|-------|--------------|--------------------------------------------|---------------------------------------------|----------------------------------------------|
|      |       |       | Nm           | Nm                                         | Nm                                          | Nm                                           |
| 32   | RA3   | 5     | 66           | 150                                        | 150                                         | 200                                          |
|      |       | 11    | 88           | 170                                        | 330                                         | 440                                          |
|      |       | 15    | 92           | 170                                        | 300                                         | 600                                          |
|      |       | 21    | 98           | 170                                        | 300                                         | 650                                          |
|      |       | 33    | 108          | 200                                        | 330                                         | 650                                          |
|      |       | 45    | 108          | 200                                        | 300                                         | 650                                          |
| 50   | RA3   | 5     | 150          | 150                                        | 150                                         | 200                                          |
|      |       | 11    | 170          | 330                                        | 330                                         | 440                                          |
|      |       | 15    | 200          | 450                                        | 450                                         | 600                                          |
|      |       | 21    | 200          | 500                                        | 630                                         | 840                                          |
|      |       | 33    | 230          | 500                                        | 990                                         | 1320                                         |
|      |       | 45    | 230          | 500                                        | 1140                                        | 1800                                         |

| Size | Model | Ratio | Rated Torque | Limit for Average Load Torque <sup>1</sup> | Limit for Repeated Peak Torque <sup>2</sup> | Limit for Momentary Peak Torque <sup>3</sup> |
|------|-------|-------|--------------|--------------------------------------------|---------------------------------------------|----------------------------------------------|
|      |       |       | Nm           | Nm                                         | Nm                                          | Nm                                           |
| 50   | RA5   | 5     | 260          | 340                                        | 400                                         | 500                                          |
|      |       | 12    | 260          | 400                                        | 880                                         | 1100                                         |
|      |       | 15    | 270          | 450                                        | 1200                                        | 1500                                         |
|      |       | 21    | 270          | 500                                        | 1150                                        | 2100                                         |
|      |       | 33    | 270          | 500                                        | 1140                                        | 2180                                         |
|      |       | 45    | 270          | 500                                        | 1140                                        | 2180                                         |
| 65   | RA5   | 5     | 400          | 400                                        | 400                                         | 500                                          |
|      |       | 12    | 600          | 960                                        | 960                                         | 1200                                         |
|      |       | 15    | 730          | 1200                                       | 1200                                        | 1500                                         |
|      |       | 20    | 800          | 1500                                       | 1600                                        | 2000                                         |
|      |       | 25    | 850          | 1500                                       | 2000                                        | 2500                                         |
|      |       | 40    | 640          | 1300                                       | 1900                                        | 4000                                         |
|      |       | 50    | 750          | 1500                                       | 2200                                        | 4500                                         |

\*1: Average load torque calculated based on the application motion profile must not exceed values shown in the table.

\*2: The limit for torque during start and stop cycles. Always operate below this value.

\*3: The limit for torque during emergency stops or from external shock loads.

**•Cross Roller Bearing Specification**

| Item | Basic Rated Load           |       |                            |       | Allowable Moment Load MC |       | Moment Stiffness Km        |                   |
|------|----------------------------|-------|----------------------------|-------|--------------------------|-------|----------------------------|-------------------|
|      | Basic Dynamic Rated Load C |       | Basic Static Rated Load Co |       | Nm                       | In-lb | x10 <sup>4</sup><br>Nm/rad | In-lb/<br>arc-min |
|      | N                          | lb    | N                          | lb    |                          |       |                            |                   |
| 32   | 20500                      | 4608  | 32800                      | 7373  | 452                      | 4000  | 42.1                       | 1084              |
| 50   | 41600                      | 9352  | 76000                      | 17085 | 1076                     | 9523  | 100                        | 2575              |
| 65   | 90600                      | 20367 | 148000                     | 33270 | 3900                     | 34515 | 364                        | 9373              |

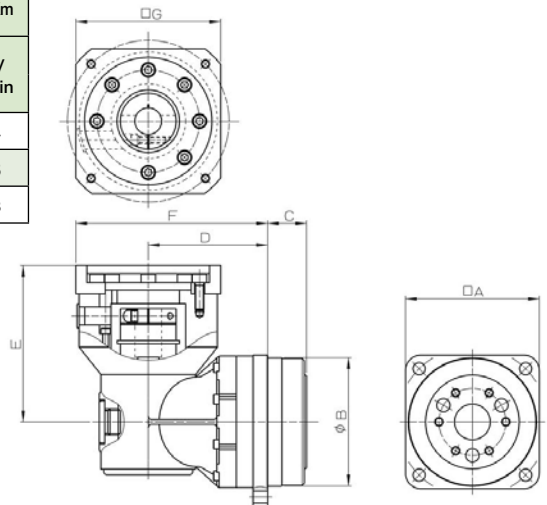
**•Dimensions**

Unit: mm

| Size | A   | øB    | C  | D   | E*      | F           | G           |
|------|-----|-------|----|-----|---------|-------------|-------------|
| 32   | 120 | 115h7 | 35 | 107 | 140/175 | 175/197/217 | 130/180/220 |
| 50   | 170 | 165h8 | 53 | 144 | 168/200 | 209/234/254 | 130/180/220 |
| 65   | 230 | 220h8 | 57 | 226 | 168/200 | 291/316/336 | 130/180/220 |

\* Left side description: The limited length of the Motor shaft is 81mm. Right side description: The limited length of the Motor shaft is 116mm.

Note: Dimensions F & G depend on the chosen Motor flange square size. Contact Harmonic Drive LLC for special flange motor combination.



Harmonic Planetary® Gearhead  
Quick Connect® Coupling  
**HPN Series**



HPN value series planetary gearheads feature a robust design utilizing helical gears for quiet performance and long life. These gearheads are available with short lead times and are designed to couple to any servo motor with our Quick Connect® coupling.

- Peak torque 9Nm to 752Nm
- Compact design
- High precision
- Backlash <5 arc-min (One-stage) , < 7 arc-min (Two-stage)
- Quick Connect® coupling
- Reduction ratios between 3:1 and 50:1
- Helical gears for quiet performance
- Motor size range 30W to 7500W
- Quick delivery

**L<sub>50</sub> Life: 20,000 h**

**•HPN Series Ratings**

| Size | Number of Stages | Ratio | Rated Torque | Repeated Peak Torque | Momentary Peak Torque |
|------|------------------|-------|--------------|----------------------|-----------------------|
|      |                  |       | Nm           | Nm                   | Nm                    |
| 11   | 1                | 4     | 14           | 14                   | 40                    |
|      |                  | 5     | 14           | 16                   | 40                    |
|      |                  | 7     | 11           | 11                   | 40                    |
|      |                  | 10    | 9            | 9                    | 40                    |
|      | 2                | 15    | 18           | 24                   | 40                    |
|      |                  | 20    | 22           | 24                   | 40                    |
|      |                  | 25    | 20           | 24                   | 40                    |
|      |                  | 30    | 25           | 26                   | 40                    |
|      |                  | 35    | 26           | 26                   | 40                    |
|      |                  | 40    | 26           | 26                   | 40                    |
| 14   | 1                | 3     | 22           | 25                   | 89                    |
|      |                  | 4     | 28           | 50                   | 110                   |
|      |                  | 5     | 29           | 50                   | 107                   |
|      |                  | 7     | 30           | 37                   | 100                   |
|      |                  | 10    | 18           | 18                   | 79                    |
|      | 2                | 15    | 30           | 43                   | 97                    |
|      |                  | 20    | 30           | 49                   | 100                   |
|      |                  | 25    | 30           | 38                   | 102                   |
|      |                  | 30    | 40           | 48                   | 98                    |
|      |                  | 35    | 40           | 49                   | 99                    |
| 20   | 1                | 40    | 30           | 38                   | 100                   |
|      |                  | 45    | 30           | 38                   | 100                   |
|      |                  | 50    | 26           | 26                   | 94                    |
|      |                  | 3     | 51           | 74                   | 226                   |
|      |                  | 4     | 80           | 130                  | 256                   |
|      | 2                | 5     | 80           | 149                  | 256                   |
|      |                  | 7     | 80           | 113                  | 256                   |
|      |                  | 10    | 54           | 54                   | 216                   |
|      |                  | 15    | 80           | 129                  | 256                   |
|      |                  | 20    | 80           | 147                  | 256                   |
| 2    | 25               | 80    | 114          | 256                  |                       |

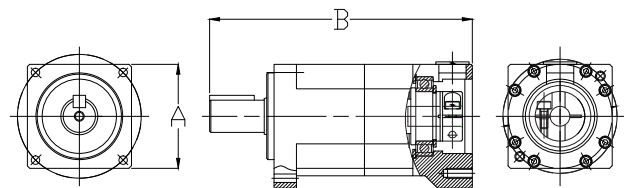
| Size | Number of Stages | Ratio | Rated Torque | Repeated Peak Torque | Momentary Peak Torque |
|------|------------------|-------|--------------|----------------------|-----------------------|
|      |                  |       | Nm           | Nm                   | Nm                    |
| 20   | 2                | 30    | 80           | 139                  | 250                   |
|      |                  | 35    | 80           | 112                  | 256                   |
|      |                  | 40    | 80           | 112                  | 256                   |
|      |                  | 45    | 80           | 112                  | 256                   |
|      |                  | 50    | 75           | 75                   | 216                   |
| 32   | 1                | 3     | 153          | 254                  | 625                   |
|      |                  | 4     | 198          | 376                  | 625                   |
|      |                  | 5     | 200          | 376                  | 625                   |
|      |                  | 7     | 200          | 376                  | 625                   |
|      |                  | 10    | 185          | 185                  | 625                   |
|      | 2                | 15    | 200          | 376                  | 625                   |
|      |                  | 20    | 200          | 376                  | 625                   |
|      |                  | 25    | 200          | 376                  | 625                   |
|      |                  | 30    | 250          | 376                  | 625                   |
|      |                  | 35    | 250          | 376                  | 625                   |
| 40   | 1                | 40    | 300          | 376                  | 625                   |
|      |                  | 45    | 300          | 376                  | 625                   |
|      |                  | 50    | 251          | 251                  | 625                   |
|      |                  | 3     | 440          | 752                  | 1137                  |
|      |                  | 4     | 460          | 752                  | 1265                  |
|      | 2                | 5     | 480          | 752                  | 1265                  |
|      |                  | 7     | 510          | 752                  | 829                   |
|      |                  | 10    | 480          | 509                  | 829                   |
|      |                  | 15    | 530          | 752                  | 1265                  |
|      |                  | 20    | 600          | 752                  | 1265                  |
| 2    | 25               | 650   | 752          | 1127                 |                       |
|      | 30               | 650   | 752          | 1265                 |                       |
|      | 35               | 700   | 752          | 1127                 |                       |
|      | 40               | 700   | 752          | 1127                 |                       |
|      | 45               | 700   | 752          | 1127                 |                       |
| 2    | 50               | 562   | 562          | 1162                 |                       |

**•Dimensions**

Unit: mm

| Size   |           | 11A  | 14A | 20A       | 32A         | 40A         |
|--------|-----------|------|-----|-----------|-------------|-------------|
| Symbol |           |      |     |           |             |             |
| A      |           | 42   | 60  | 90        | 115         | 142         |
| B      | One Stage | 93.5 | 117 | 160-184.5 | 200-264.5   | 282.5-328.5 |
|        | Two Stage | 113  | 142 | 175-206.2 | 217.5-246.5 | 327-348     |

Dimensions depend upon the motor selected. Dimensions shown in the table are a typical range for reference only. Contact HDLLC for detailed dimensions of the gear used for your motor.



# Hollow Shaft Planetary Gear HPF Series



Hollow shaft planetary gear with output flange. The flange is integrated with a robust cross-roller bearing which can support high axial, radial and moment loads without the need for additional support bearings.

- Hollow Shaft Structure
- Coaxial input and output shafts
- Cross Roller Output Bearing
- Backlash < 3 arc-min
- The precision HPF planetary gear is also available in our SHA Series Hollow Shaft Brushless Actuators as a standard product

$L_{10}$  Life: 20,000 h

## •HPF Series Ratings

| Size | Item | Ratio | Rated Torque |       | Limit for Repeated Peak Torque |       | Limit for Momentary Torque |       |
|------|------|-------|--------------|-------|--------------------------------|-------|----------------------------|-------|
|      |      |       | Nm           | In-lb | Nm                             | In-lb | Nm                         | In-lb |
| 25   |      | 11    | 21           | 186   | 100                            | 885   | 170                        | 1505  |
| 32   |      | 11    | 44           | 389   | 220                            | 1947  | 450                        | 3983  |

## • Cross Roller Bearing Specification

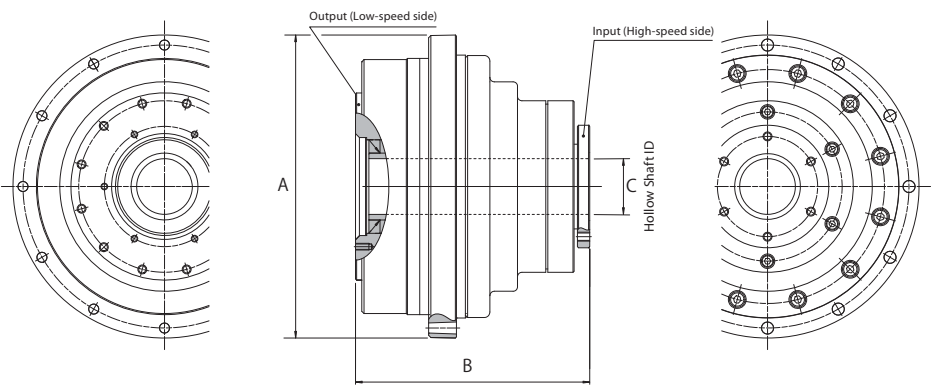
| Size | Item | Basic Rated Load           |      |                            |      | Allowable Moment Load Mc |       | Moment Stiffness Km     |               |
|------|------|----------------------------|------|----------------------------|------|--------------------------|-------|-------------------------|---------------|
|      |      | Basic Dynamic Rated Load C |      | Basic Static Rated Load Co |      | Nm                       | In-lb | x10 <sup>4</sup> Nm/rad | In-lb/arc.min |
|      |      | N                          | lb   | N                          | lb   |                          |       |                         |               |
| 25   |      | 11400                      | 2563 | 20300                      | 4564 | 410                      | 3629  | 37.9                    | 335           |
| 32   |      | 22500                      | 5058 | 39900                      | 8970 | 932                      | 8249  | 86.1                    | 762           |

\*\*1: "Basic dynamic rated load" is a constant stationary radial load that achieves a basic dynamic rated life of the bearing of one million revolutions.

\*\*2: "Basic static rated load" is a static load that achieves a contact stress of a constant level (408kN/mm<sup>2</sup>) at the center of a contact zone between the rolling element receiving a maximum load and track.

Unit: mm

| Size   | 25    | 32    |
|--------|-------|-------|
| Symbol |       |       |
| A      | 136   | 167   |
| B      | 105.1 | 125.5 |
| C      | 25    | 30    |



# Applications

## Robots



Industrial robots  
Robot peripheral equipment

Primary axis  
End effectors  
Linear axis  
Indexing table  
Peripheral equipment

- |               |     |
|---------------|-----|
| FHA-Mini      | CSG |
| FHA-C         | CSD |
| RSF           | CSF |
| Micro Encoder | SHG |
|               | SHF |
|               | SHD |
|               | HPG |

## Humanoid Robots

Humanoid Robots

Joint articulation  
Robotic hand  
Vision sensor positioning  
Torque sensing

- |               |     |
|---------------|-----|
| FHA-Mini      | CSG |
| FHA-C         | CSD |
| RSF-Supermini | CSF |
| RSF-Mini      | SHG |
| Micro Encoder | SHF |
|               | SHD |
|               | HPG |



## Metal Machine Tools



Machining centers  
Turning centers  
Work transfer systems  
CNC Grinders  
EDM systems

Tool changer  
Tool magazine  
Work positioning equipment  
Rotary table  
C Axis

- |       |
|-------|
| FHA-C |
| RSF   |
| LAH   |
| CSG   |
| CSF   |
| SHG   |
| SHF   |
| HPG   |

## Metal Working Machines

Bending machines  
Rolling machines  
Presses  
Work transfer systems

Bending axis  
Work positioning  
Work transfer

- |       |
|-------|
| FHA-C |
| RSF   |
| LSA   |
| SHG   |
| SHF   |
| HPG   |



## Printing, Bookbinding and Paper Processing Machines



Printing presses  
Folding machines  
Paper changing machines  
Paper positioning machines  
Paper machines

Web tension control  
Cutting blade positioning  
Phase adjusting  
Roller height adjustment

- |       |
|-------|
| FHA-C |
| RSF   |
| CSG   |
| CSF   |
| SHG   |
| SHF   |
| FB    |
| FR    |
| FD    |
| HPG   |



## Semiconductor Manufacturing Systems



Mask and reticle manufacturing  
 Wafer fabrication equipment  
 Wafer processing equipment  
 Test & Assembly equipment  
 Inspection equipment  
 Wafer transfer equipment

Wafer transfer robots  
 Positioning drive  
 Indexing tables  
 Wafer flipper  
 Valve opening/closing

|               |               |
|---------------|---------------|
| FHA-Cmini     | Micro Encoder |
| FHA-C         | CSF           |
| RSF           | SHD           |
| RSF-Supermini | SHF           |
| KDU           | HPG           |
| RH            |               |
| LA            |               |
| LAH           |               |

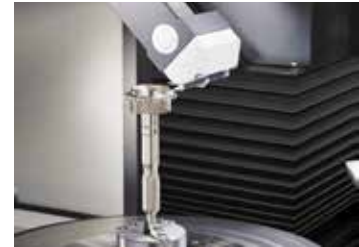
## Measurement, Analytical and Test Systems

Photometric equipment  
 Three-dimensional measuring instruments  
 Metal tensile test machines  
 Soil-column yield strength test machines

Transfer systems  
 Positioning drive  
 Prism positioning drive  
 Indexing tables  
 Direct transmission tables

|               |
|---------------|
| FHA-C mini    |
| RSF           |
| RSF-Supermini |
| KDU           |
| RH            |
| LSA           |
| Micro Encoder |

|     |
|-----|
| CSF |
| SHF |



## Medical Equipment



Three-dimensional manipulators  
 X-ray photographing and CT-NMR systems  
 X-ray film developing and take-off machines  
 Surgical operation assistant robots

Precision joint drive  
 Bed lifting and inclination drive  
 Positioning table drive

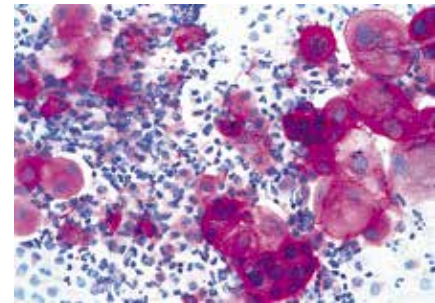
|           |
|-----------|
| FHA-Cmini |
| FHA-C     |
| RSF       |
| RH        |
| CSF       |
| SHF       |

## Optical Machines

X-ray analytical systems  
 Optical component inspection systems  
 Laser oscillation machines  
 Optical measuring instruments  
 Surface inspection systems  
 Optical disc manufacturing systems  
 Laser markers

Positioning table drive  
 Lens positioning drive  
 Laser mirror drive  
 Prism drive  
 Probe drive  
 Sensor positioning drive

|               |
|---------------|
| FHA-Cmini     |
| RSF           |
| RSF-Supermini |
| KDU           |
| RH            |
| LSA           |
| Micro Encoder |
| CSF           |
| SHF           |



## Telescopes



Condenser mirror adjusting mechanisms  
 Electromagnetic wave micrometer adjusting mechanisms  
 Secondary mirror position control  
 Robot arms for maintenance servicing

X, Y, Z axis drive  
 Indirect drive mechanisms

|               |
|---------------|
| FHA-Cmini     |
| RSF-Supermini |
| RSF           |
| KDU           |
| LA            |
| LAH           |
| LBC           |
| CSF           |
| SHF           |
| HPG           |

# Applications

## Wood, Light Metal and Plastic Machine Tools



Woodworking machines  
5-axis machining centers  
3-axis gantry mills  
Work transfer systems

Milling head drive  
Tool magazine drive  
Work positioning machines  
Rotary table drive  
Tool positioning machine drive  
Direct transmission shaft drive  
Shaft drive

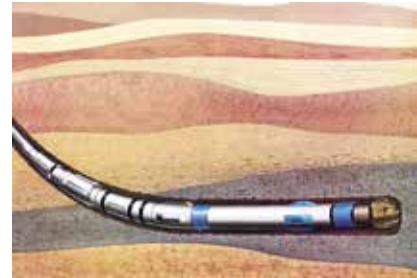
- FHA-Cmini
- FHA-C
- RSF
- RSF-Supermini
- LAH
- CSG
- CSF
- SHG
- SHF
- HPG

## Energy

Oil exploration robot  
Wind power equipment  
Electric power equipment  
Photovoltaics

Directional drilling  
Propeller pitch control  
Solar panel positioning

- FHA-C
- CSF
- FR



## Paper-making Machines



Paper-making machines  
Corrugated fiberboard box making and printing machines

Coating-process roller positioning drive  
Head box slice lip positioning  
Cutter knife positioning  
Cutter knife traveling drive

- RSF
- FHA-C
- RH
- CSF
- SHF
- HPG

## Crating and Packaging Machines

Sealing machines  
Label printing machines  
Label attaching machines  
Robots  
Work transfer systems

Shaft synchronizing drive  
Roll synchronizing drive  
Joint drive  
Trolley drive

- FHA-C
- RSF
- RH
- CSF
- SHF
- FB
- FR
- FD

HPG



## Flat Panel Display Manufacturing Systems



Array process equipment  
Cell process equipment  
Assembly process equipment  
Work transfer systems

Transfer systems  
Positioning  
Indexing tables  
Direct transmission tables  
Work reversing machines  
Tension controllers  
Hatch opening/closing drive  
Joint drive  
Trolley drive

- FHA-Cmini
- FHA-C
- RSF
- RSF-Supermini
- KDU
- RH
- LA
- LAH
- CSF
- SHF
- SHD
- HPG

## Communication Equipment



Antennas  
Microphones  
Cameras  
Wavelength duplexers  
Radars

Pan & Tilt drives  
Prism drive

FHA-C mini  
FHA-C  
RSF  
RSF-Supermini  
RH  
LA  
LSA  
HPG

Micro Encoder

## Printed Circuit Board Manufacturing Machines

Electronic component insertion machines  
Solder paste dispensing machines  
Board inspection systems  
Transfer systems

Drilling head drive  
Tool changer drive  
Tool magazine drive  
Work positioning machines  
Rotary table drive  
Tool positioning machine drive  
Shaft drive

FHA-C mini  
FHA-C  
RSF  
RSF-Supermini  
LAH  
CSG  
CSF  
SHG  
SHF  
HPG



## Space



Communication  
Antennas  
Solar Array Drives  
Robotic joints  
Robotic arms

Pan & Tilt drive  
Joint drive  
Wheel drive

CSF  
SHF  
SHD

## Aircraft

Flight simulators  
Cargo handling and transfer systems  
Reconnaissance cameras  
Valves

Valve actuator  
Trolley drive  
Cargo wheel power drive unit  
Fly-by-Wire Components

FHA-Cmini  
FHA-C  
RSF  
RSF-Supermini  
RH  
CSF  
HPG



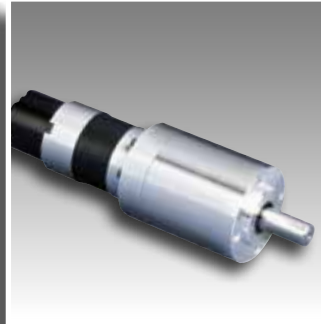
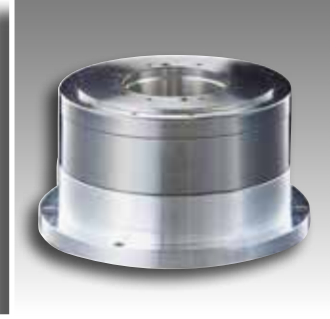
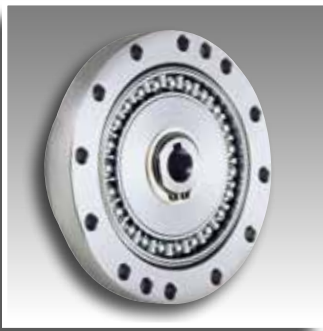
## Glass and Ceramic Manufacturing Systems



Ceramic forming machines  
Glass polishing machines  
Sheet glass cutting machines

Valve opening and closing  
Valve positioning  
Traveling trolley drive

FHA-Cmini  
FHA-C  
RSF  
LSA  
CSF  
SHF  
HPG



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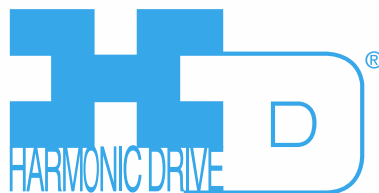
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