CGI, Inc.’s core business is manufacturing precision motion control solutions. From 1967 to present, CGI’s comprehensive technical knowledge, manufacturing expertise and “can-do” attitude has served the needs of an ever changing motion control marketplace. CGI’s diverse customer base and wide range of applications in aerospace, assembly, automotive, coordinate measuring, machine tool, material handling, medical, packaging, pharmaceutical, robotics, semi-conductor, special machinery, telecommunications and textile have earned CGI a reputation for innovation, quality and service.

CGI designs and builds high quality gearheads for AC induction motors, permanent magnet DC motors, stepmotors and servomotors. CGI can supply a complete motion control package, consisting of encoders, gearmotors, motion controllers, etc., to meet your application’s requirements. From the simple to the complex, CGI can supply off-the-shelf products or provide a custom-fit solution.

CGI, Inc. operates under an ISO9001:2000 certified quality management system. CGI’s Engineering, Manufacturing and Quality departments employ the latest systems available, such as Solidworks with FE analysis, AutoCad, CAD/CAM, Visual Manufacturing with ERP inventory management and CMM technology. We continually strive for new ways to improve standard products as well as minimize the time from the design stage to completion of your new and custom products.

CGI’s greatest asset is its people! That is how CGI has accomplished an excellent record for on-time deliveries, rush/emergency production and customer satisfaction that is known throughout the industry. CGI is dedicated to exceeding those levels of support, satisfaction and product quality.

Quality, reliability and being customer-driven makes CGI the best value for your motion control requirements.
CGI’s PLANETARY GEARHEAD SYSTEM

True planetary gearing is provided by three or more planet gears revolving around a single pinion, or sun gear, which allows internal “load sharing” over the planet gears. When compared to spur gearheads where only two gears mesh simultaneously, a true planetary design can offer three to five times more torque capacity and greater performance. With CGI’s studies of various applications, we have determined our true planetary design to be optimum for moderate to high torque factors. These factors include radial and axial loading, weight, lubrication, operating temperature extremes, typical torque/speed load points, etc.

NEMA MOUNTING INTERFACES

Presently there are no interface mounting standards for Brushless DC and servo motor products. Users of motion control equipment may have difficulty trying to mount a motor to a bulkhead and other peripheral equipment, such as gearheads. One motor manufacturer’s dimensions may not have the same mounting dimensions as other motor manufacturers.

Step motors experienced a mounting interface standardization in 1972, which was the direct effort of industry leaders in the Incremental Motion Control Society (IMCS) and the National Electrical Manufacturers Association (NEMA). There is an industry trend by these same agencies to establish a set of standard dimensions for all motors. This standard governs the package size (square dimension or diameter if round) commonly called frame size (established sizes are 11, 17, 23, 34, and 42). This standard governs mounting hole diameter and bolt circle, pilot diameter, pilot length, shaft diameter and shaft length. Although step motors conform to “NEMA” standards, there is a need for a larger shaft diameter for the more powerful BLDC and servo motors. Due to this, we can reduce excess heat and noise generated at the gear mesh. CGI has years of experience in application engineering to assist them in determining the correct gearhead design and proper material selections for critical applications.

CGI wants to provide you with the best gearhead solution to match your needs. Here are some factors to consider to maximize your application system’s performance:

- Motor Type
- Torque
- Speed/RPM
- Inertia Match
- Life Expectancy
- Radial/Axial Loading
- System Resolution
- Noise
- System Stiffness

AGMA GEAR QUALITY

AGMA stands for the American Gear Manufacturers Association. This agency has established specific tolerances that are associated with an AGMA Quality Class or Level (per AGMA 2000-A 88). Commercial gears typically are classified between AGMA 5 to AGMA 9. Precision gears range between AGMA 10 to AGMA 14. In comparison master gears are AGMA 15. CGI gears range between AGMA 10 and 13, depending on application.

SINGLE PIECE CONSTRUCTION

CGI uses precision gear cutting machines to obtain high AGMA levels, ensuring the highest quality gears are used in our motion control products. To reduce the effects of tolerance stack-ups during the assembly process of our gearhead products, we make all ring gears, output shaft/carrier plates, junctions of the gears and allows for longer lubrication life. CGI has additional lubrications for specialized applications, such as greases and dry film lubricants rated for space use and high vacuum applications that need to conform to very low “out-gassing” requirements.

Service Factors apply to the torque ratings a gearhead is capable of withstanding based on direction, motion, profile, RPM, stock loads, numbers of cycles per hour and/or how many hours per day it is in operation. To determine the correct service factor when evaluating torque ratings for your application, please look under our Product Selection Guide/Application Sheet (page 40-42).

GEARHEAD DURABILITY FACTORS

There are many factors that affect the life of a gearhead which fall into four (4) categories: Gear Geometry, Surface Durability, Lubrication, and Service Factors. CGI adheres to AGMA (American Gear Manufacturers Association) standards in the design and analysis of gear geometry. CGI takes into consideration diametral pitch, number of teeth, face width, load distribution, material strength, heat treatment, RPM and hours of life. If any of these factors are not appropriate for the application, it may result in a shortening of the gearhead life. Proper gear geometry ensures smooth transmission of power. By optimizing gear geometry, we can reduce excess heat and noise generated at the gear mesh. CGI has years of experience in application engineering to assist them in determining the correct gearhead design and proper material selections for critical applications.

Surface durability is the gear tooth’s surface resistance to wear. This wear is the greatest when the RPM is high and the torque being transmitted through the gear is high. Gears must be hardened if they are expected to have a long life. All CGI gear components are specially heat treated to prevent excessive gear tooth surface wear.

Lubrication is very critical for the long life of any gearhead. Lubrications fail for two reasons. First, operating in an ambient temperature that is higher than the grease is rated for and second is time. CGI gearheads can endure wide operating temperature extremes without damage. Our standard synthetic lubricants have a temperature range of -40°C to +150°C (-40°F to +302°F). Our front and rear mounting brackets are manufactured from aluminum, which is an excellent heat sink that conducts heat away from the gears and allows for longer lubrication life. CGI has additional lubrications for specialized applications, such as greases and dry film lubricants rated for space use and high vacuum applications that need to conform to very low “out-gassing” requirements.

CAGED ROLLER BEARINGS

We install high quality caged roller bearings inside our case hardened planet gears for long life, even when subjected to heavy torque loads.

CLAMP-ON PINION GEARS / QUICK INSTALLATION

CGI uses a balanced two-piece clamp and pinion gear design that is easy and quick to install on motor shafts. We make these pinion gears out of high strength steel and finish by heat treating for a long life. Our gearheads are complete with detailed instructions, all mounting hardware, and Allen wrenches. Complete gearhead to motor installation takes only minutes.

VITON O-RINGS

O-Rings seal each joint of our Primo™, PrimoMet™ and Spur Inline gearhead families to prevent outside contamination from entering the gearhead. The Viton material is chemically resistant and can withstand temperatures over 400°F (204°C).

NOTE: For complete sealing of motor to the gearhead, apply Loctite™ 515 (liquid gasket), or equivalent, to the motor’s face where it contacts the rear surface of the gearhead.

CGI’s Sales and Engineering Staff will gladly assist you with these or any other application/technical issues you may have.
CONSTRUCTION FEATURES

- True planetary design
- Low backlash design
- Input pinions with balanced clamp collar
- Quick installation
- Strong, caged roller bearings
- High reliability design
- High strength steels
- High shaft loading capacity
- Viton O-Ring sealed at each joint
- Sealed ball bearings
- High efficiency design
- All gears are heat treated
- NEMA mounting standards
- 5 year warranty

### PRECISION HIGH PERFORMANCE GEARHEADS

#### SINGLE, DOUBLE, TRIPLE STAGE

- **TRIPLE STAGE:** 160:1 / 280:1 / 400:1 / 550:1 / 700:1
  - Other ratios available
- **SINGLE STAGE:** 3:1 / 4:1 / 5:1 / 5.5:1 / 7:1 / 10:1
- 90% Input RPM: 6500 Max.

#### AVAILABLE RATIOS

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>PART NUMBER</th>
<th>A PILOT DIAMETER (in.)</th>
<th>B SQUARE FLANGE DIAM. (in.)</th>
<th>C SHAFT LENGTH (in.)</th>
<th>D SHAFT DIAMETER (in.)</th>
<th>E PILOT LENGTH (in.)</th>
<th>F FLANGE THICKNESS (in.)</th>
<th>G KEY LOCATION (in.)</th>
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#### EFFICIENCY SPECIFICATIONS

- 90% Input RPM: 5000 Max.
- 85% Operating Temperature Range: -40°F to +255°F
- Motor Mounting Hardware Supplied
- 48 Hour Shipping

**ALL SPECIFICATIONS SUBJECT TO CHANGE.**
<table>
<thead>
<tr>
<th>MODEL</th>
<th>RATIO</th>
<th>TORQUE RATING</th>
<th>INERTIA (IN LBS)</th>
<th>IN LBS SC IN SEC</th>
<th>SC IN SEC</th>
<th>ARC MINUTES</th>
<th>WEIGHT (OZ)</th>
<th>LENGTH (IN)</th>
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<tr>
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<td>0.2</td>
<td>15</td>
<td>268</td>
<td>16</td>
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</tbody>
</table>

**Notes:**
- Other ratios are also available, consult factory.
- Torque output is rated at 3000 RPM, and a minimum life of 10,000 hours.
- Bearing load ratings are based on a minimum life of 10,000 hours.
For complete product offerings, visit www.cgimotion.com

ALL SPECIFICATIONS SUBJECT TO CHANGE.
<table>
<thead>
<tr>
<th>MODEL</th>
<th>RATIO</th>
<th>INPUT/OUTPUT</th>
<th>GEARHEAD</th>
<th>L</th>
<th>ARC MINUTES</th>
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<td>350/280</td>
<td>1323/198</td>
<td>11</td>
<td>116.0</td>
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</table>

**NOTES:** Other ratios are also available, consult factory.

Input/Output is rated at 3000 RPM, and a minimum life of 10,000 hours.

Boiling load ratings are based on a minimum life of 10,000 hours.
PN SERIES: PARAGON™ PLANETARY GEARHEADS

SINGLE AND DOUBLE STAGE PRECISION GEARHEADS

CONSTRUCTION FEATURES
• True planetary design
• Low backlash design
• Input pinions with balanced clamp collar
• Quick installation
• Strong, caged roller bearings
• Sealed ball bearings
• High efficiency design
• All gears are heat treated
• NEMA mounting standards
• 2 year warranty

AVAILABLE RATIOS EFFICIENCY SPECIFICATIONS
SINGLE STAGE: 3:1 / 4:1 / 5.5:1 / 7:1 / 10:1 90% Input RPM: 5000 Max.

Motor Mounting Hardware Supplied

A CGI EXCLUSIVE...
Gear sizing software to help you get the right product for your project.
SIZE IT...GEAR SIZING MADE EASY!

NOTE: "O" AND "N" DIMENSIONS ON PGS. 24-25

All specifications subject to change.
### PN Series: Paragon™ Planetary Gearheads

#### Single, Double Stage

<table>
<thead>
<tr>
<th>Model</th>
<th>Ratio</th>
<th>Torque Rating</th>
<th>Input Power (kW)</th>
<th>Gearhead (kW)</th>
<th>Std/ Low Arc Minutes</th>
<th>Weight (Lbs)</th>
<th>Gearhead Length</th>
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</table>

**Notes:** Other ratios are also available, consult factory. Tc: Output torque is rated at 3000 RPM, and a minimum life of 10,000 hours. Bearing load ratings are based on a minimum life of 10,000 hours.
RADIAL & AXIAL LOAD SPECIFICATIONS

PRIMETRIC
These graphs display the allowable radial load (lbs.) at a given distance (in.) from the mount face based on an L_10 life of 10,000 hours.

PRIME & PARAGON
These graphs display the allowable radial load (lbs.) at a given distance (in.) from the mount face based on an L_10 life of 10,000 hours.
CONSTRUCTION FEATURES
- One-piece gear cluster
- High-quality spur gearhead
- Input pinion with balanced clamp collar
- Quick installation
- High reliability design
- High strength steels
- High shaft loading capacity
- Viton O-Rings sealed at each joint
- Sealed ball bearings
- High efficiency design
- All gears are heat treated
- NEMA mounting standards
- 2 year warranty

SI SERIES: SPUR GEARHEADS

NEMA DIMENSIONS

PRECISION GEARHEADS

NEMA DIMENSIONS

PRECISION GEARHEADS

<table>
<thead>
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<th>PART NUMBER</th>
<th>PIVOT DIAMETER (in.)</th>
<th>P</th>
<th>SQUARE FLANGE (in.)</th>
<th>Q</th>
<th>SHAFT LENGTH (in.)</th>
<th>R</th>
<th>SHAFT DIAMETER (in.)</th>
<th>S</th>
<th>PIVOT LENGTH (in.)</th>
<th>T</th>
<th>FLANGE THICKNESS (in.)</th>
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<th>KEY LOCATION (in.)</th>
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<th>X</th>
<th>BOLT HOLE CIRCLE (in.)</th>
<th>Y</th>
<th>SHAFT TENSION (LBS.)</th>
<th>Z</th>
<th>RADIAl SHAFT LOADING (LBS.)</th>
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<th>D</th>
<th>MOMENTARY TORQUE MAX (IN LBS.)</th>
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**Available Ratios and Shaft Rotation**

- Input RPM: 4800 Max.
- Minimum Efficiency: 90%
- Operating Temperature Range: -40°F to +205°F

**Specifications**

- Note: Size 006 Requires a Mounting Adapter
- Motor Mounting Hardware Supplied

All Specifications Subject to Change.
RC/DC SERIES: PRIME™ PLANETARY RIGHT ANGLE GEARHEADS

SINGLE, DOUBLE, TRIPLE STAGE-SINGLE OR DOUBLE SHAFT PRECISION HIGH PERFORMANCE GEARHEADS

CONSTRUCTION FEATURES
- True planetary design
- Tapered roller bearings
- Low backlash design
- Input pinion with balanced clamp collar
- Quick installation
- Strong, caged roller bearings
- High reliability design
- High strength steels
- High shaft loading capacity
- Viton O-Rings sealed at each joint
- Case hardened spiral bevel gears
- Sealed ball bearings
- High efficiency design
- All gears are heat treated
- NEMA mounting standards
- 5 year warranty

AVAILABLE RATIOS
- SINGLE STAGE: 3:1 / 4:1 / 5:1 / 5.5:1 / 7:1 / 10:1 85% Input RPM: 6500 Max.

PART NUMBER | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P
--- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | ---
017RCX/017DCX | 2.05 | 0.125 | 1.725 | 2.27 | 0.82 | 0.094 | 0.033 | 0.094 | 0.033 | 0.094 | 0.033 | 0.094 | 0.033 | 0.094 | 0.033 | 0.094 | 0.033
023RCX/023DCX | 2.99 | 0.205 | 2.625 | 3.55 | 0.99 | 0.125 | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | 0.044 | 0.044
034RCX/034DCX | 4.28 | 0.220 | 3.875 | 5.14 | 1.38 | 0.187 | 0.060 | 0.060 | 0.060 | 0.060 | 0.060 | 0.060 | 0.060 | 0.060 | 0.060 | 0.060 | 0.060
042RCX/042DCX | 5.51 | 0.280 | 4.900 | 5.89 | 1.18 | 0.250 | 0.093 | 0.093 | 0.093 | 0.093 | 0.093 | 0.093 | 0.093 | 0.093 | 0.093 | 0.093 | 0.093
056RCX/056DCX | 6.87 | 0.410 | 7.000 | 7.79 | 1.79 | 0.375 | 0.137 | 0.137 | 0.137 | 0.137 | 0.137 | 0.137 | 0.137 | 0.137 | 0.137 | 0.137 | 0.137
075RCX/075DCX | 8.64 | 0.560 | 8.460 | 11.50 | 2.95 | 0.500 | 0.187 | 0.187 | 0.187 | 0.187 | 0.187 | 0.187 | 0.187 | 0.187 | 0.187 | 0.187 | 0.187

NOTE: “O” AND “N” DIMENSION ON PGS. 24-25

PRECISION, INSIDE AND OUT.

ALL SPECIFICATIONS SUBJECT TO CHANGE.
## RC/DC SERIES: PRIME™ PLANETARY RIGHT ANGLE GEARHEADS

### Single, Double, Triple Stage-Single or Double Shaft

<table>
<thead>
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<th>Ratio</th>
<th>Torque Rating</th>
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<th>Gearhead</th>
<th>N</th>
<th>D</th>
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**All specifications subject to change.**

### Notes:
- Other ratios are also available, consult factory.
- Torque is rated at 3000 RPM, and a minimum life of 10,000 hours.
- Torque specifications for the RCX and DCX are the same.
RN/DN SERIES: PARAGON™ PLANETARY RIGHT ANGLE GEARHEADS

SINGLE, DOUBLE STAGE-SINGLE OR DOUBLE SHAFT PRECISION GEARHEADS

CONSTRUCTION FEATURES
- True planetary design
- Tapered roller bearings
- Low backlash design
- Input pinion with balanced clamp collar
- Quick installation
- Strong, caged roller bearings
- High reliability design
- High strength steels
- High shaft loading capacity
- Case hardened spiral bevel gears
- Sealed ball bearings
- High efficiency design
- All gears are heat treated
- NEMA mounting standards
- 2 year warranty

AVAILABLE RATIOS EFFICIENCY SPECIFICATIONS
SINGLE STAGE: 3:1 / 4:1 / 5.5:1 / 7:1 / 10:1 85% Input RPM: 5000 Max.

Motor Mounting Hardware Supplied

ALL SPECIFICATIONS SUBJECT TO CHANGE.

PRODUCTS WITH VISION. FOR ENGINEERS...BY ENGINEERS.

The fountains at the Bellagio Casino in Las Vegas, Nevada are powered by CGI, INC. precision gearheads.

NOTE: “O” AND “N” DIMENSION ON PGS. 24-25

NOTE: “L” DIMENSION IS ON PGS. 6-7

NOTE: “L” DIMENSION IS ON PGS. 10-11 (C)
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<th>MODEL</th>
<th>RATIO</th>
<th>TORQUE RATING</th>
<th>INERTIA</th>
<th>BACKLASH</th>
<th>GEARHEAD N</th>
<th>G</th>
<th>TYPICAL APPLICATION</th>
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**NOTES:**
- Other ratios are also available, consult factory.
- Torque output is based on 3000 RPM, and a minimum life of 10,000 hours.
- Bearing load ratings are based on a minimum life of 10,000 hours.
- Torque specifications for the RXN and DXN are the same.
RS/DS SERIES: SPUR RIGHT ANGLE GEARHEADS

NEMA DIMENSIONS-SINGLE OR DOUBLE SHAFT PRECISION GEARHEADS

CONSTRUCTION FEATURES
- One-piece gear cluster
- Tapered roller bearings
- High quality spur gearhead
- Input pinion with balanced clamp collar
- Quick installation
- High reliability design
- High strength steels
- High shaft loading capacity
- Viton O-Ring sealed at each joint
- Sealed ball bearings
- 2 year warranty
- All gears are heat treated
- Viton O-Ring sealed at each joint
- High shaft loading capacity
- High strength steels
- High reliability design
- Quick installation
- Input pinion with balanced clamp collar
- High quality spur gearhead
- Tapered roller bearings
- One-piece gear cluster

ALL SPECIFICATIONS SUBJECT TO CHANGE.

<table>
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<tr>
<th>NUMBER</th>
<th>A PILOT DIAMETER (in.)</th>
<th>B SQUARE FLANGE (in.)</th>
<th>C SHAFT DIAMETER (in.)</th>
<th>D SHAFT LENGTH (in.)</th>
<th>E PILOT LENGTH (in.)</th>
<th>F FLANGE THICKNESS (in.)</th>
<th>G KEY LOCATION</th>
<th>H KEY DIAMETER (in.)</th>
<th>L ELECTRIC CAPACITY</th>
<th>M OVERHAND WIDTH (in.)</th>
<th>N RADIAL SHAFT LOAD (lbs.)</th>
<th>O AXIAL SHAFT LOAD (lbs.)</th>
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<th>J BELT HOLE DIAMETER (in.)</th>
<th>K BELT HOLE CIRCLE (in.)</th>
<th>L RIGHT ANGLE WIDTH (in.)</th>
<th>M OVERHAND WIDTH (in.)</th>
<th>N KEY WIDTH/THICKNESS (in.)</th>
<th>O SQUARE LENGTH (in.)</th>
<th>P SQUARE WIDTH (in.)</th>
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<th>R MOUNTING LOCATION</th>
<th>S MAX INERTIA (OZ-IN-SEC²)</th>
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AVAILABLE RATIOS AND SHAFT ROTATION

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NOTE: "O" AND "N" DIMENSION ON PGS. 24-25

NOTE: "L" DIMENSION IS ON PGS. 14-15

NOTE: "L" DIMENSION IS ON PGS. 10-11

SPECIFICATIONS
- Input RPM: 4000 Max.
- Minimum Efficiency: 90%
- Operating Temperature Range: -40˚F to +255˚F
- Motor Mounting Hardware Supplied
- Note: Size 042 Requires a Mounting Adapter

ALL SPECIFICATIONS SUBJECT TO CHANGE.

*Rotation references the gearhead output shaft direction with respect to motor shaft direction.
CONSTRUCTION FEATURES

- One-piece gear cluster
- Cost-effective, light-duty spur gearmotors
- Composite bushings throughout gearhead
- Gears are high strength steel and precision hobbed
- Output shaft is heat treated stainless steel
- High temperature, molded composite housing
- Supplied with a 17 or 23 frame step motor
- Standard industry dimensions
- 1 year warranty

### SIZES 017 AND 023-RATIOS 5, 10, 18:1

#### PART NUMBER

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>A PIVOT DIAMETER (in.)</th>
<th>B SQUARE FLANGE LENGTH (in.)</th>
<th>C SHAFT DIAMETER (in.)</th>
<th>D SHAFT LENGTH (in.)</th>
<th>E Pilot LENGTH (in.)</th>
<th>F FLANGE THICKNESS (in.)</th>
<th>G FLAT LENGTH (in.)</th>
<th>H DIMENSION OVER FLAT (in.)</th>
<th>I NUMBER OF LEAD WIRES</th>
</tr>
</thead>
<tbody>
<tr>
<td>017SPX</td>
<td>0.708 / 0.710</td>
<td>0.875</td>
<td>0.79</td>
<td>0.12</td>
<td>0.19</td>
<td>0.470 @ 25˚C</td>
<td>0.22</td>
<td>0.050 (1X)</td>
<td>0.29 (1X)</td>
</tr>
<tr>
<td>023SPX</td>
<td>0.708 / 0.710</td>
<td>1.25</td>
<td>1.26</td>
<td>0.20</td>
<td>0.19</td>
<td>0.370 @ 25˚C</td>
<td>0.22</td>
<td>0.050 (1X)</td>
<td>0.29 (1X)</td>
</tr>
</tbody>
</table>

#### NUMBER

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>PART NUMBER</th>
<th>DIAMETER (MAX.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT17-075P</td>
<td>017SPX</td>
<td>2.25 F70</td>
</tr>
<tr>
<td>4023-828P</td>
<td>023SPX</td>
<td>2.625</td>
</tr>
</tbody>
</table>

### SIZES 017 AND 023-RATIOS 5, 10, 18:1

#### SPM SCHEMATIC

**SPECS:** Gearhead Ambient Operating Temperature Range: 40F to +158F. Motor is rated to 400°F. Molded Composite Housing (Max Temp. 420°F). Gears are High-Strength Heat-Treated Steel. Composite Bushings throughout Gearhead. Input/Output shafts turn in the same direction.

### SIZE 017

**MOTOR P/N:** HT17-075P

#### Bipolar Chopper Drive Switching Sequence for CW Rotation

Facing Mounting End

<table>
<thead>
<tr>
<th>Step</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

### SIZE 023

**MOTOR P/N:** 4023-828P

#### Bipolar Chopper Drive Switching Sequence for CW Rotation

Facing Mounting End

<table>
<thead>
<tr>
<th>Step</th>
<th>Red</th>
<th>Black</th>
<th>Green</th>
<th>White</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

* Motor Connection Centers To be used
* These wires are not used. Do not connect them or ground them. They must be electrically isolated.

ALL SPECIFICATIONS SUBJECT TO CHANGE.
CORE COMPETENCE AT CGI MEANS...CUSTOMS.

CGI has been building to custom gear requirements for over 36 years and we’re still going strong. Time and time again customers continue to bring us application requirements that no other manufacturer can do quickly and inexpensively.

The following products on these two pages are only a few of the hundreds of custom gearheads we have built for a wide variety of industries including Fortune 500 companies in the semiconductor, food packaging, military and medical industries. So whether it’s something simple as a special shaft or ratio or something more complex, CGI is the only choice. Contact our applications engineering department for more information.

LINEAR SLIDE

CGI gearheads are easily adapted to any of the commercially available linear slide products on the market. All of our inline or right-angle gearheads can be used to help reduce inertia. Our products match up directly to products manufactured by: Intek, Linear Industries, Daedel, Star Linear, THK, NSK, IKO, Warner, Tol-O-Matic, Macron Dynamics and Industrial Devices.

CUSTOM SHAFT OPTIONS

CGI gearheads offer increased design flexibility when built with custom shaft options such as dual-output shaft, hollow shaft and even custom input shafts that allows easy mounting to options like brakes, encoders or safety couplings that are used between the motor and the gearhead.

AEROSPACE AND MEDICAL

CGI has built custom products for the Hubble Telescope project as well as custom components for surgical hand tools for the medical industry. More and more companies rely on CGI to build non-standard products that meet the stringent requirements of these two very important industries.

SEMICONDUCTOR AND FOOD PACKAGING EQUIPMENT

CGI Prime™ PL Series gearheads can be manufactured with special seals and special grease for both the semiconductor and food packaging equipment industries. The gearheads meet various IP ratings and are usually painted white rather than our standard black anodized.
CGI, Inc. is renowned for being able to provide complex precision-machined component parts of high quality and hold tolerances as tight as 2.5 microns. These parts are machined from diverse metals, and involve a variety of hardness, surface treatment, heat-treating and plating requirements. Applications range from nuclear submarines, space vehicles, surgical devices, various semi-conductor manufacturing equipment, robotics and machine tool automation.
48 Hour Shipping

Our 48 hour shipping program, raises the bar even higher. It ensures the shipment of select standard size and ratio gearheads in stock within 48 hours. By offering quick delivery, we are able to provide this advantage to customers needing a precise solution, and needing it quickly. The market demand for quick turnaround on standard size and ratio gearboxes has become overwhelming. Sales channels need to be able to react to customers’ requests quickly. OEMs often face short development timeframes, especially in prototype applications while end-users, losing time and money in a break-down situation, need to get their replacement gearboxes in a hurry. We do our best to accommodate any rush situation.

Featured Ratios and Sizes

48 Hour Shipping is available for popular sizes and ratios from our Prime, Primemetric, Paragon, Victory, Raptor, and Raptor EP Series product lines:

- **PLX** - Prime™ Planetary Gearheads
- **RCX** - Prime™ Planetary Right Angle Gearheads
- **DCX** - Prime™ Planetary Right Angle Dual Shaft
- **PMX** - Primemetric™ Planetary Gearheads
- **PNX** - Paragon™ Planetary Gearheads
- **RNX** - Paragon™ Planetary Right Angle Gearheads
- **DNX** - Paragon™ Planetary Right Angle Dual Shaft
- **SIX** - Spur Gearheads NEMA Dimension
- **RSX** - Spur Right Angle Single Shaft
- **DSX** - Spur Right Angle Dual Shaft
- **RBD** - Right Angle Bevel
- **DBD** - Dual Right Angle Bevel
- **SPX** - Light Duty Offset Gearmotors

### Gearhead Ordering Information

**Size** | **Ratio** | **Features** | **Motor Code**
--- | --- | --- | ---
017 | 1:1 | Standard | 01917
017 | 1:1 | Low Backlash | 01918
017 | 1:1 | Vertical Mount | 01919
017 | 1:1 | Vertical Mount | 01920
017 | 1:1 | Adapter Kit | 01921
017 | 1:1 | Pinion Kit | 01922
017 | 1:1 | Rear Bracket Kit | 01923

**PLEASE NOTE:** If you have any sizing or technical questions please contact us at (775) 882-3422

**ALL SPECIFICATIONS SUBJECT TO CHANGE.**
INERTIA MATCHING

There are several rules that apply to the acceleration responsiveness of a gearmotor and external load system. (See Inertia Matching Example on page 38) They are as follows:

FOR STEP MOTORS (RULE 1 AND 2)

RULE 1: A system will respond “very fast” if the “System Inertia” is 1 to 3 times larger than the motor’s inertia.

RULE 2: A system will respond “acceptably fast” if the “System Inertia” is between 3 and 10 times larger than the motor’s inertia.

FOR SERVO MOTORS (RULE 3 AND 4)

RULE 3: A system will respond “very fast” if the “System Inertia” is 1 to 5 times larger than the motor’s inertia. Some high performance motor manufacturers state that very fast acceleration response can be obtained with reflected inertia matches as high as 10 times.

RULE 4: A system will respond “acceptably fast” if the “System Inertia” is between 6 and 10 times larger than the motor’s inertia. Some high performance motor manufacturers state that acceptably fast response can be obtained with reflected inertia matches as high as 20 times.

Once the “System Inertia” is calculated, divide this by the motor’s inertia, take the resultant number and see how it compares with the rules above to get a close approximation of the overall system responsiveness that you require.

RADIAL AND AXIAL BEARING LOAD RATINGS

Our radial and axial bearing load information for each gearhead was calculated based on the dynamic load ratings for our bearing systems. Besides lubrication, bearing life is also affected by running speed (rpm) and applied load (radial or axial). Keeping required hours of bearing operation as a constant, as rpm increases, bearing load capacity decreases and vise versa (note: static loads do not apply). Additionally, for gearhead applications, output shaft bearings are affected by the location of any applied radial load on the output shaft. As constant radial load on the output shaft is placed farther from the gearhead output face, the resultant radial load at the bearings increases.

Note: The radial and axial bearing load limit information is provided for singular load components only (not combined axial and radial loads). When combining the load components, it is safe to combine up to 10% of the maximum of the other component. (i.e. 100% of the maximum radial load limit can be combined with only 10% of the maximum axial load limit and vise versa). Consult CGI, Inc. if the second component (axial/radial) exceeds 10% of the first component’s load.

GEARHEAD / MOTOR MOUNTING

Any motor matching the mounting dimensions as shown below will attach to any of our Inline Spur, Prime™ Planetary, or Paragon™ Planetary gearheads quickly and easily. If the motor you have selected has a different mounting face than shown, an appropriate adapter can be manufactured to meet your motor’s exact mounting surface specifications.

All Gearheads come with a complete mounting kit which includes all hardware necessary for direct attachment to the motor along with easy to follow instruction. The Clamp-On Pinion and Balanced Collar simply slip onto the motor-shaft. The clamp is then fastened by two (2) Allen head screws. The motor is then slipped into the gearhead and is held in place by four (4) mounting bolts. This process should take a few minutes at most. No matching or additional components are required.

INERTIA MATCHING (continued)

One important consideration when choosing a gearhead for your application is proper inertia matching. When an external load has a large inertia and it must accelerate and decelerate responsively, a gearhead with the properly calculated inertia match will accomplish the task. A selected gear ratio will effectively reduce the external load inertia at the motor shaft by an inverse of the square of the gear ratio (see formula below).

INERTIA MATCHING EXAMPLE

INERTIA MATCHING

Depending on the application, a gearhead may be matched with a motor that has a different inertia than the gearhead’s own. In this case, the system inertia must be calculated.

To calculate the system inertia, first determine the individual inertias of the gearhead, pinion gear, and the motor rotor. Then, sum these inertias to get the system inertia.

FORMULA:

\[
\text{SYSTEM INERTIA} = \text{GEARHEAD INERTIA} + \text{PINION INERTIA} + \text{MOTOR ROTOR INERTIA}
\]

GIVEN:

\[
\begin{align*}
\text{SIZE 23} & \quad 3.5:1 \text{ PRIME GEARHEAD INERTIA} = 1.746E-04 \text{ OZ IN SEC}^2 \\
& \quad 3.5:1 \text{ PRIME PINION INERTIA} = 9.062E-04 \text{ OZ IN SEC}^2 \\
& \quad 5.5:1 \text{ PRIME GEARHEAD INERTIA} = 1.567E-01 \text{ OZ IN SEC}^2 \\
& \quad 5.5:1 \text{ PRIME PINION INERTIA} = 9.062E-04 \text{ OZ IN SEC}^2 \\
\end{align*}
\]

SOLUTION:

\[
\begin{align*}
\text{SYSTEM INERTIA} & = 1.746E-04 \text{ OZ IN SEC}^2 + 9.062E-04 \text{ OZ IN SEC}^2 + 1.567E-01 \text{ OZ IN SEC}^2 \\
& = 1.67E-01 \text{ OZ IN SEC}^2 \\
\text{RATIO OF THE SYSTEM INERTIA TO THE MOTOR ROTOR INERTIA} & = (1.67E-01 \text{ OZ IN SEC}^2) / (5.18E-03 \text{ OZ IN SEC}^2) \\
& = 1.2 TO 1 \text{ INERTIA MATCH} \\
\end{align*}
\]

IDEAL INERTIA MATCH OF 1:1 YIELDS A VERY FAST SYSTEM RESPONSE

OTHER APPLICATION PARAMETERS TO CONSIDER:

- TORQUE REQUIREMENTS
- SPEED REQUIREMENTS
- RESPONSE REQUIREMENTS
- STIFFNESS REQUIREMENTS
- RESOLUTION REQUIREMENTS
Application

**General Information**
- **Customer Name:**
- **Fax #:**
- **CGI Ship Date:**
- **Buyer Contact:**
- **Phone #:**
- **Dock Date:**
- **Technical Contact:**
- **Phone #:**
- **Ship Via:**
- **Purchase Order #:**
- **Your Project #:**
- **CGI Part #:**
- **Gearhead Type:**
- **Gearhead Size:**
- **Ratio:**

**Application Information**
- **Motor Manufacturer:**
- **Motor Model #:**
- **Motor Size:**
- **Maximum Motor Speed:**
- **Motor Print Attached?**
  - Yes
  - No
- **NEMA Motor:**
  - Yes
  - No
  - Not Sure

**Special Requirements**
- **OP – Output**
- **FB – Front Bracket**
- **RB – Rear Bracket**
- **Material**
- **Other**

**Service Factor**

<table>
<thead>
<tr>
<th>DIRECTION</th>
<th>MOTION PROFILE</th>
<th>MAX SPEED (RPM)</th>
<th>CYCLES / HOUR</th>
<th>HOURS / DAY</th>
<th>MAXICK LOAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unidirectional</td>
<td>Continuous</td>
<td>0-999</td>
<td>1</td>
<td>1-4</td>
<td>0.1</td>
</tr>
<tr>
<td>Reversing</td>
<td>Trapezoidal</td>
<td>1000-2999</td>
<td>2</td>
<td>4-8</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3000-4999</td>
<td>3</td>
<td>8-16</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5000+</td>
<td>4</td>
<td>16+</td>
<td>0.4</td>
</tr>
</tbody>
</table>

**Service Factor** = Sum of all Elements
- **Customer Sign Off:**
- **Sales:**
- **Engineering:**

---

**Certificate of Registration**

**QUALITY MANAGEMENT SYSTEM - ISO 9001:2000**

This is to certify that:

CGI Inc.
3400 Arrowhead Drive
Carson City
Nevada 89706
USA

holds certificate No. FM-66931
and operates a Quality Management System which complies with the requirements of ISO 9001:2000 for the following scope:

The design, manufacture and distribution of precision power transmission component parts and gear assemblies for motion control and automation applications.

For and on behalf of BSI:

President, BSI Management Systems America, Inc.

Originaly Registered: 03/14/2002
Latest Issue: 07/30/2008
Expiry Date: 06/14/2011

This certificate remains the property of BSI and shall be returned immediately upon request.
An electronic certificate can be authenticated online. Printed copies can be validated at www.bsigroup.com/ClientDirectory.
To be used in conjunction with the scope above or the attached appendix.

American Headquarters: 2119 Summer Hill Road, Suite 203, Fairfax, VA 22032, USA.
CGI, Inc. warrants all standard Gearheads, manufactured to be free of defects in materials and workmanship for the periods shown below, when used within Product Specifications and under Normal Operating Conditions, as determined by CGI, Inc. and within the provisions outlined below.

CGI, Inc. warrants all standard PriMetric and Prime Planetary Gearheads for a five (5) year period from date of purchase.

CGI, Inc. warrants all standard Spur Inline, Power Tube and Paragon Planetary Gearheads for a two (2) year period from date of purchase.

CGI, Inc. warrants all standard Spur Offset Gearheads for a one (1) year period from the date of purchase.

1. CGI, Inc. will repair or replace, at its sole discretion, any of its standard catalog products, which CGI agrees, in writing, are nonconforming. Any claims by Buyer for omissions or shortages in a shipment or that product is nonconforming shall be waived, unless Seller received written notice thereof within thirty (30) days after Buyer’s receipt of the shipment, or as authorized by Seller, in writing.

2. All product returned to Seller’s facility must have a Return Authorization (RA) Number. Buyer must contact CGI, Inc. before sending product for evaluation, repair, replacement, or modification. Seller assumes no liability for packages returned without proper authorization. The RA number should be clearly marked on the outside of all packages being returned. Product should be properly packaged. CGI, Inc. will not accept responsibility for damage incurred during removal, installation, shipping or handling of returned product.

3. Buyer shall pay costs of transportation for nonconforming product which is returned to Seller’s facility, unless prior written authorization is obtained from Seller. Buyer shall pay for costs of transportation on warranty repairs or replacements, using standard ground transport, unless agreed to by Seller, in writing.

4. Seller’s sole liability (whether based upon breach of contract, negligence, strict product liability or otherwise) is exclusively limited to the repair, replacement or the refund of the purchase price paid for defective product, at the Seller’s discretion. Seller shall not be liable for punitive damages, special, consequential, incidental, indirect damages or lost profits associated with said product.

5. Any CGI, Inc. product which has been damaged due to misuse, abuse, negligence, improper installation or has been modified, dismantled or disassembled by Buyer, in any manner shall void coverage by this warranty. Seller shall not accept returned products under this warranty as a result of life-cycle, reliability testing or processing outside of Normal Operating Conditions, nor custom, nonstandard or any product that has otherwise been modified at the request of or by Buyer, unless previously agreed to in writing by Seller.

6. Buyer agrees that any values of expected life furnished by Seller to Buyer are strictly estimates based on theoretical calculations, load averaging via RMC (root mean cubed) or other industry standard calculation methods. Such estimated values are furnished for Buyer’s convenience only and on the express condition that such values do not constitute any representation, warranty or guarantee by Seller whatsoever that such values will be realized in Buyer’s application. Any estimated values of expected life, oral or written information, opinions, evaluations, consultations, or cooperation of Seller or any designs, specifications, standards, performance requirements, requirements of third parties or other information of any kind furnished or communicated by Buyer, or its representatives, Buyer specifically agrees that it is Buyer’s sole responsibility to select and evaluate the correct product and other items for use in Buyer’s application.

7. Seller and Buyer agree that any and all claims, disputes and controversies concerning a product purchased by Buyer, as well as each of the terms set forth herein, shall be construed and interpreted, and in accordance with the laws of the State of Nevada without resort to conflict of laws principles. The parties further agree that venue with respect to any such claims and/or actions shall be in the state of federal courts having jurisdiction in Carson County, Nevada. Buyer waives any challenges to the jurisdiction of such courts and agrees to submit to the personal jurisdiction thereof.