

- Zero Backlash
- High Torque
- High Precision

# PSA-G Precision Gearheads



When your applications require accurate positioning and precise motion control, Harmonic Drive Technologies offers the perfect solution. Offering zero backlash and high torque, PSA-G gearheads utilize precision, high load output bearings and harmonic drive gearing mounted in superior quality housings. Input options allow compatibility with most servo and stepper motors.

## FEATURES

- Zero Backlash
- High Torque
- High Precision
- Motor Mounting Options
- High Overhung Load Capacity

## GEARHEAD SELECTION

### LOADING ANALYSIS

To select from the ratings table, it is necessary to construct or estimate a torque speed profile diagram as shown in Figures 1 and 2.

Normal operating conditions exhibit momentary peak torques that are substantially higher than constant speed running torques. These peak torques must be carefully considered when selecting a Harmonic Drive gearhead.

**Maximum Repeated Output Torque T<sub>1</sub>** – This is the torque required to accelerate the driven components from rest to normal continuous running speed.

**Normal Constant Speed Torque T<sub>2</sub>**

**Normal Deceleration Torque T<sub>3</sub>**

**Maximum Momentary Torque T<sub>4</sub>** – This is the peak torque generated by sudden shock loads, such as emergency stops or crashes. Particularly severe conditions exist with high output inertia and stringent rapid stop requirements. These high levels of torque must be limited.

Figure 1: Speed Profile

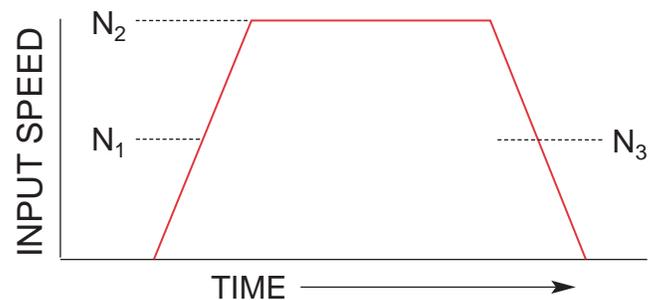
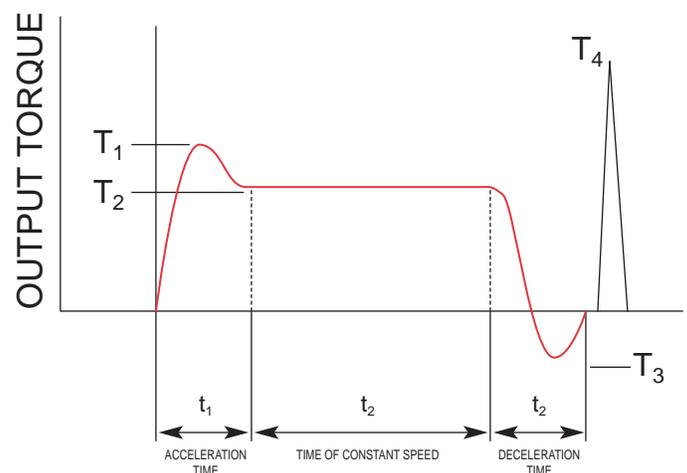


Figure 2: Torque Profile



### Mean Torque T

Calculate the mean torque.

$$T = \sqrt[3]{\frac{t_1 N_1 T_1^3 + t_2 N_2 T_2^3 + t_3 N_3 T_3^3}{t_1 N_1 + t_2 N_2 + t_3 N_3}}$$

### Mean Speed N

Calculate the mean speed.

$$N = \frac{t_1 N_1 + t_2 N_2 + t_3 N_3}{t_1 + t_2 + t_3}$$

## GEARHEAD SPECIFICATIONS

PSA	Ratio	Rated Output Torque @1750rpm		Limited for Repeated Output Torque		Limited for Momentary Overload Torque		Static Torque Limit		Maximum Speed	Input Inertia		Weight	
		lb in	NM	lb in	NM	lb in	NM	lb in	NM	RPM	lb in <sup>2</sup>	kg cm <sup>2</sup>	lb	kg
08	80	14	1.6	23	2.6			NA	NA	7000			.66	.3
	100	18	2.0	31	3.5			NA	NA					
10	50	30	3.4	30	3.4	50	5.7	50	5.7	7000	.0021	.0062	.88	.4
	80	40	4.5	40	4.5	80	9.0	70	9.0					
14	50	102	11.5	119	13.4	140	15.8	202	22.8	6000	.0114	.033	1.1	.5
	80	102	11.5	140	15.8	200	22.6	238	26.9					
	100	102	11.5	180	20.3	200	22.6	300	34.6					

### Maximum Repeated Output Torque

This is the maximum allowable torque that should be developed with dynamic torque at the input. Repetitive momentary or continuous running loads (T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>) should not exceed this rating.

### Backdriving

Harmonic Drive gearing can easily be back-driven unless the input shaft is locked. **Under no circumstances should a gearhead be used to support a load without a fail-safe device on the output if there is a risk of injury.**

### Maximum Input Speed

This is limited by the DN value of the wave generator bearing and the type of lubricant used. Maximum input speeds for each size unit using recommended grease are listed in the ratings table.

### Static Torque Limit

This is the maximum allowable torque that should be applied to the output when the input is locked. A typical example is the torque applied to the output during a work or machining operation when the Harmonic Drive is stationary.

### Rated Output Torque at Rated Speed T<sub>N</sub>

Assuming the maximum output torque (T<sub>max</sub>) is not exceeded, this is the maximum output torque which can be transmitted at the rated input speed (1750 rpm) to achieve an average wave generator life of L<sub>50</sub>=35,000 hours.

The following formula is used to calculate the continuous torque rating at input speeds other than 1750 rpm:

$$T = \left[ \frac{1750}{N} \right]^{.33} \times T_N$$

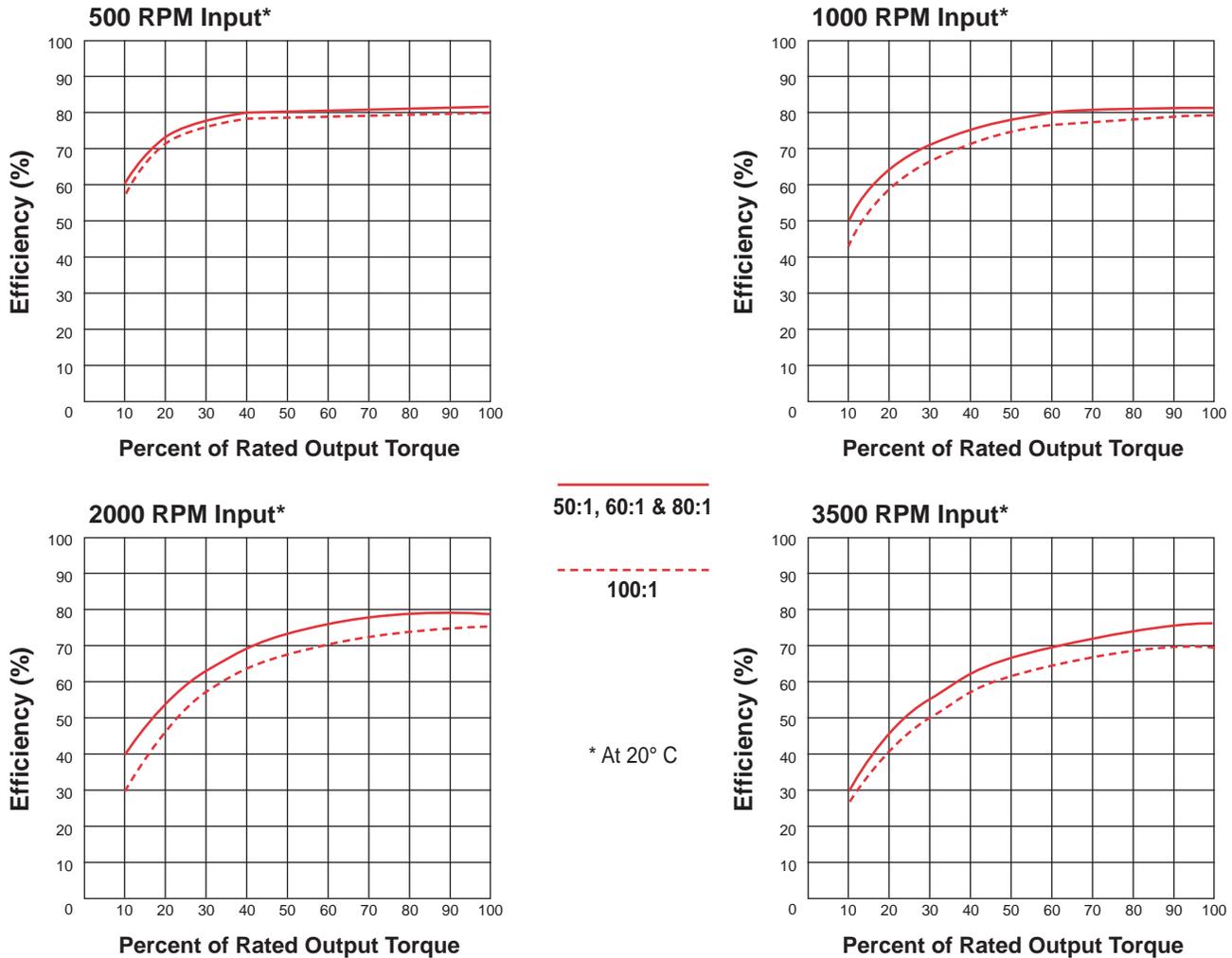
T = permissible continuous torque

N = required speed

T<sub>N</sub> = rated torque (see chart)

T must not exceed the limit for repeated output torque.

## EFFICIENCIES



The efficiency of a Harmonic Drive gearbox is dependent on speed, ratio, load and temperature. For convenience, the above graphs show efficiency against percentage of rated output torque. In applications where the output torque is very low compared to the ratings, or in extreme temperatures, consult our factory.

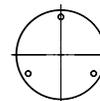
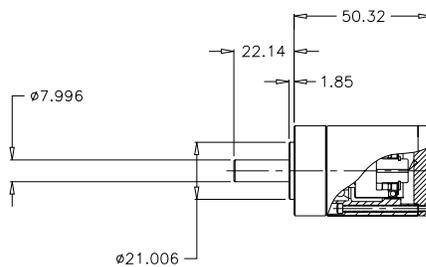
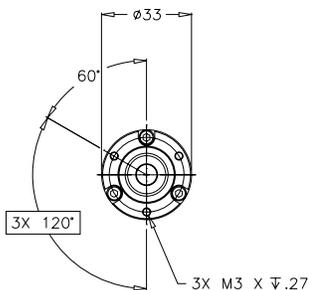
## TYPICAL APPLICATIONS

Harmonic Drive Technologies' gearheads and actuators provide the optimum solution for any high precision motion control application. Examples include:

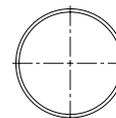
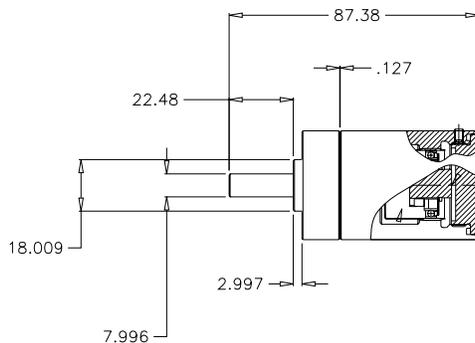
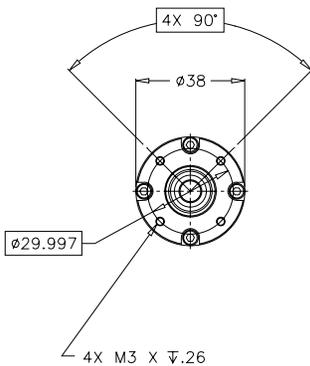
- Precise Positioning Systems
- Semiconductor Equipment
- Robotics
- Index Tables
- Medical Equipment
- Laboratory Equipment
- Printing Registration
- Wafer Handling
- Laser Positioning

Harmonic Drive Technologies has been providing quality motion control products to a variety of industries for over 40 years. Our intention is to offer a total solution to any motion control problem. We have a full engineering staff on hand to answer any questions, and all our manufacturing is done on-site at our Peabody, Massachusetts factory.

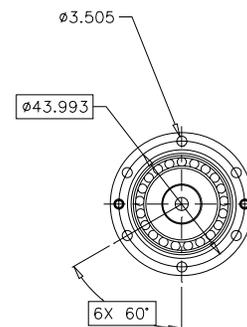
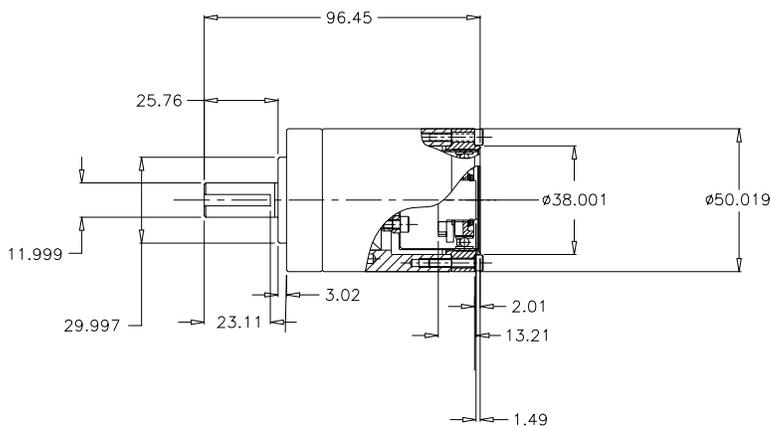
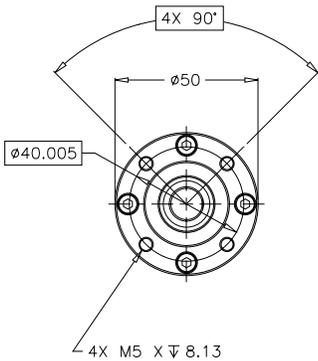
**PSA-8G\***



**PSA-10G\***



**PSA-14G\***



\*Consult factory for motor mounting options.

# Harmonic Drive Technologies.....



PSA  
Actuators and Gearheads



PSS  
Shaft Output  
Actuators and Gearheads



Flange Output  
Actuators and Gearheads



Cup, Pancake and  
Hollow Shaft Component  
Gear Sets

## Solutions for all your High Precision, Motion Control Requirements.

Harmonic Drive Technologies manufactures, markets and develops zero backlash, high ratio motion control products. Our complete line of products includes component gear sets, housed units, gearheads and actuators to satisfy any motion control requirement. Ratios range from 50:1 to 200:1. Higher ratios and custom configurations are also available. We provide our customers with the cost effective, fast time to market, most reliable motion control products, systems and solutions.

The NEW PS series offers Shaft (PSS) and Flange (PSF) output Servo Actuators and Gearheads and miniature Precision Servo Actuators and gearheads (PSA). Each of these units offers the zero-backlash and high torque synonymous with Harmonic Drive gearing with housings and motors as a solution to any motion control application.

Harmonic Drive Technologies has been supplying motion control products to industry for over 40 years. All of our design and manufacturing is done at our plant in Peabody, Massachusetts and we have a complete engineering and technical sales staff on hand to assist you with any motion control problem you may be confronted with.

Feel free to contact us with any questions you may have. We can be reached by phone 978-532-1800, fax 978-532-9406, e-mail [info@harmonic-drive.com](mailto:info@harmonic-drive.com) or on the World Wide Web at [harmonic-drive.com](http://harmonic-drive.com).



MADE IN THE USA  
ISO 9001 Certified



Teijin Seiki Boston Inc.  
247 Lynnfield Street  
Peabody, MA 01960  
Tel: 978-532-1800  
Fax: 978-532-9406

Teijin Seiki Company Ltd.  
3-3-1, Nishishimbashi  
Minato-Ku  
Tokyo 105-8628 Japan  
Tel: 81-3-3578-7461  
Fax: 81-3-3578-7471

Teijin Seiki Europe GmbH  
Klosterstraße 49  
40211 Düsseldorf  
Germany  
Tel: 49-211-17379-0  
Fax: 49-211-364-677