



BU-ORD SIZE PRECISION GEARHEADS

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BU-ORD SIZE PRECISION SPEED REDUCERS

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STERLING Basic Gearheads (T-Series, except transducer gearheads) are designed for use in high-accuracy electromechanical systems. All gears are precision cut. The output gear and all stage pinions are made of hardened 416 stainless steel. All stage gears are made of aluminum bronze due to its excellent wear-in properties. Ball bearings are stainless steel. Housings are black anodized aluminum alloy and are precision bored for exacting center distances. The cantilever design combined with wide bearing span results in extremely low backlash. These units are designed to meet all requirements of MIL-STD-810. The gearhead is attached easily and securely to the Bu-Ord frame size servomotor without modifications to the input pinion and without complicated adapters, screw threads, etc., by the versatile mounting clamp supplied. This method (an original STERLING design) simplifies the replacement of damaged motors and interchangeability among similar units. Mounting dimensions are directly identical to Bu-Ord OP 1755 motor dimensions.

The basic STERLING Gearhead design is adapted to the double-ended Speed Reducers. The transition is accomplished by removing the motor and inserting the speed reducer input assembly using the same clamp to hold it securely and accurately in position. Either input or output end can be mounted in position since dimensions on both ends are identical. Models S9115A-T6123, S9115A-T6123A, and S9118A-T6128 single-end Speed Reducers (PAT. NO. 2,943,507) use a compact reduction system whose input and output shafts are coaxially extended from the mounting end, enabling the design engineer to insert a large reduction at any location in the gear train with minimum space and backlash requirements.

STERLING Heavy-Duty Gearheads (P-Series) are designed for use in high-accuracy electromechanical systems with stepping motors. They feature a unique cantilever design in the output stage, providing maximum power (torque) per volume, without affecting the backlash. All gears and pinions are made of hardened 416 stainless steel, contributing to improved life in a hostile environment. All bearings are stainless steel with proper dynamic load to meet the required torque. Housings are made of black anodized aluminum and are precision bored. They can be converted easily to low backlash or anti-backlash design or to higher torque application. Consult STERLING Engineering Department for special applications.

STERLING Transducer Gearheads are designed to meet the strictest criteria of minimum Integrated Position Error – IPE. (Integrated Position Error is a function of all the independent errors in the gear train like backlash and transmission error. Refer to Precision Gearing by G. Michalec, John Wiley, 1966). The transducer gearheads feature unique compact design allowing direct mounting of the transducer on the output side of the gearhead. This saves space and cost of additional components like couplings and end caps. Each gearhead has two mounting options: Clamp Type (Type C) and Adapter Plate (Type A). The standard transducer gearhead has only one size, Bu-Ord size 11, which fits the most popular size of transducers. Other sizes are available on special order.

STERLING INSTRUMENT offers a wide choice of Standard Gearheads and Speed Reducers in three standard Bu-Ord Sizes. However, in many applications a special unit is required. Below is a listing of some of the Special Applications Gearheads and Speed Reducers that Sterling can produce and for which designs exist:

- **Zero Backlash and Speed Reducers** for applications which require absolutely no lost motion throughout the Gear Train. Consult Sterling for the Gearhead & Speed Reducer sizes, ratios, and output loads that Zero Backlash is applicable to.
- **Splined Shaft Gearheads and Speed Reducers** for applications which require direct meshing with other component parts of the Gear Train. Consult Sterling for the applicable Diametral Pitches and numbers of teeth.
- **Low Backlash Gearheads and Speed Reducers** for applications which do not require Zero Backlash, but do require lower Backlash than standard units. Consult Sterling for the applicable Backlash Specifications and output loads.
- **Tandem Gearheads and Speed Reducers** for applications which require reduction ratios higher than shown in the tables of this catalog.
- **Exact Ratio Gearheads and Speed Reducers** for applications which require reduction ratios which are even integers.
- **Integral Slip Clutch Gearheads and Speed Reducers** for applications which require a built-in Torque Limiting Device.
- **Heavy-Duty Gearheads and Speed Reducers** for applications which require two to three times the available output Torque of standard Gearheads and Speed Reducers.

Sterling also builds Speed Increases in Bu-Ord configurations.

STERLING gearheads and speed reducers are made to the highest exacting standards of craftsmanship. The gearheads are attachable to the U.S. Bureau of Ordnance (Bu-Ord for short) frame size servomotors without modifications to the input pinions and without complicated adapters, screw threads, etc. by the versatile mounting clamps supplied. Mounting dimensions are identical to Bu-Ord OP 1755 motor dimensions.

Gearhead Selection Guide

Catalog Series	Bu-Ord Size	Input Pinion		Description		Max. Weight oz.
		D.P.	Teeth	Backlash	Shaft Orientation	
S9111A-T617 S9111A-T618 S9111A-T619	11	120	13	LOW LOW ZERO	IN-LINE OUTPUT OFFSET OUTPUT IN-LINE OUTPUT	1.5
S9115A-T623 S9115A-T623A S9118A-T628	15 15 18	120 96 96	13 15 15	LOW	IN-LINE OUTPUT	2.5 2.5 4.0
S9108A-P-Series S9111A-P-Series S9115A-P-Series S9118A-P-Series	8 11 15 18	120 120 120 96	13 13 13	LOW	IN-LINE OUTPUT	1.0 1.65 2.75 4.4

Speed Reducer Selection Guide

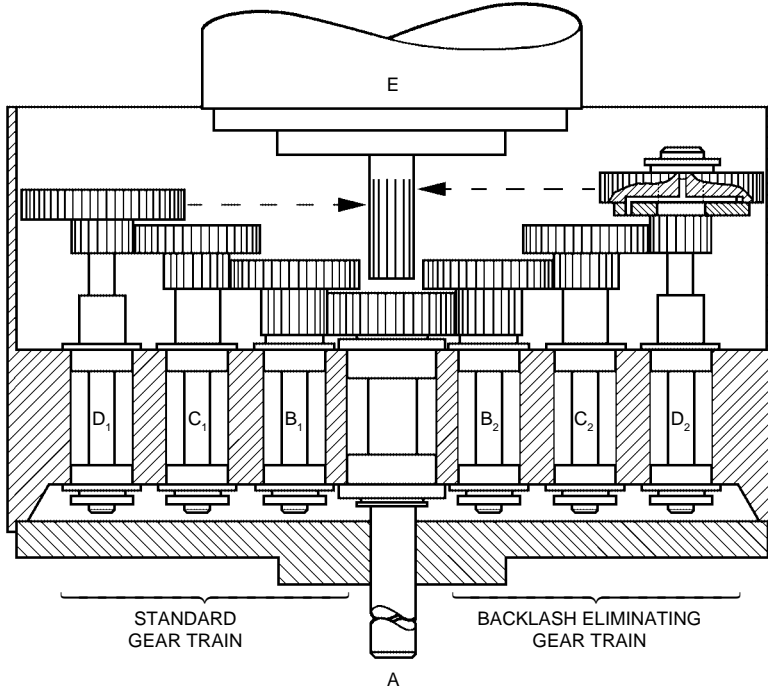
Catalog Series	Bu-Ord Size	Description			Max. Weight oz.
		Backlash	Shaft Termination	Shaft Orientation	
S9111A-T6017 S9111A-T6018 S9111A-T6019	11	LOW LOW ZERO	DOUBLE-ENDED	IN-LINE OUTPUT OFFSET OUTPUT IN-LINE OUTPUT	2.2
S9115A-T6023 S9115A-T6023A S9115A-T6123 S9115A-T6123A	15	LOW	DOUBLE-ENDED DOUBLE-ENDED SINGLE-ENDED SINGLE-ENDED	IN-LINE OUTPUT IN-LINE OUTPUT COAXIAL OUTPUT COAXIAL OUTPUT	4.0
S9118A-T6028 S9118A-T6128	18	LOW	DOUBLE-ENDED SINGLE-ENDED	IN-LINE OUTPUT COAXIAL OUTPUT	5.5

Transducer Gearhead Selection Guide

Catalog Series	Design Style	Integrated Position Error
S9111A-T640	Standard	40 arc minutes maximum
S9111A-T641	Anti-Backlash	30 arc minutes maximum
S9111A-T642	Zero-Backlash	15 arc minutes maximum

■ PAT. NO. 3,396,594

In many electromechanical instruments it is often necessary to use, as a component part of a system, a gear train which contributes a minimum amount of backlash or lost motion to the system in order to obtain maximum system accuracy. With this need in mind, STERLING has designed a gear train arrangement which completely eliminates backlash and lost motion from the entire train. At the same time, this gear system allows unusually high torque loads at the gear train output without overriding the spring loading of the system. The drawing below illustrates the application of this zero-backlash system to a gearhead or speed reducer.



The standard gear train (A, B₁, C₁, D₁, E) is identical to that which is found in STERLING standard catalog gearheads & speed reducers. Pinion & gear clusters B₂ & C₂, in the backlash eliminating gear train, are duplicates of pinion & gear clusters B₁ & C₁, in the standard gear train. The pinion of pinion & gear cluster D₂ is identical to the pinion of pinion & gear cluster D₁, with the addition of the torsion spring retaining slot in the end of the D₂ pinion. As per normal practice, the gear & pinion on the D₁ cluster are fastened together via press fitting & staking. The gear on the D₂ cluster is a slip fit on the mounting diameter of the D₂ pinion and axially retained on the mounting diameter by the torsion spring. Input pinion E and output gear A are common to both halves of the train.

In assembling the gearhead to a servomotor or to the input pinion of a speed reducer, the gear of cluster D₁ is restrained from rotation by inserting a wedge of a soft material (e.g., aluminum, nylon, etc.) thru the access hole provided in the housing and into a tooth space. The gear of cluster D₂ is then rotated, in a direction which winds the torsion spring the desired number of teeth and restrained from rotating, using a second wedge thru the second access hole. Since all speed reducer input pinions and motor pinions have an odd number of teeth, it is easier to install the motor pinion or input pinion, if the D₁ & D₂ gears are held by the wedges in a position where a tooth space on one of the gears is opposite a tooth on the other gear. Once the pinion is meshed with the D₁ & D₂ gears and the pilot diameter of the motor or speed reducer input is seated within the gearhead shell, the wedges are released, completing the zero-backlash path.