

1. Product Overview

The RollerDrive is a backlash-free right-angle reducer based on the roller gear cam mechanism—a type of solid cam. This mechanism offers a high level of positioning accuracy, stiffness, and durability in a compact footprint, which is why it is widely used as the rotary drive component for machine tools and other FA equipment.



Figure 1-1 RS Series for Machine Tool Applications



Figure 1-2 RA Series for Precision FA Applications

2. Basic Product Configuration and Technical Advantages

The RollerDrive basically consists of an input shaft with a spiral rib and an output shaft with radially planted rollers. These shafts are arranged to form a right angle, as shown in Figure 2. The rib on the input shaft has a wedge-shaped cross section that, when moved toward the output shaft, creates preload between the rollers and the rib to completely eliminate backlash. Figure 3 illustrates how the rollers transfer power by rolling contact, which is possible because of its needle bearing construction.

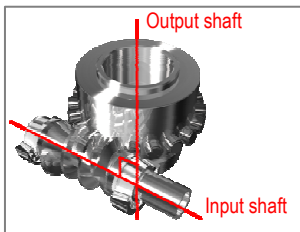


Figure 2 Basic Configuration of the RollerDrive

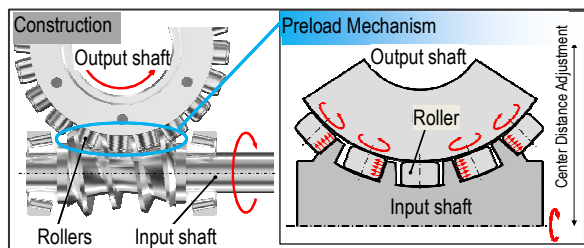


Figure 3 Preload Mechanism

Typical reducers use gears which have backlash. Ideally, backlash should be minimized. However, minimizing backlash in a mechanism that transfers rotation through a sliding contact—particularly the way gears do so using an involute or similar curve—runs the risk of heat and premature wear caused by loss of oil film. By contrast, a roller drive has a preload mechanism and is constructed to achieve a highly efficient rolling contact that leaves zero backlash. This reduces wear, which allows for long-term precision.

Figure 4 shows the RollerDrive from the side. The flanges that support the input shaft are used to offset the center of rotation of the input shaft with respect to center of the output shaft by turning the flange during the assembly process. The adjustable center distance is used to apply the correct amount of preload. These design features keep the rib and rollers under preload as they make rolling contact.

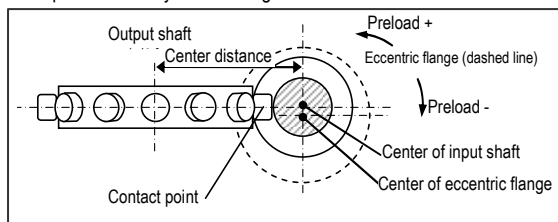


Figure 4 Operating Theory of the Preload Structure

3. Accuracy

To assess the accuracy of a RollerDrive and a gear-based reducer, we compared the rotary positioning accuracy of a RollerDrive and a worm gear designed for a machine tool application. Following JIS B6192, we measured the angular deviation over five reciprocal indexes made every 30 degrees. The speed of the output shaft was 720 deg/min and the dwell time was 3 seconds. Semi-closed loop control was used for both systems, using the encoder of the motor on the input shaft as the reference.

Figure 5 shows the measurement results. The worm gear showed a reversal value at each end of the reciprocal motion of approximately 36 arc seconds. This represents the inherent mechanical backlash of worm gears. By contrast, the RollerDrive had an extremely small reversal value, demonstrating the preload mechanism's ability to eliminate backlash. We also found the RollerDrive has little variation in unidirectional positioning comparisons.

One aspect of the design deals specifically with achieving greater accuracy—the output shaft and integral cross roller bearing. See Figure 6. If the output shaft and cross roller bearing are separate, error attributed to assembly accuracy can cause runout in the output shaft, which negatively impacts positioning accuracy. Use of a single-piece solid construction eliminates the influences of assembly accuracy, making it possible to position with greater accuracy.

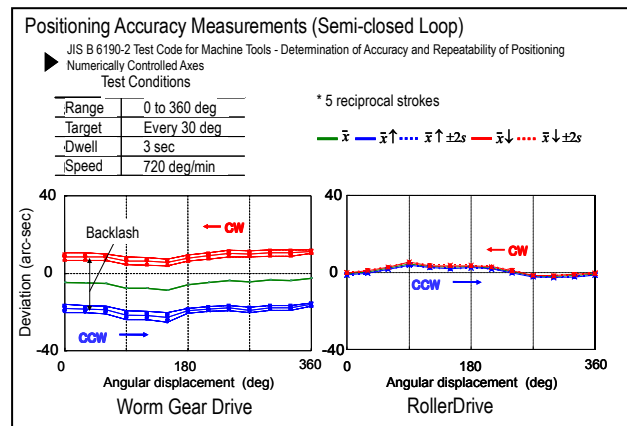


Figure 5 Positioning Accuracy Measurements

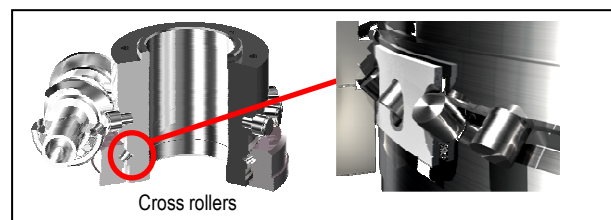


Figure 6 Output Shaft with Integral Cross Rollers

4. Durability and Longevity

With gear-based reducers, prolonged hours of use causes teeth wear, which significantly degrades accuracy. The RollerDrive, on the other hand, transfers power using a rolling contact, and addresses tribology problems with an optimized lubrication system that sees virtually no wear or reduced accuracy.

5. Sales

To date, Sankyo has delivered more than 20,000 RollerDrive reducers. Reducers based on the roller drive mechanism represent more than 95% of the domestic market. (As of January 2012, according to internal surveys)

6. Summary

The RollerDrive offers revolutionary performance in a wide range of rotary motion applications. We are committed to serving a diverse array of market demands by developing mechanisms with increased precision and speed.