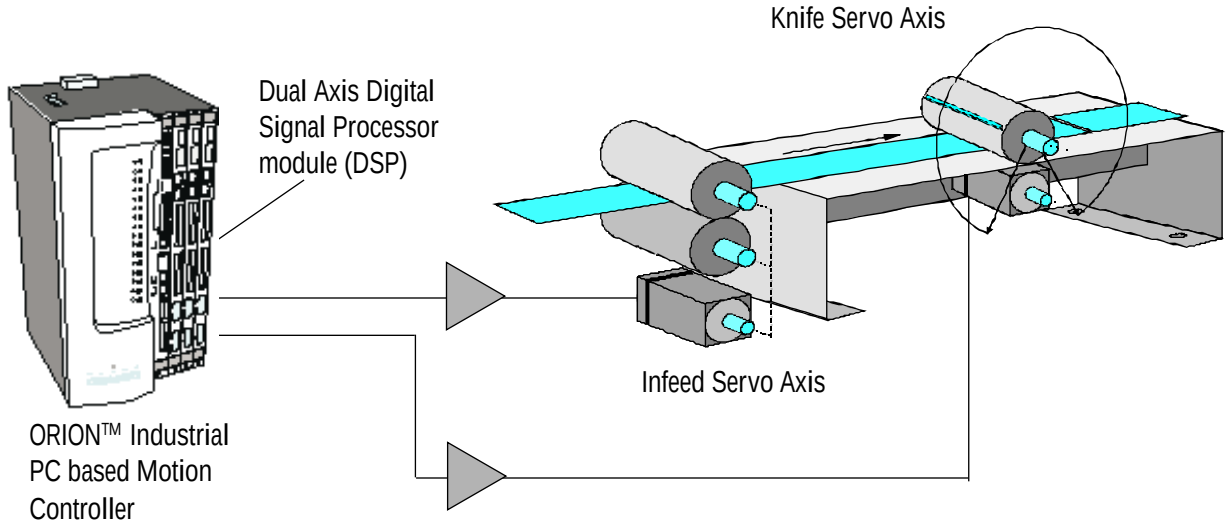
ROTARY KNIFE CUTOFF



APPLICATION FEATURES AND BENEFITS

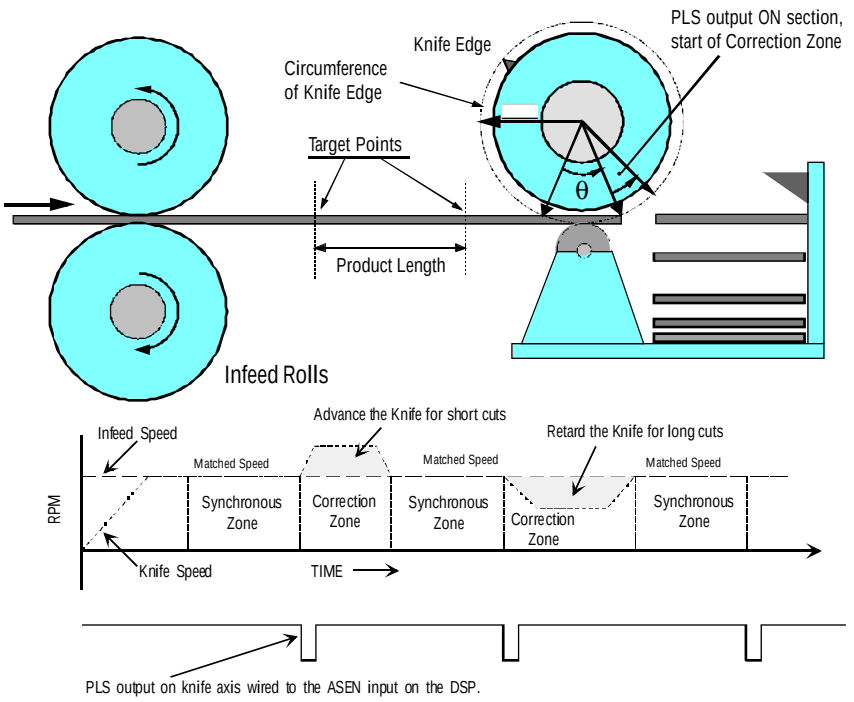
- **Precise shear points** --- all digital servo system utilizing electronic gearing capabilities make synchronizing shear tooling accurate and repeatable, increasing product quality and decreasing mechanical wear.
- **Convenient User-Unit programmability** --- MotionBASIC® software instructions provide flexible user-unit conversion, simplifying application software and parameter inputs.
- **On-the-fly cut-length adjustments** --- are possible by using the ability of DSP queue management. Motion commands loaded as repeat blocks are interrupted and changed without the loss of continuity.
- **Programmable Limit Switches** --- Output switch transitions, directly controlled by the DSP, provide gating operations at precise points of the machine cycle.
- **Integral & flexible axis control** --- provides versatility in machine control by allowing flexibility to be designed into the user's application software programs.
- **Fast product changes** --- versatile operator interface touchscreens and mass data storage capabilities of the ORION™ controller allow product recipes to be stored on-line providing a simple and quick product changeover process.
- **Registration capability** --- when cutting pre-printed or featured material needing registration to a position mark, ORION™ controllers provide direct interfacing to the DSP position capture registers.
- **Quick knife angle correction**--- ORION™ servo control algorithm techniques provide stable control and agility for high machine throughput.
- **Error reporting** --- production information given by the operator can be checked against machine capability and cut rates can be determined. Built-in system error reporting and error handling routines make the software development job quick and effective.

INDUSTRY FIT

- Rubber tire belting cutoff
- Cutting carton inserts
- Notching paper inserts
- Product extrusion cutoff
- Plastic sheet cutting
- Sheet metal cutting
- Rubber gasket cutoff
- Metal forming process
- Paper sheet cutting
- Film cutting

OVERVIEW

Rotary knife cutoff application is a implementation of ORION's advanced servo control that synchronizes a linear movement of material and a rotary tool such as a knife. The knife axis is electronically geared to the linear movement of material to control the precise position of the knife edge by advancing or retarding the knife to accurately match up to the target positions for the required cut length without stopping the material.



TECHNICAL BRIEF

Rotary Knife Cutoff

The ***Synchronous Zone*** is defined as that portion of the total knife travel where the speed of the knife edge may be required to match the linear speed of the material as it is being cut. The distance of this zone, also known as the **wrap angle** θ, is determined by the knife design and material thickness plus any settling distance needed by the servomotor driven system.

Once the knife has cleared the material, it enters the ***Correction Zone.*** While in the Correction Zone, the system will either increase the speed of the knife to catch the next **target point**, or the knife edge could slow down to let enough material go by to catch the next target point. How the system controls the knife during the correction zone is dependent on the **product length** of the material being cut. The distance of material fed from the infeed axis is coordinated to the distance needed in the correction zone.

To accomplish the coordinated motion between the infeed and the knife axes the ORION™ institutes MotionBASIC® 'GEARING' commands. GEARING commands use simple motion parameters specific to the problem such as the total move distances, the acceleration distance, and the input start point that set up the DSP axis controller. When these parameters are applied by the DSP axis controller to the infeed and knife axes, it properly coordinates the distance travelled by the knife to the distance travelled by the infeed. Note that time is never used as a parameter and any requirements in time are met as a result of precise distance moves performed by the GEARING commands.

Starting the process involves first gearing the knife axis to infeed axis as a one to one ratio achieving matched speed using the following simple MotionBASIC® 'GEAR axis AT' statement:

```
GEAR knife AT 1 TO 1.
```

Where both axes are configured with the proper user units giving a linear representation in measured units (inches, feet, millimeters, etc.) that account for actual values of roll diameters, knife diameters, gear boxes and motor resolutions used in the machine design. Once at matched speed, a signal marking the correction zone will start the next gear command superimposed onto the 'GEAR AT' already running to correct for the difference between the circumference and the cut length. This command automatically repeats using the REPEAT command (a DSP command queue directive) every sensor signal.

```
REPEAT GEAR knife FOR (Circumference - CutLength) IN
    CorrectionZone AFTER SensorSignal
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