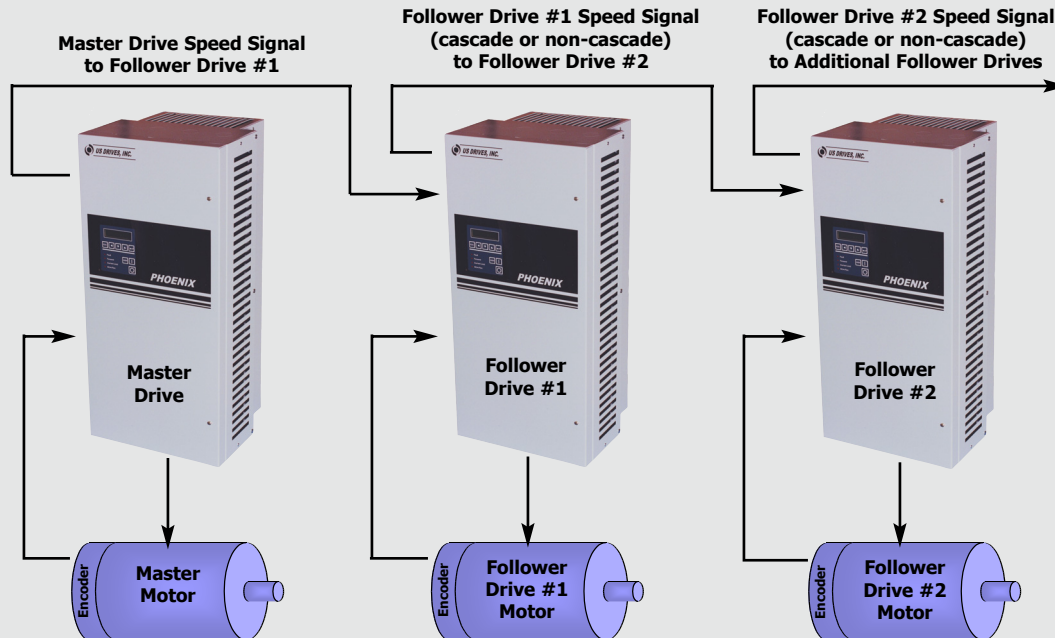


## Position Synchronization Using Phoenix EX AC Drive



### MASTER DRIVE WITH FOLLOWERS

Precise synchronization of two or more independent machines or machine sections is easily accomplished using the position control software built into every Phoenix EX AC Vector Drive. Mechanical line shafts have long been used to synchronize machinery but mechanical line shafts have their limitations. Machine sections separated by long distances and independent machines provided by different manufactures are not easily coordinated using mechanical line shafts. Mechanical line shafts are costly to install and the associated mechanical components require ongoing customer maintenance. Also, mechanical line shaft synchronization may be impossible when product changes dictate alternate flow paths through multiple use machinery. US Drives offers a practical alternative to the old mechanical line shaft. We offer an Electronic Line Shaft. Rigid as the one made of steel but more flexible because it's constructed using software.

An Electronic Line Shaft is provided with every Phoenix EX AC Vector Drive. Most Electronic Line Shaft applications consist of one Master Drive and one or more Follower Drives. The Master Drive controls the speed of the lead machine or lead machine section. The Follower Drives control the machines or machine sections that need to be synchronized with the master. The Follower Drives are speed and position locked to the Master

Drive, just as they would be if a mechanical line shaft was installed. Motor Shaft to Motor Shaft synchronization within one tenth of one degree is possible.

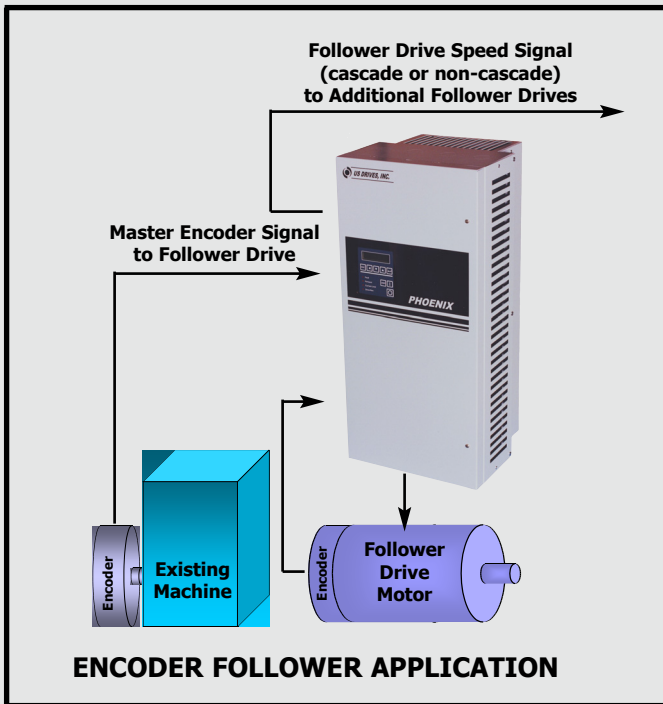
The Electronic Line Shaft software running in the Follower Drive continuously monitors the speed of a Reference Encoder mounted on the Master Drive or Master Machine and sets the speed of the Follower Drive to exactly match the speed of the Master. Our Electronic Line Shaft software also compares the total number of Reference Encoder counts received from the Master against the total number of Feedback Encoder counts received from the Follower Drive. Any difference in total counts represents a position error accumulated over time. The speed of the Follower Drive is trimmed up or down to remove any accumulated position error. The end result is perfect long-term speed match with no net accumulation of position error. Our Electronic Line Shaft software also includes a Ratio Control feature that allows the Follower Drive to operate at a programmable ratio relative to the Master. This Ratio Control feature can be used to compensate for different gear and/or belt ratios that may exist between the Master and Follower. It can also be used to create a programmable, draw (or stretch) ratio between the Master and Follower. The hardware provided supports both cascaded and non-cascaded draw systems.

**Other Features:**

Additional features include rigid or non-rigid position lock, the ability to advance or retard the Follower Drive relative to the Master, Orientation, and Registration. Rigid position control is used for most Electric Line Shaft applications but non-rigid position control has application when stall conditions can occur. The advance/retard feature allows phase angle adjustment of one machine or machine section relative to another. This feature is required in applications like packaging where a definite phase angle relationship must be established between adjacent machine sections. The Orientation feature allows the Follower Drive to orient itself to a specific position on stop and the Registration feature allows the drive to synchronize itself with an external marker signal.

**Position Control Features:**

- Precise position alignment of two independent mechanical systems
- Zero drift (phase shift) between Follower and Master over time
- Ability to advance or retard the Follower Drive relative to the Master
- Rigid or Non-Rigid Position Lock
- Ratio control for gear-ratio compensation or adjustable draw
- Maximum Follower to Master Ratio: 4000 to 1
- Minimum Follower to Master Ratio: 1 to 1000
- Ratio control handles non-repeating gear ratios
- Encoder repeater can send Master or Follower speed signal to next Follower Drive (cascade or non-cascaded draw control)
- Follows either a quadrature type encoder or a pulse train and direction signal
- Local Position Reference for simple position control applications
- Orientation on Stop
- Synchronize with a marker pulse



A Master Drive is not required in all applications. A Follower Drive can be synchronized with an existing machine or an existing machine section provided a speed/position sensor (an Encoder) can be mounted on the existing machinery. In these applications, Follower Drive Motor Shaft to Reference Encoder Shaft synchronization within one tenth of one degree is possible.

**Benefits:**

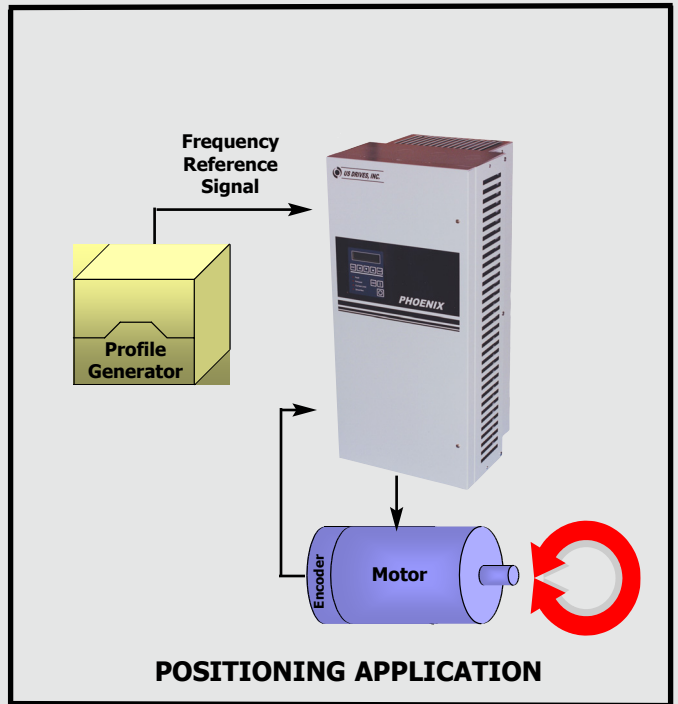
- No need for expensive mechanical linkage
- No external hardware or software required
- Increased flexibility and performance
- Easily change machine configuration
- Reduced maintenance

**Product Description:**

- Phoenix EX AC Vector Drive
- 3 HP to 3500 HP
- 200-250 VAC, 380-500 VAC, 525-600 VAC
- Closed Loop AC Vector Control
- Speed Range: To Zero Speed
- Speed Regulation: 0.01% of Max Speed
- Full Torque at Zero Speed
- Nema 1 Enclosure
- Short Circuit and Ground Fault Protection
- Built in DC Bus Reactor
- Line Transient Protection
- RFI Filtering

**Product Options / Modifications:**

- Special Enclosures:
  - Nema 12, Nema 4, Nema 3R (Outdoor)
- Power Modifications:
  - Input Disconnect, Circuit Breaker,
  - Input or Output Contactors
- Communications:
  - Modbus RTU, Ethernet, Others
- Dynamic Braking
- Line Regeneration
- Clean Power (18 Pulse) Rectification



A built in local position reference is available for simple positioning applications. The drive can also follow an external frequency reference signal from a profile generator for more complex applications.