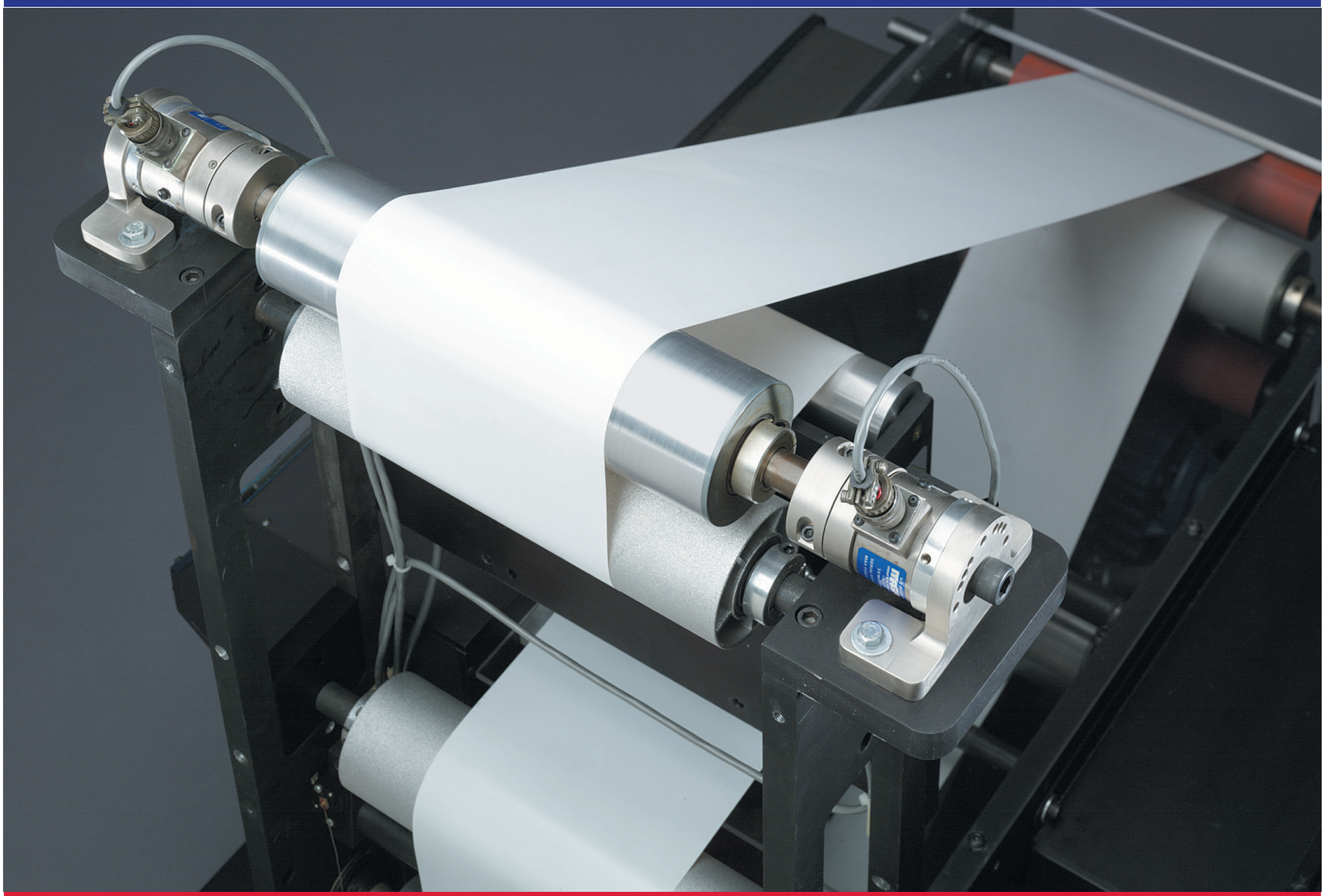
MAXCESS®

MAGPOWR

MAGPOWR TENSION CONTROL SOLUTIONS



Magpowr Tension Control Solutions

Advanced Web Tension and Torque Control Technologies

High quality and efficiency are the goals of every web production line, and proper control of tension and torque are critical in achieving the results you require. MAGPOWR's range of tension control products and accessories are designed to help you reach those goals, whether your operation runs paper, film, foil, wire or any other material.

Industry-Preferred Control

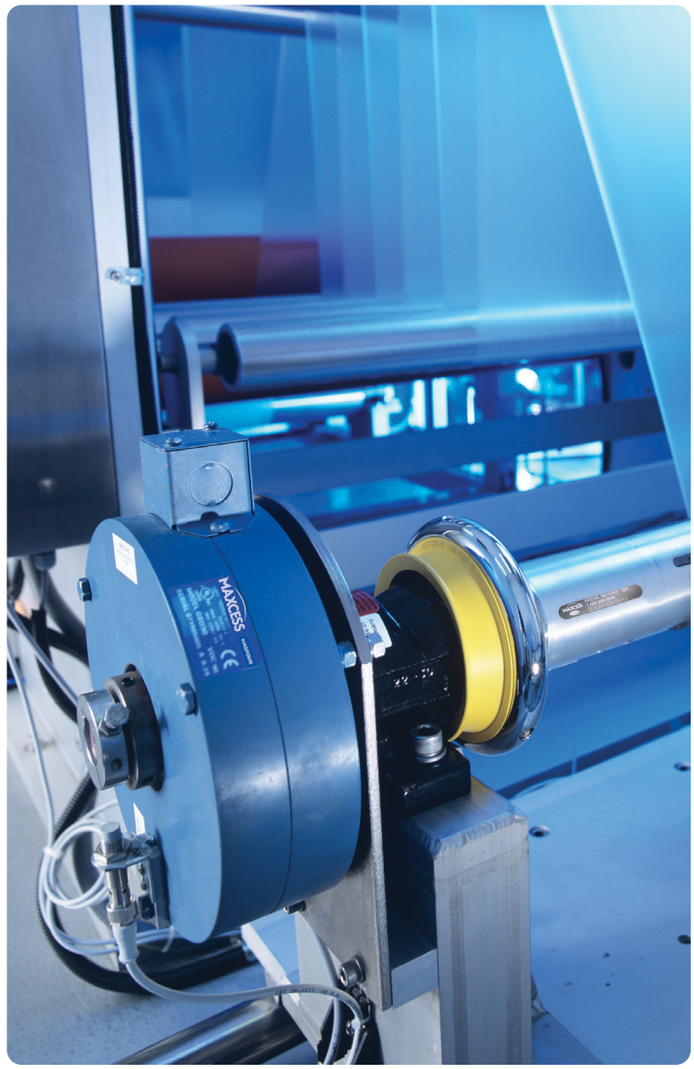
The industry has overwhelmingly chosen MAGPOWR's tension control systems as the preferred brand, with the most systems installed worldwide. With more than 40 years of providing high-quality tension control solutions, MAGPOWR has the first-hand experience and flexibility required to configure the right system to fit the needs of your application.

With a broad range of products including tension controls, readouts, load cells, brakes and clutches, MAGPOWR can match your line requirements to the proper solution, from the simplest to the most advanced.

Leading Technology & Expertise

Knowledgeable support and impeccable service are the hallmark of MAGPOWR's role as the industry leader. That service begins with the internal sales staff and continues far beyond installation. Factory-trained in various service disciplines, including applications analysis, design and engineering, MAGPOWR's service team is dedicated to providing solutions specifically designed for your applications.

MAGPOWR also offers the most comprehensive array of accessories and periphery equipment in the industry, thanks to its partner companies VisionMax (Inspection), Valley Roller (Rubber Covered Rolls), RotoMetrics (Tooling), Webex (Precision Rolls), Fife (Guiding & Inspection) and Tidland (Slitting & Winding). Combined, the Maxcess companies provide a global reach, with operations in North America, South America, Europe and Asia.



Industry 4.0

The DLCA NET is a new load cell amplifier with embedded dual port communications including EtherNet/IP, PROFINET, Modbus TCP and EtherCAT. Also included are Rockwell features like EDS File based AOP (add on profile), DR (Device Level Ring) and PTP data time stamping.

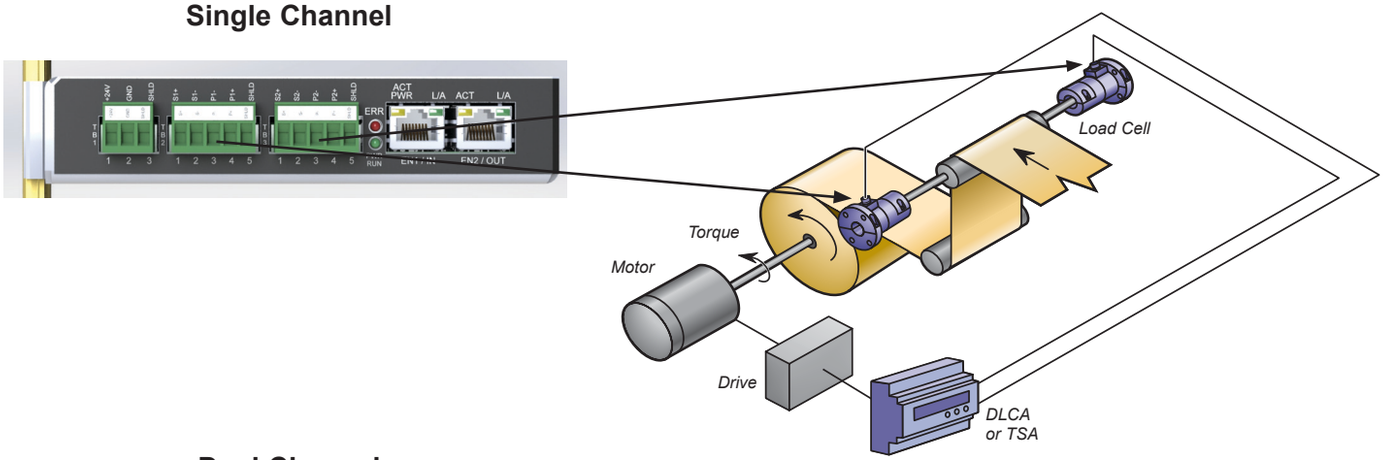
The DLCA NET transmits calibrated tension values over the communications to a PLC, HMI or drive to display tension or be used in a tension control loop when not using a MAGPOWR tension control.

The DLCA NET is available in 2 mounting options as shown above and is available as a single channel version to monitor tension in a single zone with separate left and right load cell inputs or as a dual channel amplifier for 2 separate tension zones.

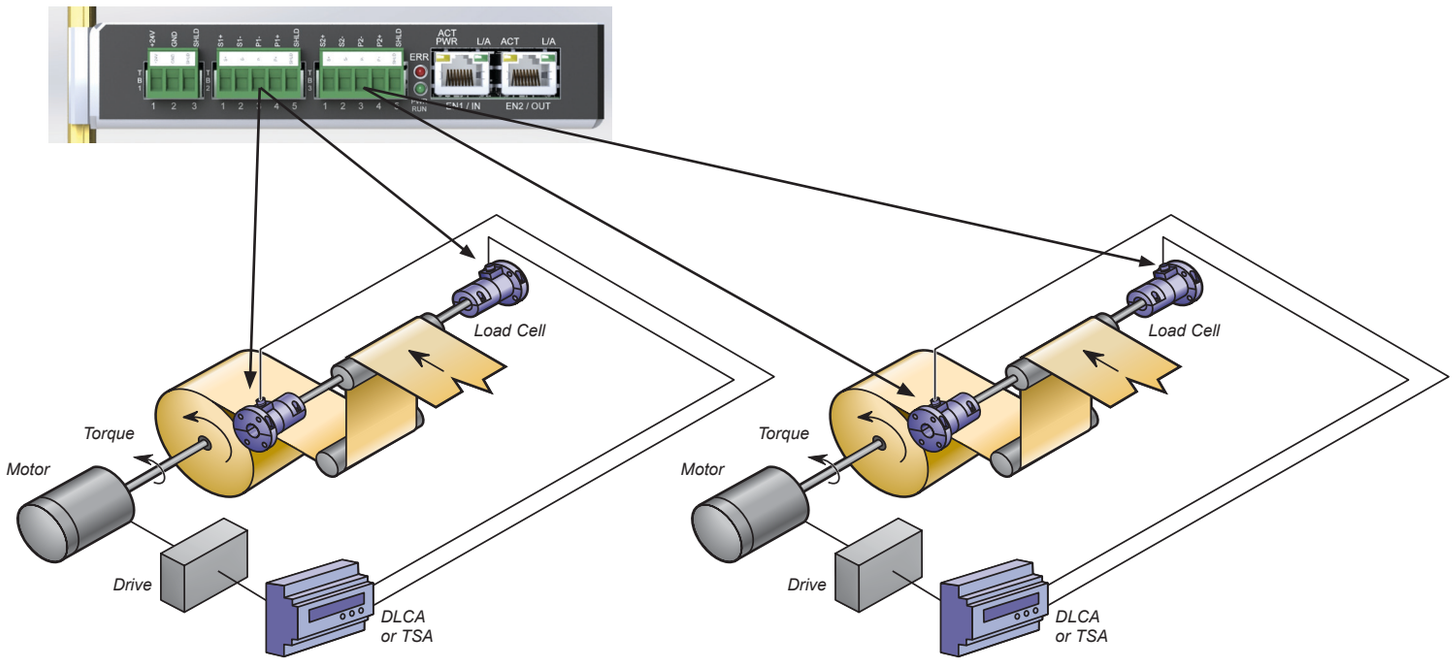
DLCA NET

DLCA NET-SLIM

Single Channel



Dual Channel



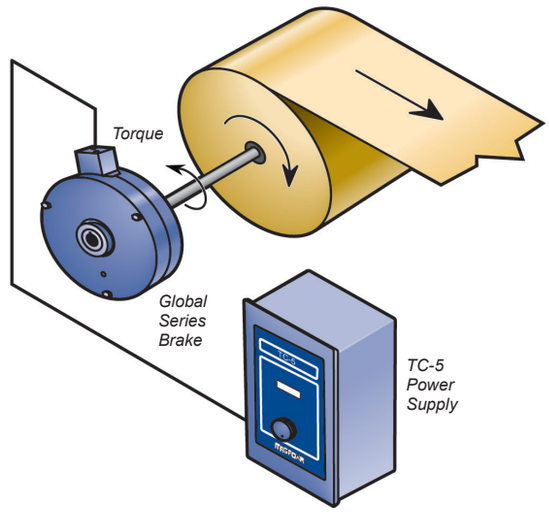
Manual Control

Unwind (Magnetic Particle Brake)

MAGPOWR Manual Tension Control systems are a low-cost solution for Rewind, Point-to-Point and certain Unwind Applications. Our manual power supplies allow you to overcome residual magnetism and use the full range of your magnetic particle brake or clutch with their unique reverse current feature.

These systems are ideal for (1) Rewind Applications where natural taper is needed, (2) Point-to-Point Applications where roll build does not change and (3) Unwinds where material can withstand small changes in tension from roll to core.

- Manual power supplies are current regulated so output will not change as the clutch or brake coil rises from ambient to operating temperature
- 90 VDC and 24 VDC power supplies are available with jumper selectable current ratings to match the correct magnetic particle device for your application
- Available mounting options: DIN Rail (CE), Wall Mount or Panel Mount

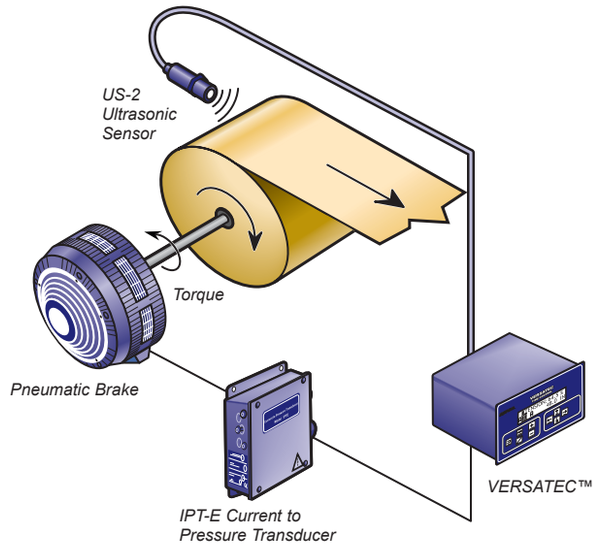


Open Loop Ultrasonic

Unwind (Pneumatic Brake)

These systems are accurate, simple to engineer and easy to install. Tension control is based upon changing roll diameter, with no physical contact made to your web.

- Adjustable Taper Tension for Rewinds also available
- Inverse Diameter Output available to slow rewind motor as roll builds, decreasing slip heat in clutches
- Available control outputs: 0 to 10 VDC 4 to 20 mADC, -10 to 10 VDC, 90 VDC and 24 VDC
- Available mounting options: Wall Mount (CE), DIN Enclosure Mount (CE)

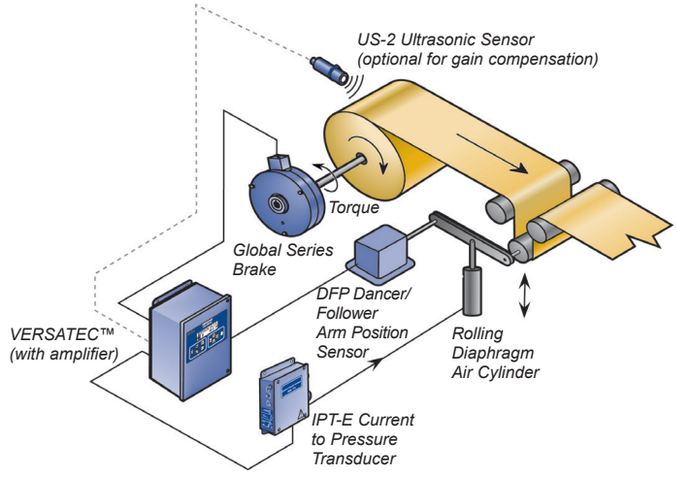


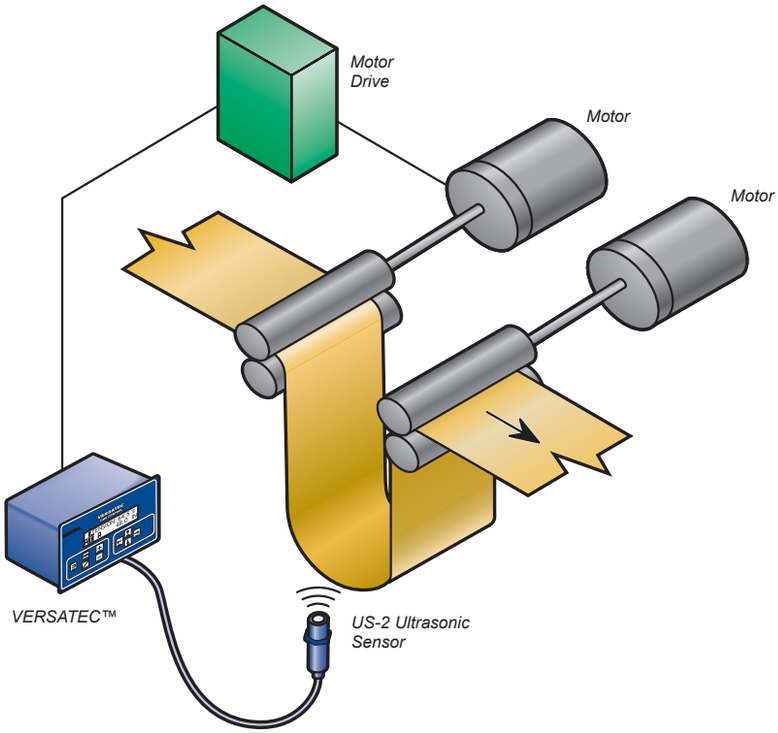
Closed Loop Dancer

Unwind (Magnetic Particle Brake)

These systems are the ideal choice for maintaining constant tension on start/stop applications or when unwind rolls are out-of-round.

- Inverse Diameter Output available to slow rewind motor as roll builds, decreasing slip heat in clutches (when using optional US-2 Sensor with Versatec™)
- Available control outputs: 0 to 10 VDC, 4 to 20 mADC, -10 to 10 VDC, 90 VDC and 24 VDC
- Available mounting options: Wall Mount (CE), DIN Enclosure Mount (CE), DIN Rail Mount (CE), Printed Circuit Board



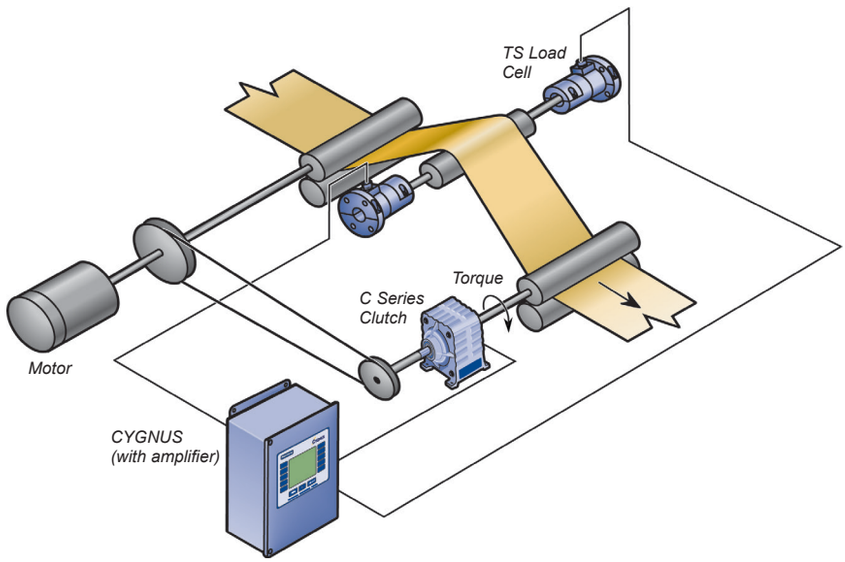


Ultrasonic Free Loop

Point-to-Point (Motor Drive)

These simple to engineer systems provide a low-cost solution for speed control on applications where the weight of the web is enough to provide tension.

- For applications where the weight of the material provides adequate tension
- Ideal for start/stop applications or if unwind rolls are out-of-round
- Provides control through loop position feedback
- Mounting options: Enclosure Mount (CE), DIN Panel Mount (CE)
- Available outputs: 0 to 10 VDC, 4 to 20 mADC, -10 to 10 VDC

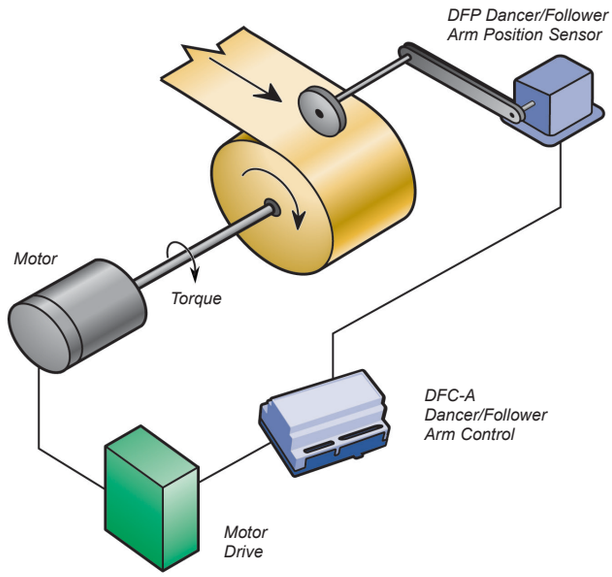


Closed Loop Load Cell

Digital Tension Readout and Control
Point-to-Point (Magnetic Particle Clutch)

Designed to provide “actual” tension feedback, these product combinations will ensure you get the most accurate method of tension control available.

- Adjustable taper tension for rewinds standard
- Available control outputs: 0 to 10 VDC, 4 to 20 mADC, -10 to 10 VDC, 90 VDC and 24 VDC
- Available mounting options: Wall Mount (CE), DIN Enclosure Mount (CE) and DIN Rail Mount (CE)
- Inverse Diameter Output available to slow rewind motor as roll builds, decreasing slip heat in clutches
- Web break detection



Open Loop Follower Arm

Rewind (Motor Drive Torque Mode)

These easy-to-install systems provide tension control based on changing roll diameter.

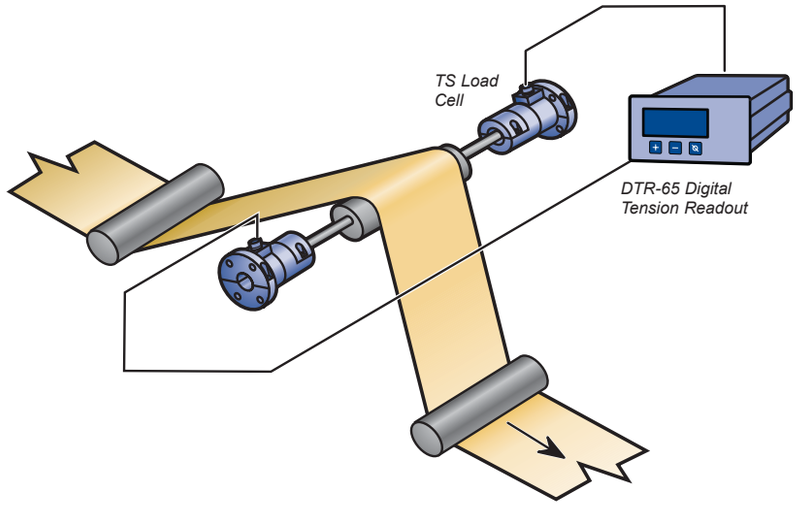
- Available control outputs: 0 to 10 VDC, 4 to 20 mADC, and 90 VDC
- Available mounting options: DIN Rail (CE), Printed Circuit Board

Tension Monitoring

Unwind (Magnetic Particle Brake)

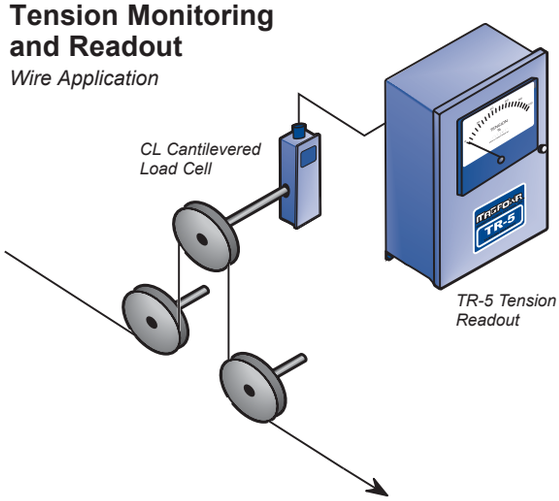
Magpowr has a broad range of tension control products designed to deliver precise readouts every time. These products can be easily combined to create the ideal tension monitoring solution for your application.

- Analog and Digital displays available
- Amplifiers available to send a 0 to 10 VDC or 4 to 20 mADC signal to a PLC or motor drive
- Available mounting options: DIN Rail (CE), Wall Mount, Panel Mount

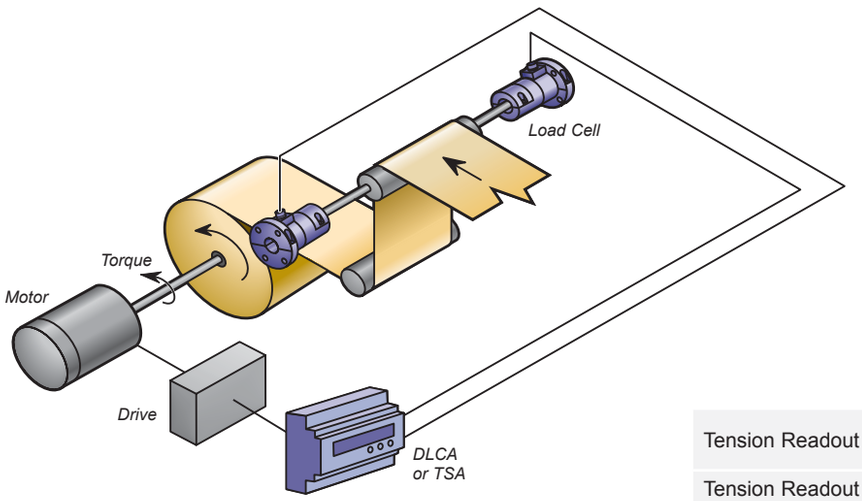


Tension Monitoring and Readout

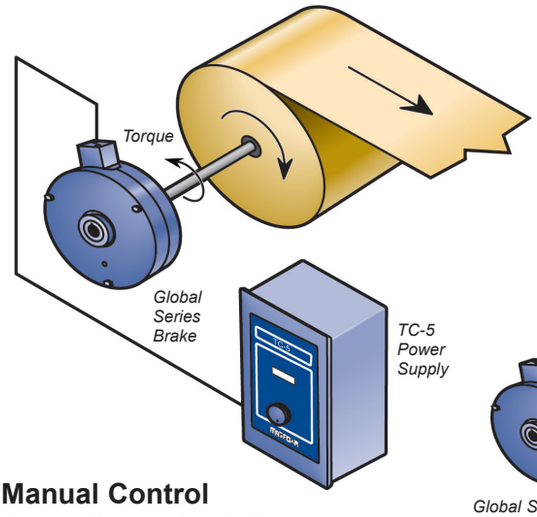
Wire Application



Tension Reference to Winder Drive



	TS\CL\GTS\TSU\LC\TLC Load Cells	DTR65 Digital Tension Readout	DTM Digital Tension Meter	TR-5 Load Cell Amplifier	TSA\DLCA\DLCANET Load Cell Amplifier	IS-2 Intrinsically Safe Amplifier	9A22-1 Tension Meter
Tension Readout	★	★	★	★	★		★
Tension Readout in Hazardous Area	★		★			★	★

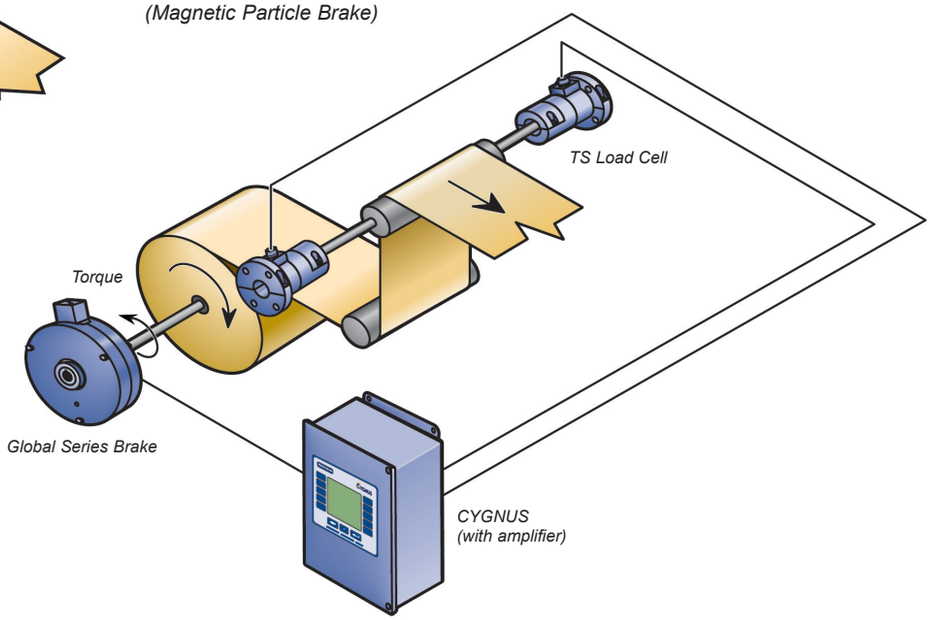


Manual Control

Unwind (Magnetic Particle Brake)

Closed Loop Load Cell

Digital Tension Readout and Control Unwind (Magnetic Particle Brake)

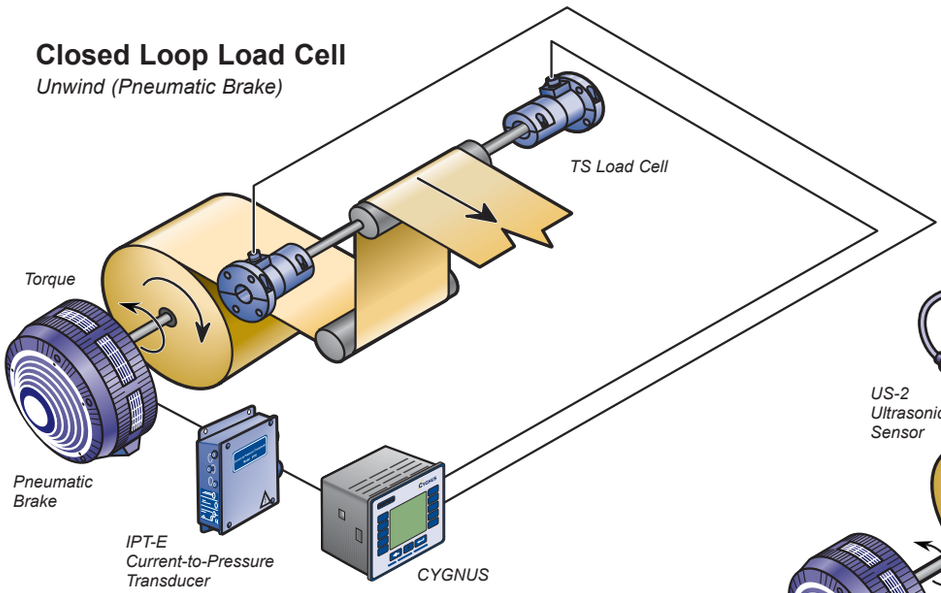


	CYGNUS Tension Control	SpyderPlus Tension Control	VERSATEC Tension Control	PA-90\PA-2 Power Amplifiers	US-2 Ultrasonic Sensor	DFC-90 DIN Mounted Tension Control	DFC-A DIN Mounted Tension Control	TC-5\TC-5P Power Supply	PS-90\PS-24 Power Supply	DFP\DFP-2 Position Sensors	TS\CLIGTS\TSU\LC\TLC Load Cells	DTM Digital Tension Meter	9A22-1 Tension Meter	C Style Magnetic Particle Brake	Global Magnetic Particle Brake	B Style Magnetic Particle Brake	SOFSTEP Magnetic Particle Brake
Manual Unwind *(Magnetic Particle)*								★	★					★	★	★	★
Ultrasonic Unwind *(Magnetic Particle)*		★*	★	★	★				★					★	★	★	★
Follower Arm Unwind (Magnetic Particle)						★				★				★	★	★	★
Digital Tension Readout and Control Unwind (Magnetic Particle)	★	★							★		★	★	★	★	★	★	★
Dancer Control Unwind (Magnetic Particle)		★	★	★	★	★	★		★	★				★	★	★	★

** Requires 3rd party diameter sensor with a 0 to 10 VDC output*

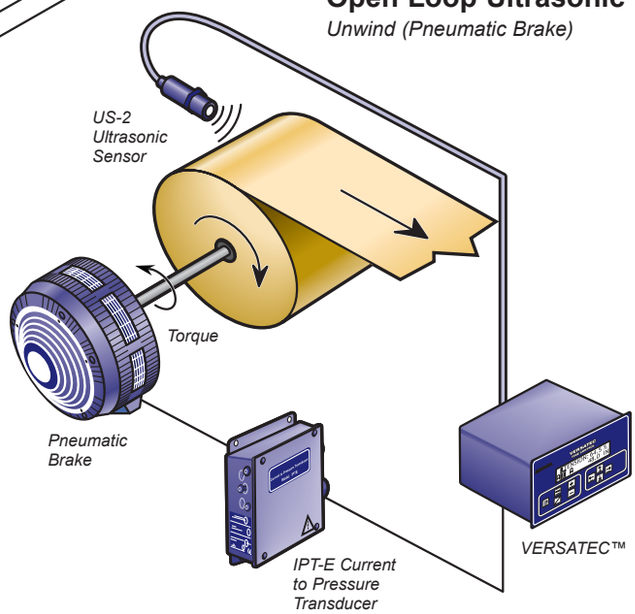
Closed Loop Load Cell

Unwind (Pneumatic Brake)



Open Loop Ultrasonic

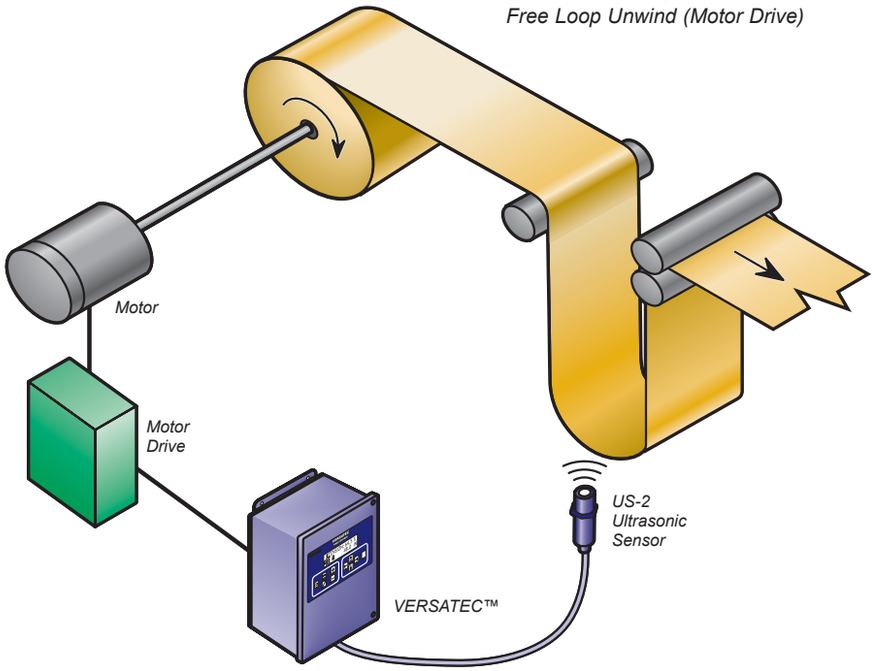
Unwind (Pneumatic Brake)



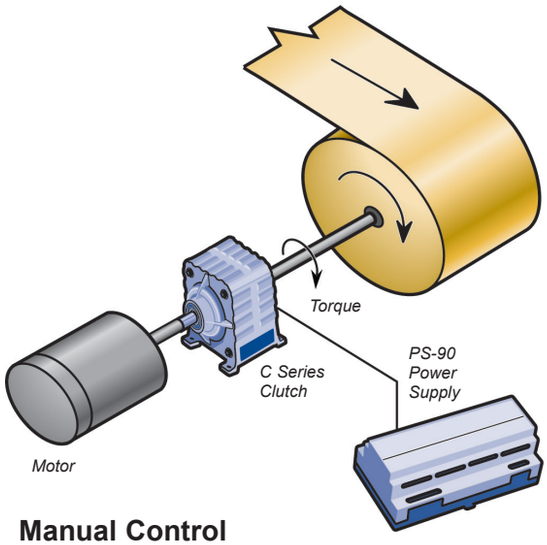
	CYGNUS Tension Control	SpyderPlus Tension Control	VERSATEC Tension Control	US-2 Ultrasonic Sensor	DFC-A DIN Mounted Tension Control	IPT\IPTE\IP80 Tension Transducers	DFP\DFP-2 Position Sensors	TS\CL\GTS\TSU\LC Load Cells	DTM Digital Tension Meter	9A22-1 Tension Meter	HEB250 Pneumatic Brake
Ultrasonic Unwind (Pneumatic)		★*	★	★		★					★
Follower Arm Unwind (Pneumatic)					★	★	★				★
Digital Tension Readout and Control Unwind (Pneumatic)	★	★				★		★	★	★	★
Dancer Control Unwind (Pneumatic)		★	★	★	★	★	★				★

Closed Loop Control

Free Loop Unwind (Motor Drive)

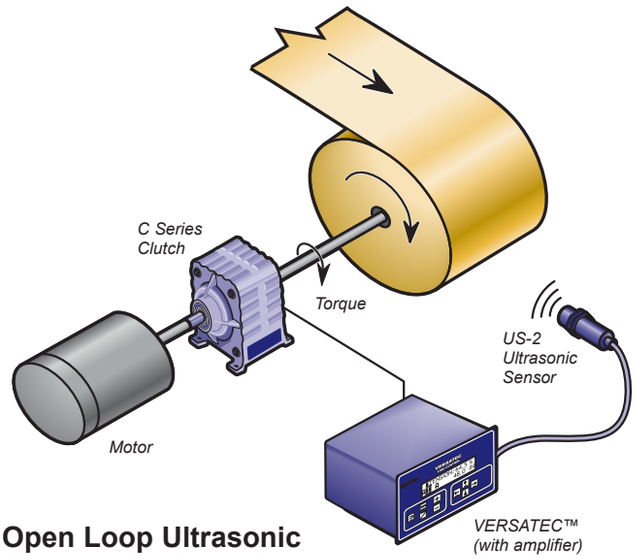


	CYGNUS Tension Control	SpyderPlus Tension Control	VERSATEC Tension Control	US-2 Ultrasonic Sensor	DFC-A DIN Mounted Tension Control	DFP\DFP-2 Position Sensors	TS\CL\GTS\TSU\LC Load Cells	DTM Digital Tension Meter	9A22-1 Tension Meter
Ultrasonic Free Loop Unwind (Motor Drive)			★	★					
Digital Tension Readout and Control Unwind (Motor Drive)	★	★				★	★	★	
Dancer Control Unwind (Motor Drive)		★	★	★	★				★



Manual Control

Rewind (Magnetic Particle Clutch)

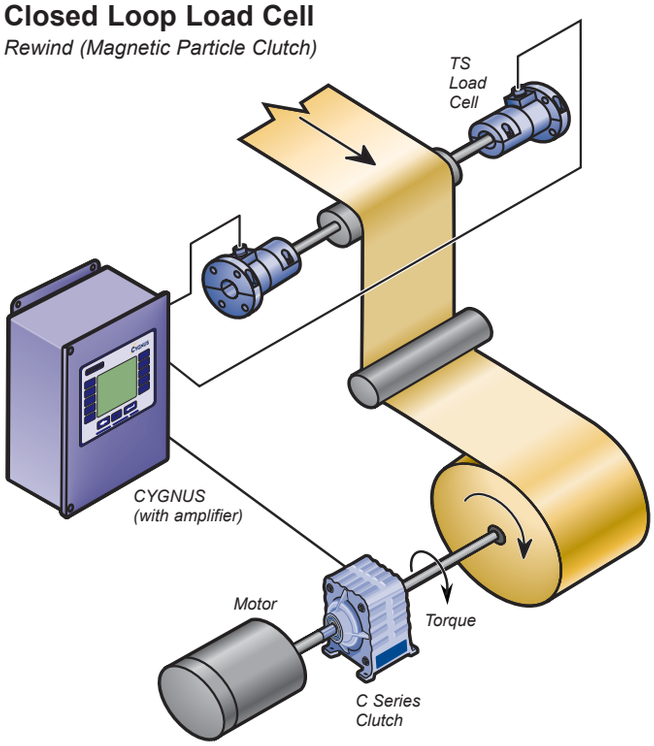


Open Loop Ultrasonic

Rewind (Magnetic Particle Clutch)

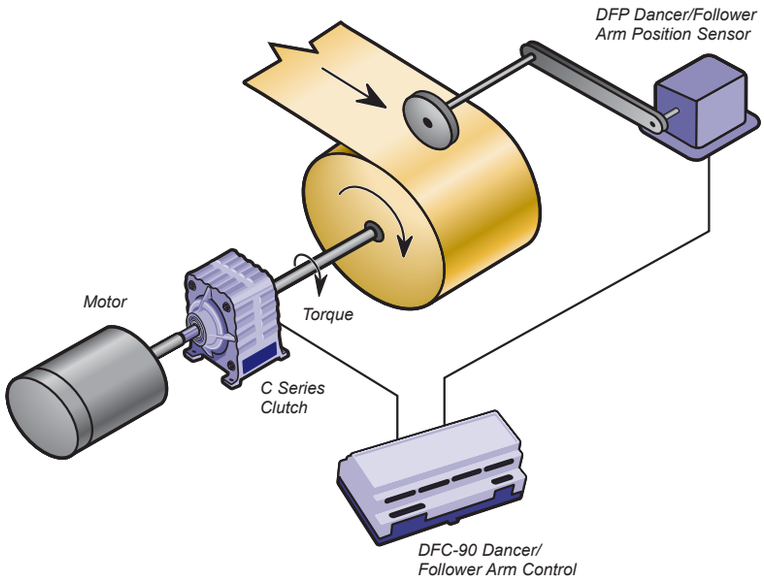
Closed Loop Load Cell

Rewind (Magnetic Particle Clutch)



Open Loop Follower Arm

Rewind or Unwind (Magnetic Particle Clutch)

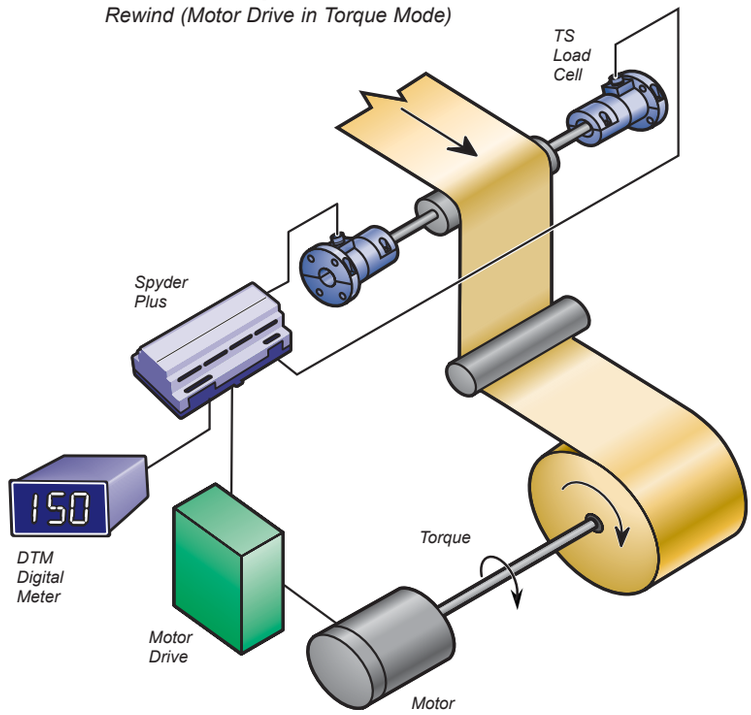


	CYGNUS Tension Control	SpyderPlus Tension Control	VERSATEC Tension Control	PA-90\PA-2 Power Amplifiers	US-2 Ultrasonic Sensor	DFC-90 DIN Mounted Tension Control	DFC-A DIN Mounted Tension Control	TC-5\TC-5P Power Supply	PS-90\PS-24 Power Supply	DFP\DFP-2 Position Sensors	TS\CL\GTS\TSU\LC\TLC Load Cells	DTM Digital Tension Meter	9A22-1 Tension Meter	C Style Magnetic Particle Clutch	Global Magnetic Particle Clutch	SOFSTEP Magnetic Particle Clutch
Manual Rewind (Magnetic Particle)								★	★					★	★	★
Ultrasonic Rewind (Magnetic Particle)		★*	★	★	★				★					★	★	★
Follower Arm Rewind (Magnetic Particle)						★				★				★	★	★
Digital Tension Readout and Control Rewind (Magnetic Particle)	★	★							★		★	★	★	★	★	★
Dancer Control Rewind (Magnetic Particle)		★	★	★	★	★	★		★	★				★	★	★

** Requires 3rd party diameter sensor with a 0 to 10 VDC output*

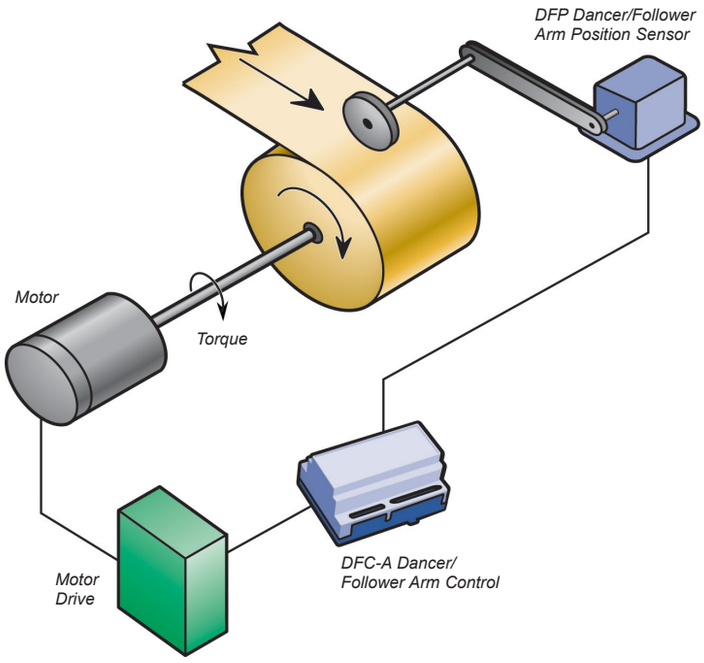
Closed Loop Load Cell

Rewind (Motor Drive in Torque Mode)



Open Loop Follower Arm

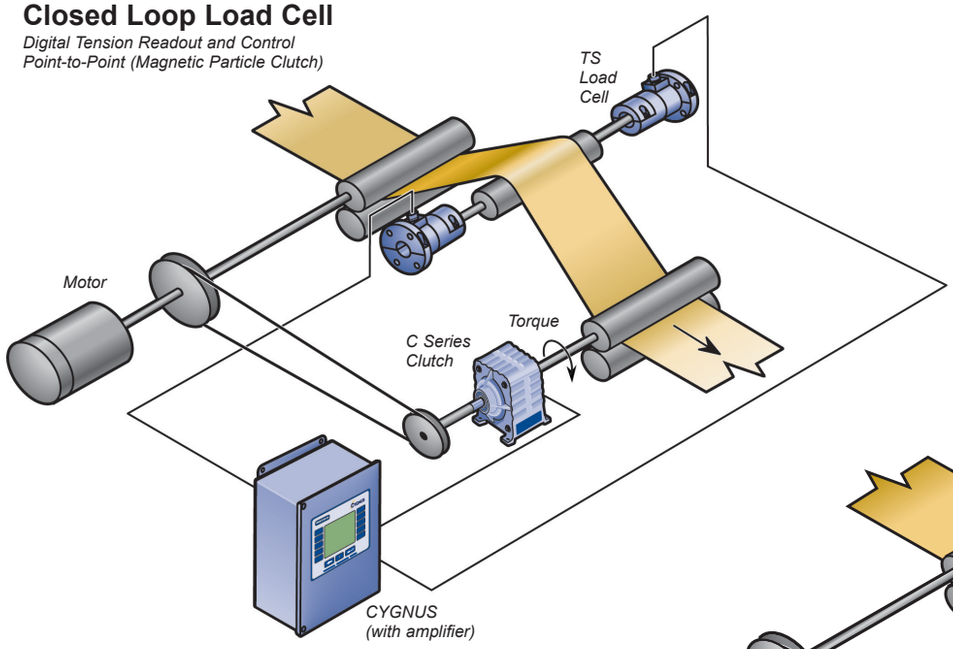
Rewind (Motor Drive Torque Mode)

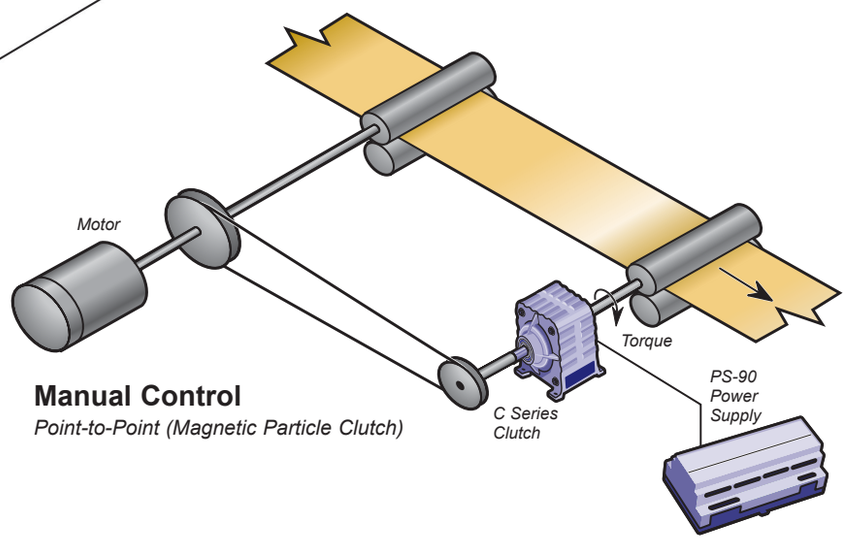


	CYGNUS Tension Control	SpyderPlus Tension Control	VERSATEC Tension Control	US-2 Ultrasonic Sensor	DFC-A DIN Mounted Tension Control	DFP\DFP-2 Position Sensors	TSICL\GTS\TSU\LC Load Cells	DTM Digital Tension Meter	9A22-1 Tension Meter
Ultrasonic Rewind (Motor Drive)		★*	★	★					
Follower Arm Rewind *(Motor Drive)*					★	★			
Ultrasonic Free Loop Rewind (Motor Drive)			★	★					
Digital Tension Readout and Control Rewind (Motor Drive)	★	★					★	★	★
Dancer Control Rewind (Motor Drive)		★	★	★	★	★			

Closed Loop Load Cell

Digital Tension Readout and Control
Point-to-Point (Magnetic Particle Clutch)

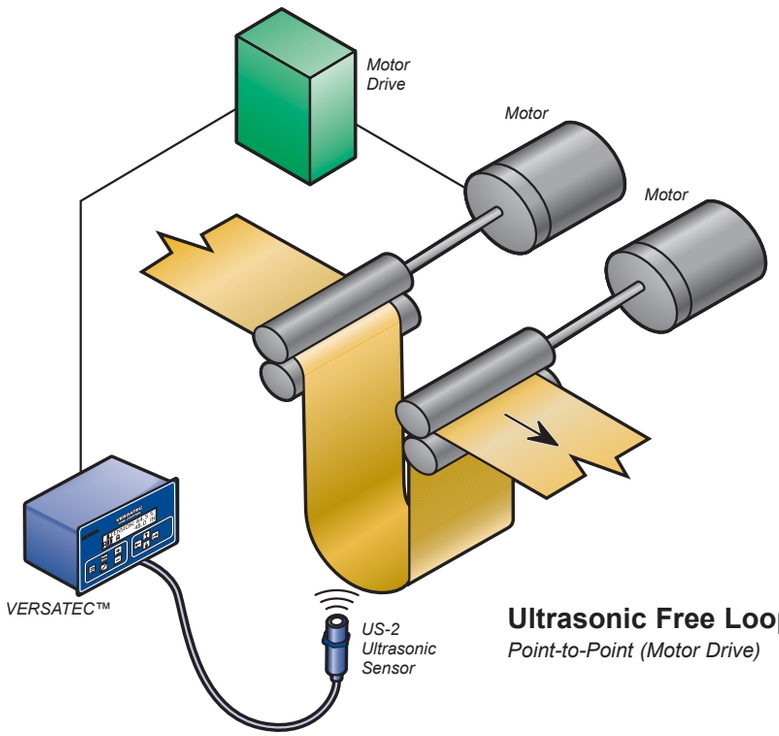




Manual Control

Point-to-Point (Magnetic Particle Clutch)

	CYGNUS Tension Control	SpyderPlus Tension Control	TC-5\TC-5P Power Supply	PA-90\PA-2 Power Amplifiers	TS\CL\GTS\TSU\LC Load Cells	DTM Digital Tension Meter	9A22-1 Tension Meter	C Style Magnetic Particle Clutch	C Style Magnetic Particle Brake	Global Magnetic Particle Clutch	Global Magnetic Particle Brake	B Style Magnetic Particle Brake	SOFSTEP Magnetic Particle Clutch	SOFSTEP Magnetic Particle Brake
Manual Point-to-Point *(Magnetic Particle)*			★	★				★	★	★	★	★	★	★
Digital Tension Readout and Control Point-to-Point *(Magnetic Particle)*	★	★		★	★	★	★	★	★	★	★	★	★	★

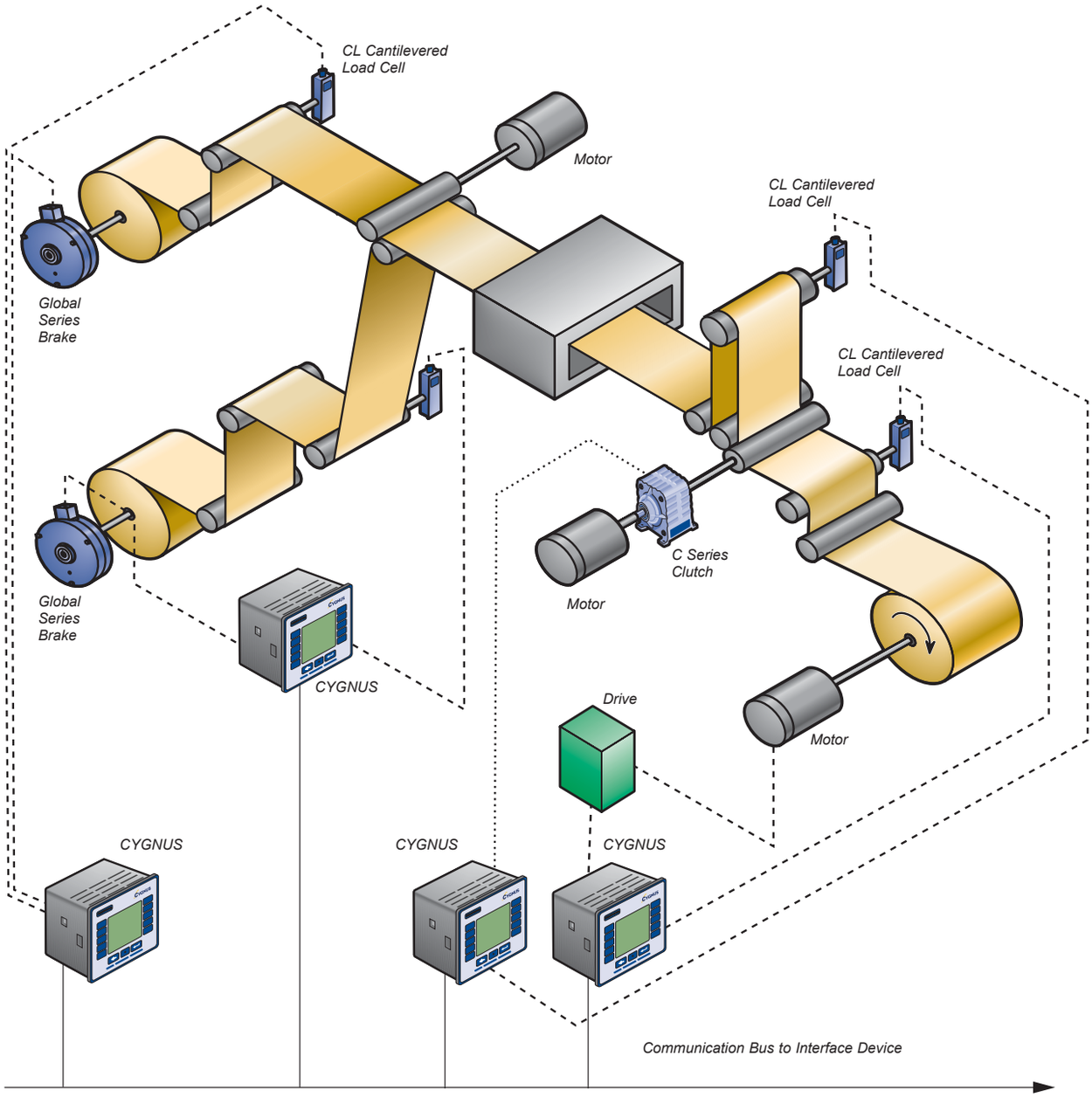


Ultrasonic Free Loop
Point-to-Point (Motor Drive)

	CYGNUS Tension Control	SpyderPlus Tension Control	TC-5\TC-5P Power Supply	PA-90\PA-2 Power Amplifiers	TS\CL\GTS\TSU\LC Load Cells	DTM Digital Tension Meter	SOFSTEP Magnetic Particle Brake
Ultrasonic Free Loop Point-to-Point (Motor Drive)			★	★			
Digital Tension Readout and Control Point-to-Point *(Motor Drive)*	★	★			★	★	★

Closed Loop Load Cell

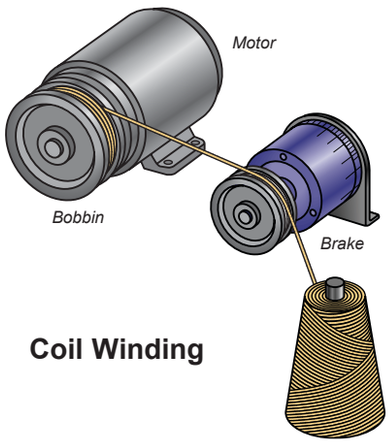
Fieldbus Application



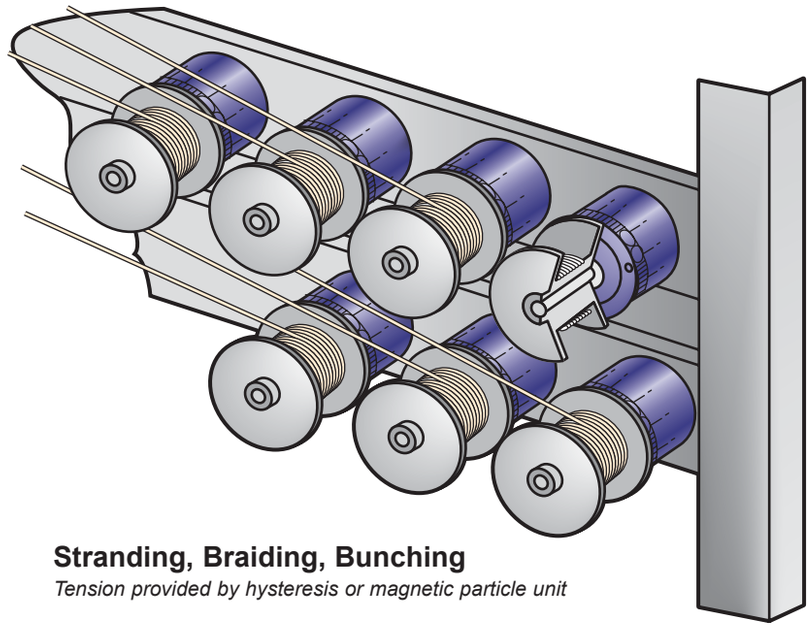
Closed Loop Load Cell Fieldbus

Access and control multiple independent tension zones over an Ethernet IP, DeviceNet or Profibus DP network. Modbus/TCP available on some models..

- Ethernet capabilities for networking and remote access
- Available control outputs: 0 to 10 VDC, 4 to 20 mADC, -10 to 10 VDC, 90 VDC and 24 VDC
- Available mounting options: Enclosure Mount (CE), DIN Panel Mount (CE) and DIN Rail Mount (CE)

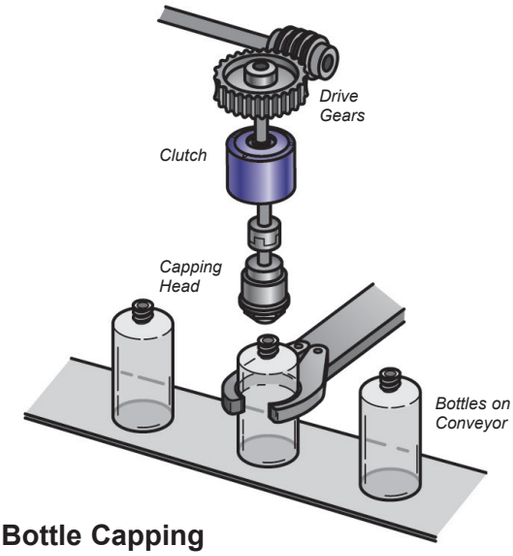


Coil Winding



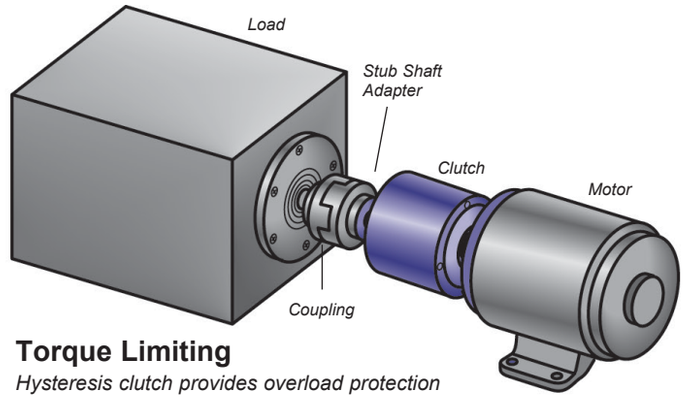
Stranding, Braiding, Bunching

Tension provided by hysteresis or magnetic particle unit



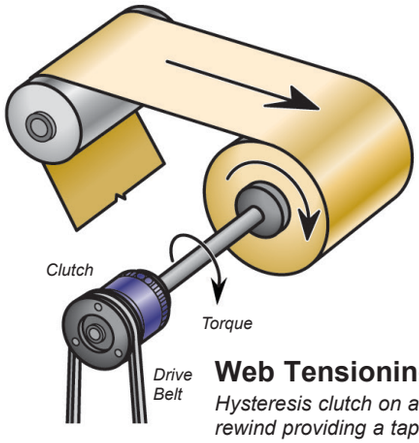
Bottle Capping

Constant torque provided by a hysteresis clutch



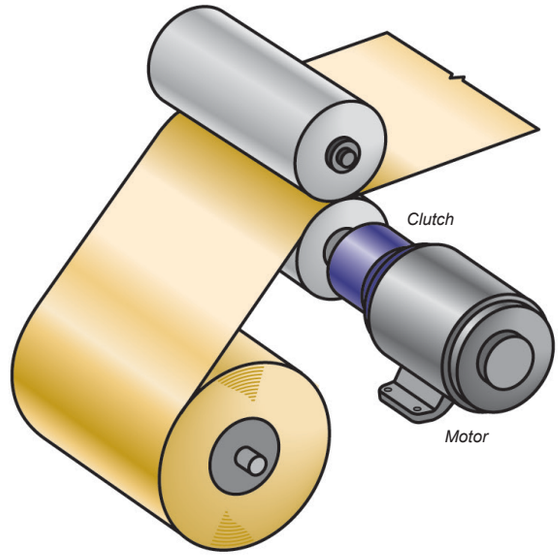
Torque Limiting

Hysteresis clutch provides overload protection



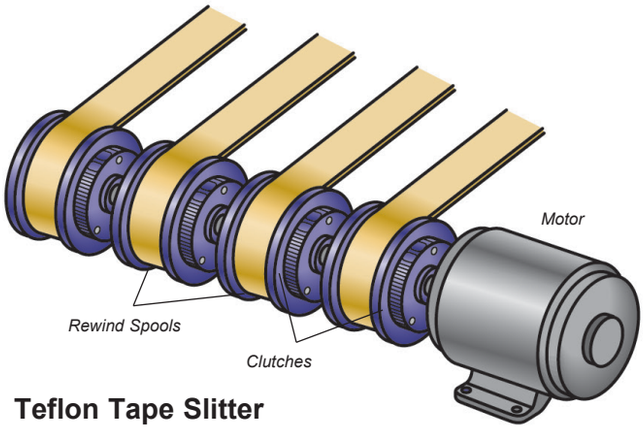
Web Tensioning

Hysteresis clutch on a web rewind providing a taper tension



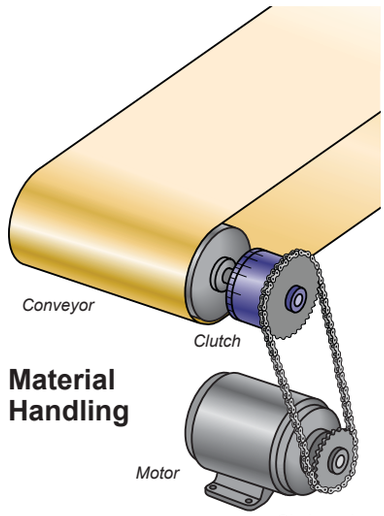
Film Tensioning

Constant tensioning provided by hysteresis clutch

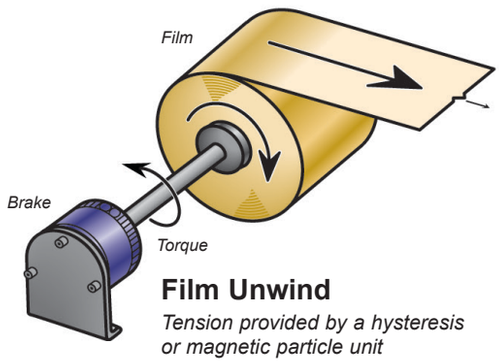


Teflon Tape Slitter

Hysteresis clutches on tape rewinds providing taper tension



Material Handling



Film Unwind

Tension provided by a hysteresis or magnetic particle unit

As a tensioner

By using one of the Perma-Tork assemblies, you can accurately control tension. The hysteresis unit is best suited for tensioning on unwind stands and nip rolls.

As a magnetic coupling

Perma-Tork clutches guarantee a soft transfer of power between prime mover and load at start-up. In this application, Perma-Tork behaves similar to a fluid coupling, but locks in at zero slip once torque is reached.

Testing

Perma-Tork hysteresis units provide a constant slip torque unaffected by wear, humidity or “stick-slip.” This makes it an ideal device for many testing applications. The torque can be precisely adjusted (even at low speeds). Torque will not fluctuate over extremely long testing periods.

As a torque limiting device

The power-free, maintenance-free Perma-Tork design is particularly suitable for protecting all drive train, winding or unwinding components. It not only provides overload and jam load protection, but there are no complicated electrical feedback systems or mechanical wearing parts to break down or require maintenance. The only wearing parts are the bearings themselves, and nothing but the highest quality ball bearings are used.

Inertia

The tendency of matter to remain at rest or continue at a fixed velocity, unless it is affected by an outside force. The velocity can be linear or rotational.

Inertia = (WK2), where W = weight of object
K = distance from the axis of rotation

Some inertia are:

A. SOLID DISK (WK^2) = ½W X R^2 where R is Radius in feet

B. CLUTCH GEARED TO LOAD

$$(WK^2)_{\text{(at clutch)}} = (WK^2)_{\text{(at load)}} \left[\frac{\text{RPM (load)}}{\text{RPM (clutch)}}\right]^2$$

C. W = Conveyor load in pounds
V = Velocity in ft/min
RPM = measured at clutch

$$WK^2_{\text{(conveyor)}} = W \left[\frac{V}{2\pi RPM}\right]^2$$

Relating Inertia to Torque

To determine the torque required to start or stop a load in a specified amount of time:

$$\text{Torque} = \frac{(WK^2)RPM}{308t}$$

(WK^2) = Inertia in lb-ft^2

t = time in seconds

Shortcut Web Formulas

Example: Tension = 66 lb Velocity = 500 fpm
Full Roll Dia = 36 inches Core Dia. = 9 inches

Web HP: $\frac{\text{Web Tension x Web Velocity}}{33{,}000}$

$$= \frac{66(500)}{33{,}000} = 1 \text{ HP}$$

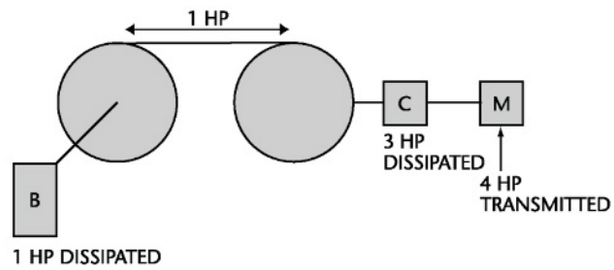
Unwind Dissipation = WEB HP = 1HP (746 Watts)

Rewind Dissipation = (DIAMETER RATIO - 1)(Web HP)

$$\left(\frac{36}{9} - 1\right) \text{x1 HP} = 3 \text{ HP}$$

Motor HP = (DIAMETER RATIO)(Web HP)

$$\frac{36}{9} \text{ x1 HP} = 4 \text{ HP}$$



Useful Conversions

GENERAL
1 meter = 100 centimeters
= 1,000 millimeters
1 micron = 0.001 millimeter
1 kilogram = 1,000 grams
1 foot = 12 inches
1 mil = 0.001 inches
1 pound = 16 ounces

LENGTH
1 foot = 0.3048 meters
1 inch = 2.54 centimeters

FORCE
1 pound = 4.4482 newtons

TORQUE
1 pound-foot = 1.3558 newton-meters
1 pound-foot = 0.13826 kilogram-meters
1 pound-inch = 0.1130 newton-meters

VELOCITY
1 foot per minute = 0.3048 meters per minute

POWER
1 horsepower = 745.7 watts

INERTIA
1 pound-foot2 = 0.04214 kilogram-meter2

MATERIAL THICKNESS
1 mil = 25.4 microns

TEMPERATURE
C = 5/9 (degrees F-32) or
F = 9/5 (degrees C) + 32

PRESSURE
1 pound per square inch = 6.89 kilopascals

MASS
1 pound = 0.4536 kilograms

Application Problems or Questions?

Call The Tension Hotline:

1-800-MAGPOWR
624-7697

www.magpowr.com

Clutch or Brake Placement

Application Data

Rewind a material with constant tension
Tension = 40 lb
Full roll diam. = 3 feet
Core diam. = 0.5 feet
Velocity = 100 fpm

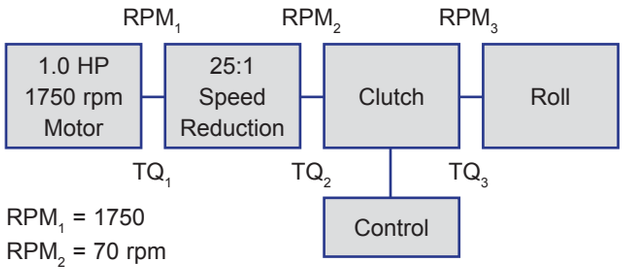
Calculating Requirements at the Roll

Torque (max) = Tension x Radius (full roll)
Torque (max) = 40 lb x (3/2 ft) = 60 lb-ft
Torque (min) = T x R (core) = 40 lb (0.5/2 ft) = 10 lb-ft

$$\text{RPM (full roll)} = \frac{100 \text{ fpm}}{(3 \text{ ft})\pi} = 10.6 \text{ rpm}$$

RPM (core) = 10.6 (3/0.5) = 63.6 rpm

Case 1: Clutch is directly coupled to the rewind roll



RPM_1 = 1750
RPM_2 = 70 rpm
RPM_3 = 63.6 to 10.6 rpm
Tq_1 = 3 lb-ft
Tq_2 = 75 lb-ft
Tq_3 = 10 to 60 lb-ft

Clutch Sizing: Maximum torque required = 60 lb-ft
Minimum torque required = 10 lb-ft

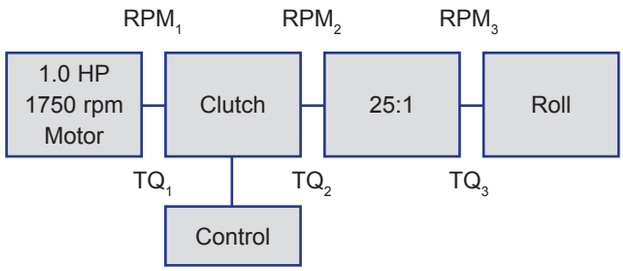
Slipwatts:

$$\frac{\text{Tq (max) (RPM in – RPM out)}}{7} = \frac{60 \text{ lb-ft } (70 - 10.6)}{7} = 509 \text{ Watts}$$

Therefore you should choose a C-100

NOTE: In this case a 1 lb-ft change in torque through the clutch will result in a 1 lb-ft change in torque at the roll.

Case 2: Clutch is placed between the motor and the speed reducer



RPM_1 = 1750
RPM_2 = 1590 to 265 rpm
RPM_3 = 63.6 to 10.6 rpm

Tq_1 = 3 lb-ft
Tq_2 = 0.4 to 2.4 lb-ft
Tq_3 = 10 to 60 lb-ft

Clutch Sizing:

Maximum torque required = 2.4 lb-ft
Minimum torque required = 0.4 lb-ft

$$\text{Slipwatts} = \frac{2.4 \text{ lb-ft } (17750 - 265)}{7} = 509 \text{ Watts}$$

NOTE: Tentative selection would be a C-3A

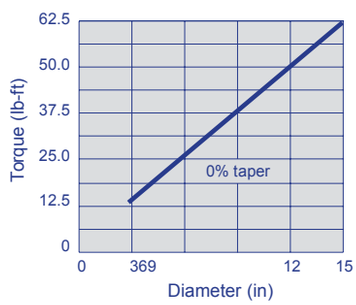
Notice that the heat dissipation required has not changed, but it looks like a smaller clutch can be used. The major disadvantage is in the ability to control tension at the rewind roll. Now, a 1 lb-ft change in torque through the clutch will result in a 25 lb-ft change in torque at the roll. Relating this change to a change in tension at the core of the roll, the tension change due to 1 lb-ft in clutch torque is 100 lbs of tension change! This situation could result in stability problems when trying to control tension.

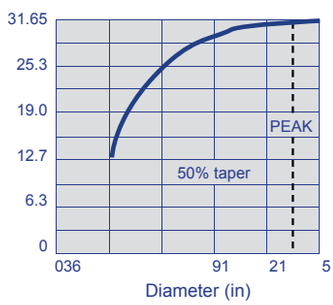
Conclusion: Whenever possible, place the clutch as close to the load as possible.

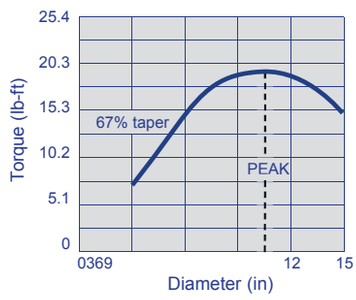
Use the C-100, Case 1

Taper Tension

In taper tension winding, two factors control the torque level. First, the torque must be increased in proportion to roll radius to provide constant tension, and second, at the same time the torque must be modified to decrease the tension as the roll builds. As a result of this, the actual peak torque requirement may occur at some intermediate point in the roll. The point of peak torque is determined by the percent of taper desired, and by the diameter ratio of the core to full roll. In the examples below, we see graphs of constant tension (0% taper), 50% taper tension, and 67% taper tension. These graphs are for a 3 inch core to a 15 inch OD, with 100 lbs starting tension.







NOTE: The torque requirement and the peak torque point changes for each change in taper tension. Drives, however, must be sized for constant tension, as this is the most demanding situation from a torque or power standpoint.

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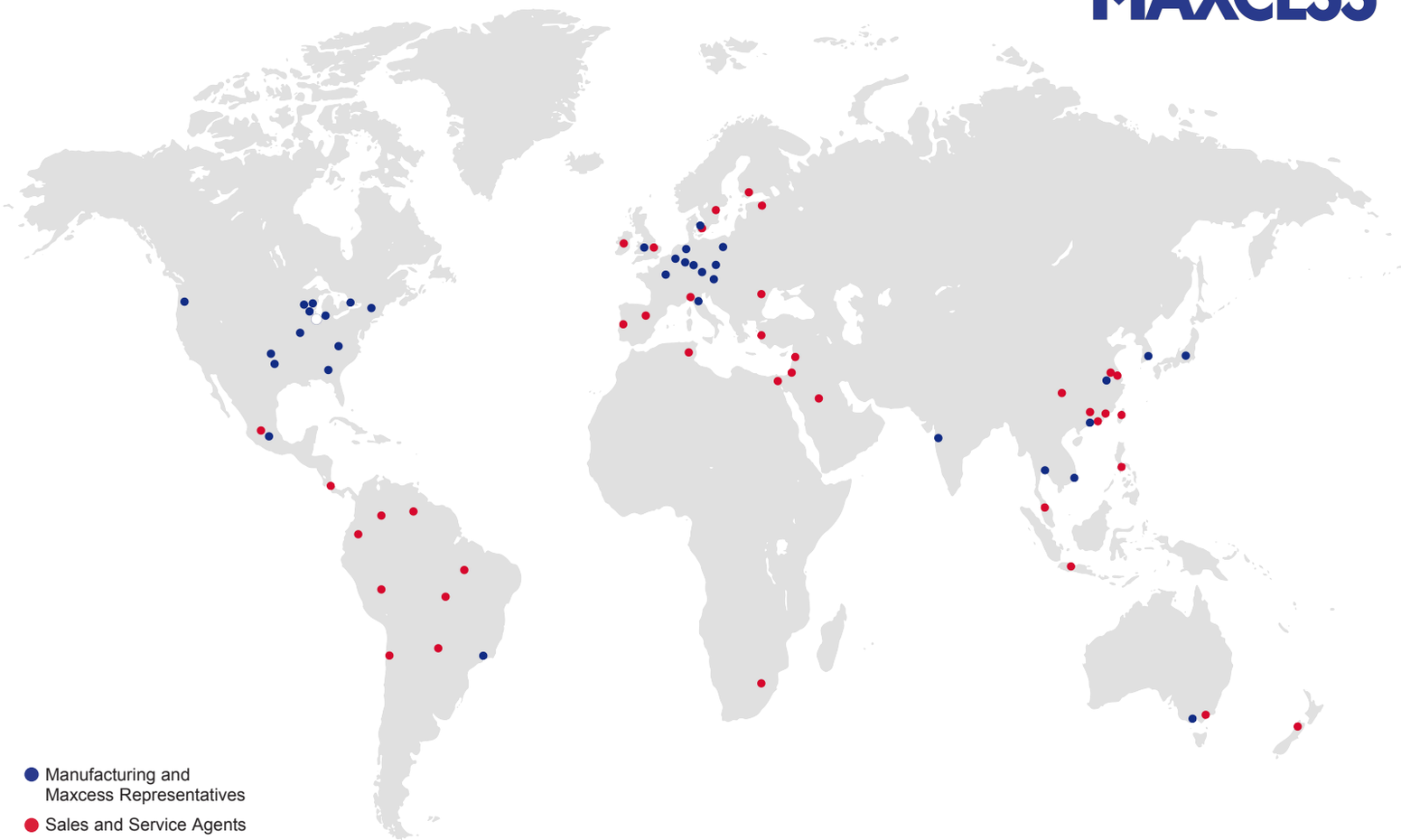

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