Tension Control Systems

Wichita Clutch
Wichita offers the most complete product line dedicated to the TENSION CONTROL MARKET. Our extensive experience has enabled us to develop high performance controls able to operate in open and closed loop with brakes and motors.

ABOUT THIS CATALOGUE

This master catalogue groups all the solutions / products that Wichita offer. An important part is dedicated to design solutions with particular consideration to the type of machine and the tension control installed. This should help you choose the right solution, taking into consideration the results you want to achieve. All the product characteristics and dimensions are included for every product.

Applying the appropriate Tension Control will help you

- save material
- improve quality of the operation
- increase production
- lower your production cost

For any further assistance, call your local Wichita company listed on the back cover
MARKET / SOLUTION
- Tension control definition
- Tension control application
- Tension control in closed loop
- Tension control in open loop
- Torque and power determination
- Configuration selection
- Closed loop – sensor selection
- Open loop – setting selection

WICHITA BRAKE RANGES
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Before going through the various products and solutions Wichita can offer, it is important to make a correct analysis of the need. What we call “need” is the tension control accuracy you need to operate a good material transfer through the machine and to maintain perfect operation with the material.

WHAT’S TENSION CONTROL ?

Tension control is the ability to permanently control the mechanical tension in any material (mainly the raw material available in roll size). This control has to be operated dynamically and statically. On every machine the operator should be only concerned by the speed and operation. The line speed is considered as master function. The tension control must be efficient at any machine speed phase, including machine acceleration, steady speed and speed deceleration. Emergency stop case does not require accurate tension control but should act in the way to avoid the web breakage. It is then very important to consider all machine speed phases for the system determination.

WHY A TENSION CONTROL ?

When web material has to be treated in a specific machine (printer, slitter, coater…) it is very important to transport the web with a controlled tension for two main reasons:

- Correct web transport in the machine
- Correct operation on the transported material

On the other hand, this kind of machine works very often with an “edge guiding system”. Loosing the tension in material will affect the correct edge guiding system.

WHERE DOES IT APPLY ?

In any roll fed web processing machine. Typically:

- PRINTING machine
- LAMINATING machine
- SLITTING machine
- SHEETING machine
- COATING machine
- EXTRUDERS
- Stand alone UNWINDER / REWINDER
- In general all CONVERTING equipment

Treating material such as:

- Paper
- Plastic film
- Textile
- Aluminium foil
- Wires / cables

In general in all machines whose block diagram can be represented as follow:
**Tension control application**

Preparing a project in tension control requires good analysis and support. The block diagram below is a general representation of any machine supporting tension control. We recommend using this diagram or a part of it in any discussion and correspondence in order to avoid possible misunderstandings:

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**GENERAL BLOCK DIAGRAM**

![General Block Diagram](image)

**IMPORTANT CONSIDERATION**

In every machine the speed point location must be clearly identified. In general one of the machine nip rolls is driven, setting the linear velocity of the machine. The machine speed is considered as **MASTER** function. The tension control, whatever the chosen solution, works in **SLAVE** mode. Practically, the operator sets the machine speed with a simple potentiometer and all tension control system existing on the machine have to follow, keeping the desired tension at any speed and during all transitory speed phases.

**REFERING TO THE GENERAL BLOCK DIAGRAM**

Three zones are clearly identified:

**ZONE 1, Typical characteristics (unwind)**
- Tension zone definition: A-B
- Speed point in B
- Variable roll rotation speed
- Variable inertia
- In general constant tension X
- Brake system applicable
- Motor system applicable

**ZONE 2, Typical characteristics**
- Tension zone definition B-C
- Speed point in C or B
- Constant roll rotation speed
- Constant inertia
- In general constant tension Y
- Brake system applicable
- Motor system applicable

**Zone 3, Typical characteristics (rewind)**
- Tension zone definition C-D
- Speed point in C
- Variable roll rotation speed
- Variable inertia
- Constant or Taper tension Z
- Brake not applicable
- Motor system required

**NOTE:** Each zone is individually controlled. Tension may be different in each zone. It is assumed that there is no slipping on the nip roll.
To create tension it is necessary to apply a force - or more precisely a torque - when applied to a turning part. Wichita manufacture a wide range of brakes with torque ranges from fractional Nm to thousands of Nm. Two main solutions exist in terms of system configuration to apply the right torque:
- Closed loop control.
- Open loop control (or more precisely open loop setting).

CLOSED LOOP SOLUTION

The tension control, as any electronic control, is working basically in closed loop according the electrical block diagram below. In closed loop we sense the result we want to achieve and compare it with a reference in order to ensure permanent balance between what we want and what we have.

The closed loop is an electrical/mechanical loop. In such a loop all parts are important in terms of quality.
- The control – has to have high performance to manage all parameter changes correctly during the operation.
- The driver – has to be as fast as possible in terms of response.
- The power part – has to be sized correctly according the need and as fast as possible in terms of response.
- The sensor – has to be accurate, stable over time and to have a good repeatability.

The quality of the mechanical construction is important. The control loop is closed through the mechanical transmission between the power element and the sensor roll. The web itself is a part of the loop. In the case of webs with high elasticity, special consideration should be given in control setting.

THREE WAYS TO SENSE THE TENSION

- **Direct tension** measurement with **LOAD CELL**.
- **Indirect tension** measurement with **DANCER ARM**.
- **Indirect tension** measurement with **FREE LOOP**.
OPEN LOOP SOLUTION

The open loop configuration does not require any control or sensor. It is composed only with a power element (brake or motor) and an associated driver. In this case the torque is not controlled. We have to set the torque on the driver according to the diameter of the roll. The electrical block schematic drawn from the closed loop system becomes as follows:

The power part is transmitting the necessary torque to the roll. Since the result is not measured, all the effect due to the inertia of the roll influence the tension in the web. Some compensations are possible but the system stays an open loop with limited accuracy.

THREE POSSIBILITIES TO APPLY THE SETTING

- **MANUAL** by potentiometer

- **AUTOMATIC** with the diameter reading

- **AUTOMATIC** with the diameter calculation

To summarise, web tension control can be operated in two system configurations: OPEN and CLOSED loop. For each configuration, three main possibilities for SETTING and SENSING are possible. The solution choice depends on:

- The accuracy you need in your web tension
- The mechanical construction of the machine
- The degree of automation you need
- The acceleration/deceleration imposed on the system

In the next section Wichita lists some criteria to help facilitate your choice. It’s not our intention to impose a solution, but to offer a guide drawn from Wichita experience. We put the emphasis on the limits of the various possibilities in order to achieve the results you are expecting.
“POWER” FROM MOTOR OR BRAKE ?

Based on two parameters:

- Do I need a positive torque or is a negative torque sufficient ?
- Which technology is on the machine ?

In the case where the “torque need” calculation shows positive results we are forced to use a motor. Only a motor is able to provide positive torque. It’s typically the case on the rewind stand; on the other hand, the brake solution very often suits the requirements for an unwind stand.

The technology parameter is purely a customer decision. The tension control with motor is today operated with AC motor and flux vector control drive with full power regeneration in the line.

WICHITA offer both solutions with a wide range of products.

TORQUE NEED EVALUATION

Example of calculation on a typical machine (slitter / rewinder).

Unwind stand

Max torque to provide the tension: \(-1 \text{ m} \times 250 \text{ N} / 2\) = -125 Nm

Min torque to provide the tension: \(-0,09 \text{ m} \times 250 \text{ N} / 2\) = -11,25 Nm

Inertia of the full roll: \(0,5 \times 500 \text{ Kg} \times 0,5 \text{ m} \times 0,5 \text{ m}\) = 62,5 Kgm\(^2\)

Max rotation speed (at full line speed): \(+ (400 \text{ m/min} / 0,09\text{m} / 3,14)\) = +1415 rpm

Min rotation speed (at full line speed): \(+ (400 \text{ m/min} / 1\text{m} / 3,14)\) = +127 rpm

Torque to accelerate the full roll: \(+ (62,5 \text{ Kgm}^2 \times 127 \text{ rpm} / 9,55 / 8 \text{ sec})\) = +104 Nm

Torque to decelerate the full roll: \(- (62,5 \text{ Kgm}^2 \times 127 \text{ rpm} / 9,55 / 2,66 \text{ sec})\) = -312 Nm

Max continuous power dissipated: \(- 125 \text{ Nm} \times 127 \text{ rpm} / 9550\) = -1,66 kW

The torque need for each machine phase shows a negative result. Brake and motor can comply with all parameters. Whatever the choice the selection must be based on the max requirements of heat, torque and speed.
Rewind stand (zone 3)

Both shafts are similar in terms of mechanical parameters. It’s practically always the case for slitting machines.

<table>
<thead>
<tr>
<th>Description</th>
<th>Expression</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max torque to ensure the tension (biggest diameter, all rolls)</td>
<td>+ (0,5 m * 100 N * 60% / 2)</td>
<td>+ 15 Nm</td>
</tr>
<tr>
<td>Max torque to ensure the tension (smallest diameter, all rolls)</td>
<td>+ (0,06 m * 100 N / 2)</td>
<td>+ 3 Nm</td>
</tr>
<tr>
<td>Max shaft rotation speed</td>
<td>+ (400 m/min / 0,06 m / 3,14)</td>
<td>+ 2123 rpm</td>
</tr>
<tr>
<td>- In reality the max speed in never reached on the core diameter.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For the max speed on the core we can assume a practical reduction of 25%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Then max rotation speed</td>
<td>+ (2123 rpm * 75%)</td>
<td>+ 1592 rpm</td>
</tr>
<tr>
<td>Min shaft rotation speed</td>
<td>+ (400 m/min / 0,5 m / 3,14)</td>
<td>+ 255 rpm</td>
</tr>
<tr>
<td>- In reality the full roll is never reached at full speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For the min speed at full roll we can assume a practical reduction of 25%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Then min rotation speed</td>
<td>+ (255 rpm * 75%)</td>
<td>+ 191 rpm</td>
</tr>
<tr>
<td>Inertia of the full roll, all rolls</td>
<td>0,5 * 80 Kg * 0,25 m * 0,25 m</td>
<td>2,5 Kg*m²</td>
</tr>
<tr>
<td>Torque to accelerate the full roll, all rolls</td>
<td>+ (2,5 Kg*m² * 191 rpm / 9,55 / 8 sec)</td>
<td>+ 6,25 Nm</td>
</tr>
<tr>
<td>Torque to decelerate the full roll, all rolls</td>
<td>- (2,5 Kg*m² * 191 rpm / 9,55 / 2,66 sec)</td>
<td>- 18,8 Nm</td>
</tr>
<tr>
<td>Final torque need on the roll to ensure correct tension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- In acceleration</td>
<td>+ 15 Nm + 6,25 Nm</td>
<td>+ 21,25 Nm</td>
</tr>
<tr>
<td>- In steady speed for d to D</td>
<td>+ 3 to + 15 Nm</td>
<td>+ 15 Nm</td>
</tr>
<tr>
<td>- In deceleration</td>
<td>+ 15 Nm – 18,8 Nm</td>
<td>- 3,8 Nm</td>
</tr>
<tr>
<td>- Max power continuous dissipated per shaft</td>
<td>+ 15 Nm * 255 rpm / 9550</td>
<td>+ 0,4 kW</td>
</tr>
</tbody>
</table>

MAIN DRIVE NIP ROLL (zone 2)

Necessary theoretical power:

Worst tension balance = 250 N – (2 * 100 N * 60%) = 130 N

Max power need = 130 N * 400 m/min/60 = 867 W

Max roll rotation speed: depends of nip roll diameter

MACHINE POWER BALANCE

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unwind stand</td>
<td>- 1,66 kW</td>
</tr>
<tr>
<td>Main drive</td>
<td>+ 0,87 kW</td>
</tr>
<tr>
<td>Rewind shaft (2)</td>
<td>+ 0,80 kW</td>
</tr>
<tr>
<td><strong>TOTAL POWER</strong></td>
<td>+ 0,01 kW</td>
</tr>
</tbody>
</table>

Please note it is a theoretical calculation. We did not take all the initial friction into account. Looking at the torque need for each zone we can say:

- Tension function on unwind stand can be achieved by motor or brake.
- Nip roll system has to be motor driven.
- Tension function on rewind shaft must be provided by motor.

Wichita can offer you the appropriate engineered solution whatever your choice, from our wide range of controls, hydraulic and and pneumatic clutches and brakes.
**Configuration - selection**

The power part selection is the same whatever the configuration. As soon as the power element and its associated drive are defined we have to determine how the system will be driven: in open or closed loop?

As previously stated, one important factor is the tension accuracy you need.

**CLOSED LOOP - ADVANTAGES / DISADVANTAGES**

![Diagram of closed loop control system]

**Advantage**
- High accuracy.
- All initial friction in mechanical parts, even if they are changing over time are overcome.
- Tension is controlled during all the machine speed phase (accel, decel, steady speed).
- System can work in slave without any electrical connections to the machine.

**Disadvantage**
- Risk of instability.
- Can be more complex to set-up.
- More expensive compared to open loop.

**OPEN LOOP - ADVANTAGE / DISADVANTAGE**

![Diagram of open loop control system]

**Advantage**
- Very stable.
- Easy to start-up.
- Low cost compared to closed loop (sensor and control units not required).

**Disadvantage**
- Poor accuracy
- Strongly dependent on quality of mechanical parts.
- Accel, decel phase reflected on tension.

**DO NOT FORGET :** all above considerations - even if example is unwind stand - are applicable to the three various machine zones we have defined on page 5.

Every zone of the complete machine can be controlled with its own appropriate tension system configuration. A typical example is the tension in a printing machine. It is very often controlled on an unwind stand in closed loop where the accuracy is important for good printing and on a rewind stand in open loop where the tension precision is not so important after the print operation. Finally it's the customer’s decision. *Wichita* can offer advice in solution and product choice.
**LOAD CELLS SIZING - MOUNTING RECOMMENDATIONS**

Please keep this principle in mind: The load cell installed is destined to measure the WEB TENSION and not other constraints applied to it.

Take the following points into consideration before selecting, sizing and installing material components.

- Load cells location should be vibration free. Vibrations will decrease quality measurement.
- The sensing shaft fitted on or in has to be very well balanced. Unbalanced shaft will create measurement oscillation, causing variations in control quality.
- Adapted ball bearing have to be used to avoid original stress on load cell (self-aligning ball bearing).
- Respect a reasonable sensing shaft weight/web tension measure ratio. Less than 1.
- Do not oversize the load cell respect to your calculation. Max admitted factor 1.5, recommended 1.25.
- Respect a minimum wrapping angle on load cell. Min = 240°.
- So far as it is possible, use load cell in compression, with web tension effect in same direction as the weight of shaft.
DANCER ARM BUILDING AND OPERATIONAL RECOMMENDATIONS

Dancer arm system is used for indirect tension measurement. It is in fact a position control. The desired tension in web is provided with an external component. As general principle keep this concept in mind:

We have to create tension with force and not with a weight.

Take the following points into consideration before manufacturing, sizing and installing the components.

- Moving part of dancer has to be as light as possible.
- The dancer can act as both position control and web accumulator.
- The larger the quantity of material stored in dancer, the easier will be the position control, and hence the tension control.
- To set tension you need to use a pneumatic actuator “P” acting on arm of the swinging roll.
- In case of light tension do not add balance weights to compensate for excessively heavy dancer arms, but choose free loop.

FREE LOOP INSTALLING RECOMMENDATIONS

This is an indirect tension measure. It is in fact a position control similar to the dancer arm. The loop position is read with ultrasonic sensor. Free loop is applied especially in textile market where tension required are generally low. The free loop system suits to the requirement expressed as “zero tension”. Main difficulty is to obtain reliable position reading.

For free loop operation the following points should be taken into consideration:

- The tension in material is the own weight of material in the loop.
- A light core “C” often is placed in the loop to immobilise the loop, making easier the position reading.
- As the system is very light it is very sensible to the “wind”. Some guards “G” are installed to prevent accidental loop moving.
- As the system is dedicated to very low tension it often requires a motor as power system.
Open loop - Setting selection

Working in open loop requires that a torque setting is defined. As seen on page 7, three possibilities exist. The choice depends on the machine complexity and the automation required. One important factor that remains is the tension precision. For unwind and rewind systems the diameter ratio will play an important role. Working in open loop also requires special considerations regarding system inertia.

MAIN APPLICATIONS - ADVANTAGES AND DISADVANTAGES

<table>
<thead>
<tr>
<th>Setting type</th>
<th>Where, When, Why?</th>
<th>Advantage</th>
<th>Disadvantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual setting by pot.</td>
<td>- Cable machine</td>
<td>- Low cost solution</td>
<td>- Tension precision</td>
</tr>
<tr>
<td></td>
<td>- No fast accel/decel</td>
<td>- Easy to start-up</td>
<td>- depends on operation</td>
</tr>
<tr>
<td></td>
<td>- Low roll diameter ratio</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Operator intervention admitted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diameter reading</td>
<td>- The most commonly used solution in open loop</td>
<td>- Physical reading, no reset</td>
<td>- Poor reading accuracy on core</td>
</tr>
<tr>
<td></td>
<td>- No operator intervention admitted</td>
<td>- Easy to start-up</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Large roll diam ratio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diameter computing</td>
<td>- In rewind station</td>
<td>- Electrically integrated</td>
<td>- Need line speed signal</td>
</tr>
<tr>
<td></td>
<td>- In sophisticated machine</td>
<td>- Easy compensation for tranitory phases</td>
<td>- Need roll rotation speed signal</td>
</tr>
<tr>
<td></td>
<td>- Large roll diam ratio</td>
<td></td>
<td>- Can be complex to set-up</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Need reset</td>
</tr>
</tbody>
</table>

All solutions remain an open loop solution with limited precision. As we do not measure the result we want to achieve, all initial friction and inertia influence the precision of the system.

SOME PRECAUTIONS WHEN USING READING SOLUTION

Reading solution is generally with ultrasonic sensor. Another type of reading is the roll arm follower. Both use the same principle. The roll diameter measure is applied as torque setting on the power part driver. The sonic reading offers the advantage of not touching the roll. The reading reliability is the weak point of the system. Ultrasonic sensor location is important and should respect the recommendations below.

The block diagram used in all ultrasonic open loop application shows the sonic in any position. The position shown in explanation is not necessarily the ideal position to get good reading reliability. The problem when using sonic reading is to get signal reliability at the end of the roll when approaching the core. The best position when applicable is the position shown on this diagram where the sensor position axis is voluntarily offset from the theoretical vertical axis. Placing the sensor axis in X position will ensure a good and stable reading even at the end of the roll. The small error provided is not important and the reading stability is guaranteed.
### Tension brake overview

The selection of the power part element (brake or motor) is determined by the max torque needed to ensure the tension for the max machine speed. The basic principle is to calculate the torque we need to obtain the desired max tension needed during all machine speed phases.

### Wichita Brake Range

<table>
<thead>
<tr>
<th>Wichita-Type</th>
<th>Description</th>
<th>Torque Range</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wichita-Modevo</td>
<td>Pneumatic brake, Modular, Up to 7 Bar, 5 sizes</td>
<td>Up to 4400 Nm</td>
<td>Higher Torques available to special design</td>
</tr>
<tr>
<td>Wichita-Mistral</td>
<td>Pneumatic brake, Modular, 5.5 Bar supply, 2 sizes, fan cooled</td>
<td>Up to 1800 Nm</td>
<td></td>
</tr>
<tr>
<td>Wichita-Cab</td>
<td>Pneumatic brake, Modular, 5.5 Bar air supply, 3 sizes, Water cooled</td>
<td>Up to 6600 Nm</td>
<td></td>
</tr>
</tbody>
</table>

### Which Type for Which Application?

Analysing the following considerations will lead you to select the right brake for your application:

- The max calculated torque you need.
- The eventual technological choice between electric and air brake in the overlapping zone.
- The pneumatic brake has higher heat capability.
- The modularity need.
- The mechanical size (square or round size, dimensions).
- The own customer technological preferences (air or water cooled).

**NOTE:** The sizing of brake or motor is absolutely independent of the control system you have chosen (open or closed loop).
Two important parameters are used in brake selection:

- Max torque requirement
- Max thermal power to be dissipated

These two values are determined by the application (see calculation example on pages 8-9).

### PNEUMATIC BRAKE TYPE SELECTION: MISTRAL / MODEVO / CAB

**Example: unwind brake selection**

- Max reel diam. = D = 1.200 m
- Min reel diam. = d = 0.100 m
- Max width = W = 1000 mm
- Min width = w = 600 mm
- Max tension = T = 0.4 N/mm
- Min tension = t = 0.3 N/mm
- Max line speed = V = 300 m/min

- Brake mounted directly on reel shaft

- Max Torque = T*W*D / 2 = 0.4*1000*1.200 / 2 = 240 Nm
- Min torque = t*w*d / 2 = 0.3*600*0.100 / 2 = 9 Nm
- Max heat = T*W*V / 60000 = 0.4*1000*300 / 60000 = 2.0 kW
- Max rotational speed = V / (d * π) = 300 / (0.100 * π) = 955 rpm

- Effective cooling speed = (2*V) / [(D + d) * π] = (2*300) / [(1.2 + 0.1) * π] = 147 rpm

The effective cooling speed compensates for the fact that the reel rotates at slow speed longer than it does at high speed.

Selection is based on:

- a) Heat transfer capability at Effective Cooling Speed
- b) Max & Min torque requirements
- c) Max speed capability

A Wichita Mistral 200/2 brake with an integral cooling fan (shown on page 24) would suit all the parameters. The choice depends on the customer preference with regard to the overall size of the brake and the best shape to suit the machine aesthetics.
“ModEvo” Tension Control Brake

The name for Wichita’s ModEvo tension control brake is derived from ‘modular’ and ‘evolutionary’, terms that describe it perfectly. Modular – because braking systems to suit diverse tensioning applications can be assembled from a minimal number of modules common to the entire ModEvo range. Evolutionary – because continuous development of new materials, improved design and manufacturing techniques have enabled Wichita to develop ModEvo to match all customers’ tension needs at affordable cost.

The advantages of the new ModEvo brake lie in the versatility of the modular system, ensuring that the requirements of a wide range of printing and converting unwind tension applications can be met from just a handful of parts common to the ModEvo range. This in turn brings cost benefits, as users can choose just the options they require and add to or upgrade these as their needs change, whilst carrying a minimum of spare parts.

Actuator options

More force, no loss of torque precision

Newly developed rolling diaphragm actuators are used in ModEvo, producing more force than previous designs to allow higher torque ratings. However, the sensitivity for which rolling diaphragms are favoured is not compromised. Three actuator options are available, offering clamping forces of 100%, 60% or 25%.

The finned, die-cast aluminium brake module is common to all brake disc diameters. Each module houses two pairs of actuators and allows friction pads to be changed quickly without dismantling the module.

Friction Pad options

Match machine requirements exactly

To provide maximum flexibility when selecting the required torque/tension range for an application, two pad options are available with different coefficients of friction: Low (μ=0.20); colour coded Orange and Standard (μ=0.35); colour coded Grey. Pad types may be mixed within a single brake assembly to provide an exact match to machine requirements.
The name “ModEvo” comes from Wichita’s ‘modular’ – ‘evolutionary’ design of tension brake. The original ModEvo tension brake was launched in 2000 and has been highly successful in the global tension market.

Wichita is now happy to extend the successful ModEvo range to include the single actuator ModEvo. Designed for lighter tension duties, the single actuator unit is available with all of the same options as the dual acting unit. We believe it offers our customers even greater flexibility in their applications.

With the added benefit of lower cost, we expect this unit to be a great success in the tension market, whilst maintaining the high Wichita quality standards.

**Performance**

<table>
<thead>
<tr>
<th>MODEL</th>
<th>Torque Nm</th>
<th>Heat capacity for effective cooling speeds:</th>
<th>Max Speed rpm(S)</th>
<th>Inertia (J) kgm²</th>
<th>Weight kg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min(var)</td>
<td>Max @ 6 bar</td>
<td>50rpm</td>
<td>100rpm</td>
<td>200rpm</td>
</tr>
<tr>
<td>250/1</td>
<td>5</td>
<td>85</td>
<td>149</td>
<td></td>
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<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td>300/1</td>
<td>6</td>
<td>108</td>
<td>189</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>350/1</td>
<td>8</td>
<td>130</td>
<td>228</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>400/1</td>
<td>10</td>
<td>152</td>
<td>267</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>450/1</td>
<td>11</td>
<td>176</td>
<td>308</td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Min torque listed is with standard friction coefficient with a single actuator.
For LC Low Coefficient multiply Min torque by 0.6
(2) LC - Low Coefficient based on 0.2 Coefficient of friction
(3) Std - Standard based on 0.35 Coefficient of friction
(5) Max speed is with standard brake disc. A high speed disc capable of 50% higher speed is available (derate heat by 10%)

All torque values are obtained based on Wichita’s new ModEvo Rolling Diaphragm Actuators
Smaller area (60% and 25%) Rolling Diaphragm actuators are also available for lower torque requirements

Limit to 2.5kw /actuator (normal or 2.8kw /actuator (fan cooled)
**Performance Charts**

<table>
<thead>
<tr>
<th>MODEL</th>
<th>Torque Nm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min (øA)</td>
</tr>
<tr>
<td></td>
<td>0.2 bar</td>
</tr>
<tr>
<td></td>
<td>50rpm</td>
</tr>
<tr>
<td>250/1</td>
<td>5</td>
</tr>
<tr>
<td>250/2</td>
<td>10 (5)</td>
</tr>
<tr>
<td>250/4</td>
<td>20 (5)</td>
</tr>
<tr>
<td>250/6</td>
<td>30 (5)</td>
</tr>
<tr>
<td>300/1</td>
<td>6</td>
</tr>
<tr>
<td>300/2</td>
<td>14 (7)</td>
</tr>
<tr>
<td>300/4</td>
<td>28 (7)</td>
</tr>
<tr>
<td>300/6</td>
<td>42 (7)</td>
</tr>
<tr>
<td>300/8</td>
<td>56 (7)</td>
</tr>
<tr>
<td>350/2</td>
<td>16 (8)</td>
</tr>
<tr>
<td>350/4</td>
<td>32 (8)</td>
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<tr>
<td>350/6</td>
<td>48 (8)</td>
</tr>
<tr>
<td>350/8</td>
<td>64 (8)</td>
</tr>
<tr>
<td>350/10</td>
<td>80 (8)</td>
</tr>
<tr>
<td>400/2</td>
<td>20 (10)</td>
</tr>
<tr>
<td>400/4</td>
<td>40 (10)</td>
</tr>
<tr>
<td>400/6</td>
<td>60 (10)</td>
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<tr>
<td>400/8</td>
<td>80 (10)</td>
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<tr>
<td>400/10</td>
<td>100 (10)</td>
</tr>
<tr>
<td>400/12</td>
<td>120 (10)</td>
</tr>
<tr>
<td>450/2</td>
<td>21 (11)</td>
</tr>
<tr>
<td>450/4</td>
<td>42 (11)</td>
</tr>
<tr>
<td>450/6</td>
<td>63 (11)</td>
</tr>
<tr>
<td>450/8</td>
<td>84 (11)</td>
</tr>
<tr>
<td>450/10</td>
<td>105 (11)</td>
</tr>
<tr>
<td>450/12</td>
<td>126 (11)</td>
</tr>
<tr>
<td>450/14</td>
<td>147 (11)</td>
</tr>
</tbody>
</table>

**Dimensions**

- øA - Disc Size
- øB - Overall
- øC - Bolt P.C.D
- øD - Clearance Dia.
- U - As cast bore
- Max. Bore
- Z˚ - Angular Position
- Maximum No. of Brake Modules
- Wichita. Generic Drawing No.
## ModEvo Dimensions Table

<table>
<thead>
<tr>
<th>øA - Disc Size</th>
<th>250</th>
<th>300</th>
<th>350</th>
<th>400</th>
<th>450</th>
</tr>
</thead>
<tbody>
<tr>
<td>øB - Overall</td>
<td>324</td>
<td>369</td>
<td>415</td>
<td>461</td>
<td>508</td>
</tr>
<tr>
<td>øC - Bolt P.C.D</td>
<td>298.5</td>
<td>343.5</td>
<td>389</td>
<td>435.5</td>
<td>482.5</td>
</tr>
<tr>
<td>øD - Clearance Dia.</td>
<td>90</td>
<td>140</td>
<td>190</td>
<td>240</td>
<td>290</td>
</tr>
<tr>
<td>U - As cast bore</td>
<td>SOLID</td>
<td>SOLID</td>
<td>SOLID</td>
<td>SOLID</td>
<td>SOLID</td>
</tr>
</tbody>
</table>

### ModEvo Performance Charts

<table>
<thead>
<tr>
<th>kW</th>
<th>200rpm</th>
<th>300rpm</th>
<th>400rpm</th>
<th>500 rpm</th>
<th>600 rpm</th>
<th>Min torque @ 6 bar</th>
<th>Max speed rpm</th>
<th>Inertia (J) kgm²</th>
<th>Weight kg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>rpm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rpm</td>
<td></td>
<td>total rotating</td>
<td></td>
</tr>
<tr>
<td>2250</td>
<td>0.060</td>
<td>12.4</td>
<td>13.2</td>
<td>17.6</td>
<td>22.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1900</td>
<td>0.125</td>
<td>17.3</td>
<td>18.1</td>
<td>22.5</td>
<td>27.0</td>
<td>31.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1650</td>
<td>0.23</td>
<td>24.8</td>
<td>29.2</td>
<td>33.7</td>
<td>38.2</td>
<td>42.7</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1450</td>
<td>0.4</td>
<td>31.3</td>
<td>35.7</td>
<td>40.2</td>
<td>44.7</td>
<td>49.2</td>
<td>53.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1250</td>
<td>0.61</td>
<td>37.5</td>
<td>41.9</td>
<td>46.4</td>
<td>50.9</td>
<td>55.4</td>
<td>59.8</td>
<td>64.3</td>
<td></td>
</tr>
</tbody>
</table>

- Min torque listed is with standard friction coefficient. Values in (brackets) are with a single actuator.
- For LC Low Coefficient multiply Min torque by 0.6.
- LC - Low Coefficient based on 0.2 Coefficient of friction
- Std - Standard based on 0.35 Coefficient of friction
- Max speed is with standard brake disc. A high speed brake disc capable of 50% higher speed is also available (reduce heat by 10%)
- All torque values are obtained based on Wichita’s new ModEvo Rolling Diaphragm Actuators. Smaller area (60% and 25%) Rolling Diaphragm actuators are also available for lower torque requirements.
- Limit to 2.5kw /actuator (normal or 2.8kw /actuator (fan cooled))
Wichita Mistral brakes

A high performance range of brakes, especially designed for modern corrugating machines to allowing high line speeds within a compact design of brake. An integrated fan is housed within the brake to give high heat dissipation and multi-range actuators allow precise selection of brake torque capacity for optimum tension control.

CHARACTERISTICS
- Pneumatically applied – spring release.
- Single disc design.
- Integrated cooling fan for increased heat dissipation.
- Fully guarded – needs no additional guard.
- End of shaft mounting.
- Maximum air pressure 5.5 bar.
- Easy maintenance – automatic air and electrical supply disconnection on front cover removal.
- For dry use only.

MOUNTING PRECAUTIONS
- Back casing of brake must be supported by machine frame.
- Inner hub of brake must be supported by machine shaft.
- Designed for horizontal shaft axis. Consult Wichita if vertical mounting is required.

TORQUE
- Torque is directly proportional to air pressure applied.
- Standard or Low coefficient (LC) friction pads for various torque requirements.
- Multi-range actuators for optimum torque selections.

OPTIONS
- Larger hub bores may be possible with special designs.
- Speed detection sensors.
- Infra red positional sensors.
- Mini actuators for lower torque requirements.
- 24V DC or 110V and 220V AC fans.

TYPICAL APPLICATION
## PERFORMANCE - SELECTION TABLE

<table>
<thead>
<tr>
<th>Model</th>
<th>Dynamic Slipping Torque Capacity</th>
<th>Heat Transfer Capacity</th>
<th>Max Speed</th>
<th>Inertia of Rotating Parts</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>@ 0.2 BAR *</td>
<td>@ 5.5 BAR</td>
<td>No fan</td>
<td>With fan</td>
<td></td>
</tr>
<tr>
<td>Mistral</td>
<td>[Nm]</td>
<td>[Nm]</td>
<td>[kW]</td>
<td>[kW]</td>
<td>[kW]</td>
</tr>
<tr>
<td>Mistral</td>
<td>@ 0.2 BAR *</td>
<td>@ 5.5 BAR</td>
<td>Cont</td>
<td>30 Min On/Off</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[Nm]</td>
<td>[Nm]</td>
<td>[kW]</td>
<td>[kW]</td>
<td>[min⁻¹]</td>
</tr>
<tr>
<td>200/2/LC</td>
<td>4</td>
<td>200</td>
<td>1,1</td>
<td>2,4</td>
<td>2,8</td>
</tr>
<tr>
<td>200/2</td>
<td>5</td>
<td>300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200/4/LC</td>
<td>8 (4)</td>
<td>400</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200/4</td>
<td>10 (5)</td>
<td>600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200/6/LC</td>
<td>12 (4)</td>
<td>600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200/6</td>
<td>15 (5)</td>
<td>900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>280/3/LC</td>
<td>5</td>
<td>400</td>
<td>1,4</td>
<td>4,8</td>
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<td>600</td>
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<tr>
<td>280/6/LC</td>
<td>10 (5)</td>
<td>800</td>
<td>1,4</td>
<td>4,8</td>
<td>5,2</td>
</tr>
<tr>
<td>280/6</td>
<td>12 (6)</td>
<td>1200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>280/9/LC</td>
<td>15 (5)</td>
<td>1200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>280/9</td>
<td>18 (6)</td>
<td>1800</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### NOTES

* Torque value at 0.2 bar is for full quantity of actuators.
  Torque at minimum quantity of actuators is shown in (parenthesis).
  Torque at zero air pressure = zero Nm.
**DIMENSIONS**

![Diagram of Wichita Mistral brakes]

**Table of Dimensions**

<table>
<thead>
<tr>
<th>Model (l)</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>295</td>
<td>260</td>
<td>220</td>
<td>H7</td>
<td>N/A</td>
<td>60</td>
<td>6</td>
<td>3 x M12</td>
<td>25</td>
<td>50</td>
<td>40</td>
<td>178</td>
<td>0</td>
<td>70</td>
</tr>
<tr>
<td>280</td>
<td>410</td>
<td>355</td>
<td>N/A</td>
<td>175</td>
<td>H7</td>
<td>65</td>
<td>0</td>
<td>3 x M16</td>
<td>30</td>
<td>60</td>
<td>20</td>
<td>192</td>
<td>9.5</td>
<td>80</td>
</tr>
</tbody>
</table>

**Table of Fan Voltages and Actuator/Inlet**

<table>
<thead>
<tr>
<th>Model</th>
<th>Fan Voltages</th>
<th>Fan Power</th>
<th>Electric</th>
<th>Pneum.</th>
<th>Actuator/Inlet</th>
<th>‘AA’</th>
<th>‘BB’</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>110VAC or 24VDC</td>
<td>20 W</td>
<td>PG9</td>
<td>1/8 BSP</td>
<td>200/2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>220VAC or 110VAC</td>
<td>25 W</td>
<td>3/8 NPT</td>
<td>1/8 NPT</td>
<td>200/4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>280</td>
<td>110VAC or 24VDC</td>
<td></td>
<td>M16</td>
<td>1/8 BSP</td>
<td>200/6</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PG9</td>
<td>1/8 BSP</td>
<td>280/3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3/8 NPT</td>
<td>1/8 NPT</td>
<td>280/6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>280/9</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>
Pneumatically actuated, water cooled brakes designed for use in constantly slipping applications. Utilising copper alloy wear plates, the brake has a high power rating within a reduced envelope size. Optimum torque selection is achieved by utilising either a single annular piston or multiple piston actuators for finer torque control. Visual wear indicator is incorporated in standard.

**CHARACTERISTICS**
- Pneumatically applied – spring released.
- 1 or 2 disc design.
- Water cooled incorporating copper alloy plates for high heat dissipation.
- For dry use only on friction surfaces.
- Fully incorporated guard.
- Easy maintenance.
- End-of-shaft or through shaft mounting.

**MOUNTING PRECAUTIONS**
- Outer ring of brake must be supported by machine frame.
- Inner hub of brake must be supported by machine shaft.
- Designed for horizontal shaft axis. Consult Wichita if vertical mounting is required.
- Through-shaft models require centre guard of brake removed.

**SAFETY**
- Maximum air pressure 5.5 bar.
- Maximum water inlet pressure is 2.7 bar.

**TORQUE**
- Torque is directly proportional to air pressure applied.

**OPTIONS**
- High speed – high performance materials available for increased rotational speeds.
- Larger hub bores may be possible with special designs.
- MR - Multi-range actuators for optimum torque selection available on all sizes.

**TYPICAL APPLICATION**
Wichita CAB - Copper Alloy Brakes

PERFORMANCE - SELECTION TABLE

<table>
<thead>
<tr>
<th>Model</th>
<th>Dynamic slip torque @ 0.2 bar Nm</th>
<th>Dynamic slip torque @ 5.5 bar Nm</th>
<th>Heat transfer capacity kW</th>
<th>Max speed rpm</th>
<th>Inertia Hub &amp; drive plate m² kgm²</th>
<th>Total brake kg</th>
<th>Hub &amp; drive plate kg</th>
<th>Water flow L/min</th>
<th>Piston displacement volume new cm³ worn cm³</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAB 123</td>
<td>20</td>
<td>380</td>
<td>12.5</td>
<td>3150</td>
<td>32</td>
<td>7</td>
<td>7</td>
<td>67</td>
<td>405</td>
</tr>
<tr>
<td>CAB 223</td>
<td>40</td>
<td>760</td>
<td>25</td>
<td>3150</td>
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<td>1050</td>
<td>25</td>
<td>2250</td>
<td>50</td>
<td>17</td>
<td>13</td>
<td>134</td>
<td>810</td>
</tr>
<tr>
<td>CAB 231/MR 5</td>
<td>20</td>
<td>525</td>
<td>50</td>
<td>2250</td>
<td>50</td>
<td>17</td>
<td>13</td>
<td>134</td>
<td>810</td>
</tr>
<tr>
<td>CAB 231/MR 10</td>
<td>40</td>
<td>1050</td>
<td>50</td>
<td>2250</td>
<td>50</td>
<td>17</td>
<td>13</td>
<td>134</td>
<td>810</td>
</tr>
<tr>
<td>CAB 231</td>
<td>80</td>
<td>2100</td>
<td>50</td>
<td>2250</td>
<td>50</td>
<td>17</td>
<td>13</td>
<td>134</td>
<td>810</td>
</tr>
<tr>
<td>CAB 145</td>
<td>125</td>
<td>3300</td>
<td>50</td>
<td>1590</td>
<td>50</td>
<td>17</td>
<td>13</td>
<td>134</td>
<td>810</td>
</tr>
<tr>
<td>CAB 245/MR 5</td>
<td>62</td>
<td>1650</td>
<td>100</td>
<td>1590</td>
<td>50</td>
<td>17</td>
<td>13</td>
<td>134</td>
<td>810</td>
</tr>
<tr>
<td>CAB 245/MR 10</td>
<td>125</td>
<td>3300</td>
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<td>50</td>
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<td>134</td>
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<tr>
<td>CAB 245</td>
<td>250</td>
<td>6600</td>
<td>100</td>
<td>1590</td>
<td>50</td>
<td>17</td>
<td>13</td>
<td>134</td>
<td>810</td>
</tr>
</tbody>
</table>

DIMENSIONS

Water inlet temperature 10° C min. - 50° C max.
Max temperature rise across brake = 25° C.
If a lower minimum torque is required please consult Wichita.
**WATER HOSE CONNECTIONS**

<table>
<thead>
<tr>
<th>Model</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>E</th>
<th>F</th>
<th>H</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>Q</th>
<th>S</th>
<th>T</th>
<th>U1</th>
<th>U2</th>
<th>V</th>
<th>W</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAB 123</td>
<td>230</td>
<td>225</td>
<td>85</td>
<td>78</td>
<td>51</td>
<td>–</td>
<td>193</td>
<td>71</td>
<td>73.5</td>
<td>276</td>
<td>60</td>
<td>15</td>
<td>40</td>
<td>9</td>
<td>4</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td>CAB 223</td>
<td>230</td>
<td>225</td>
<td>85</td>
<td>78</td>
<td>150</td>
<td>27</td>
<td>291</td>
<td>71</td>
<td>73.5</td>
<td>276</td>
<td>60</td>
<td>15</td>
<td>40</td>
<td>9</td>
<td>4</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td>CAB 131</td>
<td>310</td>
<td>280</td>
<td>120</td>
<td>76</td>
<td>55</td>
<td>–</td>
<td>200</td>
<td>73</td>
<td>74</td>
<td>30</td>
<td>370</td>
<td>60</td>
<td>25</td>
<td>75</td>
<td>14</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>CAB 231</td>
<td>310</td>
<td>280</td>
<td>120</td>
<td>76</td>
<td>152</td>
<td>27</td>
<td>300</td>
<td>73</td>
<td>74</td>
<td>30</td>
<td>370</td>
<td>60</td>
<td>25</td>
<td>75</td>
<td>14</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>CAB 145</td>
<td>450</td>
<td>445</td>
<td>162</td>
<td>80</td>
<td>72</td>
<td>–</td>
<td>238</td>
<td>89</td>
<td>92</td>
<td>20</td>
<td>528</td>
<td>50</td>
<td>35</td>
<td>100</td>
<td>18</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>CAB 245</td>
<td>450</td>
<td>445</td>
<td>162</td>
<td>90</td>
<td>180</td>
<td>35</td>
<td>362</td>
<td>89</td>
<td>92</td>
<td>20</td>
<td>528</td>
<td>50</td>
<td>35</td>
<td>100</td>
<td>18</td>
<td>8</td>
<td>16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>W1</th>
<th>W2</th>
<th>W3</th>
<th>W4</th>
<th>W5</th>
<th>W6</th>
<th>W7</th>
<th>A1</th>
<th>A2</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAB 123</td>
<td>44</td>
<td>325</td>
<td>60</td>
<td>110</td>
<td>130</td>
<td>140</td>
<td>200</td>
<td>115</td>
<td>20</td>
<td>1/2</td>
<td>3/4</td>
<td>3/8</td>
</tr>
<tr>
<td>CAB 223</td>
<td>44</td>
<td>325</td>
<td>60</td>
<td>110</td>
<td>130</td>
<td>140</td>
<td>200</td>
<td>115</td>
<td>20</td>
<td>1/2</td>
<td>3/4</td>
<td>3/8</td>
</tr>
<tr>
<td>CAB 131</td>
<td>44</td>
<td>445</td>
<td>50</td>
<td>100</td>
<td>110</td>
<td>–</td>
<td>–</td>
<td>155</td>
<td>20</td>
<td>1/2</td>
<td>3/4</td>
<td>3/8</td>
</tr>
<tr>
<td>CAB 231</td>
<td>44</td>
<td>445</td>
<td>50</td>
<td>100</td>
<td>110</td>
<td>100</td>
<td>160</td>
<td>155</td>
<td>20</td>
<td>1/2</td>
<td>3/4</td>
<td>3/8</td>
</tr>
<tr>
<td>CAB 145</td>
<td>60</td>
<td>445</td>
<td>60</td>
<td>110</td>
<td>130</td>
<td>–</td>
<td>–</td>
<td>225</td>
<td>20</td>
<td>3/4</td>
<td>1</td>
<td>3/8</td>
</tr>
<tr>
<td>CAB 245</td>
<td>60</td>
<td>445</td>
<td>60</td>
<td>110</td>
<td>130</td>
<td>135</td>
<td>198</td>
<td>225</td>
<td>20</td>
<td>3/4</td>
<td>1</td>
<td>3/8</td>
</tr>
</tbody>
</table>

* -0.0/+0.1 mm

**DIMENSIONS:** Certified drawings showing exact dimensions are sent with every order acknowledgement and these should always be obtained before finalising any design details.
### PNEUMATIC BRAKE DRIVER

The pneumatic driver - an electro-pneumatic transducer - has to have a fast response in order to avoid difficulties when used in closed loop system.

All the pneumatic brakes are rated for the max air pressure 5,5 Bar.

<table>
<thead>
<tr>
<th>Model</th>
<th>Electrical input</th>
<th>Air pressure supply range</th>
<th>Air pressure output range</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPC-V</td>
<td>0 – 10 VDC</td>
<td>1 - 10 bar</td>
<td>0 - 9 bar</td>
</tr>
<tr>
<td>Piping gauge</td>
<td>G 3/8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filter required</td>
<td>5 μ, dry air</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting position</td>
<td>Vibrations free, preferably vertical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Supply</td>
<td>24 VDC / 100 mA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The electro-pneumatic transducer has to be placed as close as possible to the brake. Excessive air piping length will penalise the controllability of the system.

### WIRING with ALTRAЕASY CONTROLLER

<table>
<thead>
<tr>
<th>EPC-V (EPC-I) connections</th>
<th>ALTRAЕASY CONNECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>White (signal EPC-V)</td>
<td>Output 1</td>
</tr>
<tr>
<td>Brown (+24 VDC)</td>
<td>C3-9</td>
</tr>
<tr>
<td>Blue (0 VDC)</td>
<td>C7-1</td>
</tr>
<tr>
<td>Black (display output)*</td>
<td>C3-10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ALTRAЕASY CONNECTIONS</th>
<th>Output 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>C3-11</td>
<td>C3-12</td>
</tr>
<tr>
<td>C7-1</td>
<td>C7-1</td>
</tr>
<tr>
<td>NOT USED</td>
<td>NOT USED</td>
</tr>
</tbody>
</table>

Exhaust port G 1/4"

Air pressure output port G 3/8"

Air pressure supply port G 3/8"

Gauge port
Most tension controls work in closed loop configuration. In this case the **controller** is indispensable. This element is the heart of the system. The control is continuously comparing the web tension information coming from the **sensor** with the tension reference we give to the controller. As soon as the controller detects a difference between the two values a correction is applied to the power element through the driver.

### WICHITA CONTROL LINE OVERVIEW

![Diagram of control system]

**Low cost analogue control** **including driver** in 2 versions:
- Altra Steady Plus With P.I.D
- Altra Steady Standard Version

**Digital control**
- Altra Easy (with flying splice capability)

**Typical applications**
Altra Steady control is based on adjustable P, I, and D terms. The loop gain can be set on front face potentiometers. Switcheable gain for large roll diameter ratio change. To ensure proper operation it is important to wire the function “Drift Stop”. This function releases the Integral term as soon as the machine runs. The Altra Steady is dedicated to Dancer Control and electric brakes only.

ANALOGUE CONTROL

<table>
<thead>
<tr>
<th>Power supply</th>
<th>110-220 VAC selectable</th>
<th>Open front face to access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output current capability</td>
<td>Max 2, 5 Amps, shortcircuit protected</td>
<td>Front face potentiometer</td>
</tr>
<tr>
<td>User settings</td>
<td>Loop gain</td>
<td>Front face potentiometer</td>
</tr>
<tr>
<td></td>
<td>Offset torque</td>
<td></td>
</tr>
<tr>
<td>Output voltage</td>
<td>0-24 VDC (0-10 VDC Steady Plus)</td>
<td>Compatible all Wichita electric brakes</td>
</tr>
<tr>
<td>Housing</td>
<td>Metal rugged housing</td>
<td></td>
</tr>
<tr>
<td>Loop gain</td>
<td>2 adjustable range selection</td>
<td>Can be changed during operation</td>
</tr>
<tr>
<td>Accessories</td>
<td>Dancer arm (Loadcell Steady Plus)</td>
<td></td>
</tr>
</tbody>
</table>

Technical information

Altra Steady control is based on classical and fixed PID terms. The loop gain can be set on front face potentiometer. Due to the fixed PID terms, its use is limited in terms of roll diameter ratio. One input is provided to change the loop gain and has to be used when diameter ratio exceeds 8 to 10. To ensure proper operation it is important to wire the function “Drift Stop”. This function releases the Integral term as soon as the machine runs.
The Altra Easy high performance tension controller offers probably the most versatile web tension control system on the market today.

Whether your interest is as system integrator, maintenance, production or quality control manager, the powerful tools will be of benefit to all.

The intuitive Windows based software suite provides powerful diagnostic, management and data logging tools. Graphical PID tuning makes light work of commissioning.

Designed in association with TTS, this controller may be configured to control tension on unwind stands or winders working with any electric or pneumatic brakes via appropriate drivers. The one unit interfaces with load cells, dancers and diameters measurement devices as well as handling splicing.

Features and Benefits:
- Data logging and diagnostic software tools included
- No complicated menus
- For use with load cells or dancers
- MODBUS communication
- Diameter functions
- Graphical PID tuning and configuration
- No internal adjustments required
- 24V Supply
- A range of support products is available

Altra Easy configuration options

Load Cell Control

Load Cells measure the force in the web and compare that force to the set point tension in the controller.

If there is any variation, the controller automatically increases or decreases the output, thus maintaining constant tension.

Dancer Control

The Dancer indicates a position error which is proportional to the web tension, and the controller compares that position to the set point within the controller. If there is any variation the controller automatically increases or decreases the output, thus maintaining constant tension.

Ultrasonics

Can be used in open or closed loop mode with the controller.

The signal from the ultrasonic device is used to measure the diameter of the reel.
Altra Easy - Important features

The Altra Easy is provided with very interesting and useful features. Below is a brief description of the most interesting ones.

As already stated, the main problem in tension control is the roll inertia change during operation. The PID function is optimal for one inertia value. The Altra Easy is provided with an important PID correction feature. Based on the available diameter information you can apply continuous PID correction; when no information is available, an internal PID change can be programmed.

Each parameter P, I and D can be set individually for the smallest (core) and biggest diameter. As soon as the correct parameters are found for the extreme diameter value, they are stored. The diameter information provided will fix the PID values for the present diameter value. This will allow the system to keep an excellent stability during the whole diameter evolution. In the case where the diameter information is not available we can provide this signal by installing a sonic sensor or by working with internal correction. The external diameter information supplied to the controller will ensure a better precision compensation compared to an internal correction.

WHATEVER YOU NEED, THE ALTRA EASY IS CAPABLE ...

<table>
<thead>
<tr>
<th>You need</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>the tension control connected to PC.</td>
<td>RS232 communication.</td>
</tr>
<tr>
<td>an adaptive PID due to big diameter ratio.</td>
<td>internal or external PID correction.</td>
</tr>
<tr>
<td>your own load cell.</td>
<td>Altra Easy can accept any signal.</td>
</tr>
<tr>
<td>flying splice on the machine.</td>
<td>Altra Easy can manage it.</td>
</tr>
<tr>
<td>to control a brake and a motor.</td>
<td>Altra Easy can control both.</td>
</tr>
<tr>
<td>a multi-material machine range.</td>
<td>Operator selectable programs.</td>
</tr>
<tr>
<td>taper function.</td>
<td>Altra Easy can manage it.</td>
</tr>
<tr>
<td>a 0-10 V.</td>
<td>Altra Easy can accept any signal range.</td>
</tr>
<tr>
<td>to work in open + closed loop.</td>
<td>Altra Easy is provided with both function.</td>
</tr>
<tr>
<td>a perfect setting.</td>
<td>Save it to a laptop computer.</td>
</tr>
<tr>
<td>to display the tension in Newton, kilo...</td>
<td>Altra Easy can be programmed for any unit.</td>
</tr>
<tr>
<td>a very special application.</td>
<td>We can assist you in control definition.</td>
</tr>
</tbody>
</table>

Ask a Wichita representative, we can propose any customised solution / software.
The cost effective alternative to digital

The Wichita Altra Sonic is an open loop analogue regulated tension controller designed to maintain stable web tension during the steady running phase of unwinding and rewinding operations. Simple to set up and use, the Altra Sonic is an analogue device that enables the tension control user to save a significant percentage of the cost of buying and commissioning one of the more complex digital controllers from the Wichita range.

Consistent web tension

Working in an open-loop configuration the controller receives an input from a scalable ultrasonic sensor, or a reel follower arm monitoring the change in diameter of the unwind or rewind reel on the machine, then adjusts the applied torque proportionately according to the reference settings programmed into the brake driver.

Remote operation and clear display

The brake on the machine can be operated from the Altra Sonic during the unloading and loading of reels and also via an optional external switch which can be positioned by the brake if required. The display on the controller is clear and simple, with a moving bar array indicating the percentage output to the brake. The position of the function rotary switch indicates the status of the ‘Run’, ‘Manual’, ‘Hold’ and ‘Brake Off’ functions.

Easy set-up

Setting up the controller is straightforward. The Altra Sonic receives its input from a scalable ultrasonic sensor. The sensor scaling can be pre-programmed at the factory if the range details are given at the point of order, or they can be manually achieved via the enclosed instructions. The output signal is sent to an EPC-V brake driver, which converts the electrical signal to pneumatic pressure for the brake, or to the MCS2000-DRV driver if an electromagnetic brake is used.

Tension controller Altra Sonic

Potentiometer-regulated analogue input tension controller.

Scalable ultrasonic sensor

The sensor emits an ultrasonic signal towards the surface of the reel. The reflected waveform serves as a means of measuring the distance to the reel and its changing diameter, thus signalling to the controller to adjust the torque.

Brake driver for pneumatic brake

Wichita’s electrical to pressure transducer is used to convert the electrical output signal from the tension controller to the pneumatic pressure required to operate the brake.

Wichita Pneumatic tension brake

Wichita offers a wide range of air cooled, fan cooled and water cooled tension brakes. The brakes are pneumatically applied via multi-range actuators to provide maximum flexibility with smooth tension control over a wide range of requirements. Torque range from 5 Nm to 200 000 Nm (3.7 lb.ft to 147500 lb.ft).
Working in closed loop requires a web tension sensor. When working with load cell the system is called “Direct Tension Feedback”. When working with dancer arm the system is called “Indirect Tension Sensor”. Position sensors are divided in two categories: linear and rotary.

**Sensors Overview**

<table>
<thead>
<tr>
<th>Model</th>
<th>Type / Symbol</th>
<th>Range</th>
<th>Main Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES01</td>
<td>End shaft load cell</td>
<td>10 - 500Kg</td>
<td>Typical output voltage: 10 mV at full load, Resistive bridge, 40 mm ball bearing diam.</td>
</tr>
<tr>
<td>TE</td>
<td>Foot mounted load cell</td>
<td>10Kg to 10 tonnes</td>
<td>Typical output voltage: 10 mV at full load, Resistive bridge</td>
</tr>
<tr>
<td>RPS</td>
<td>Rotary</td>
<td>±30°</td>
<td>Typical output voltage: ±3.0 VDC for ±10 VDC power supply and ±30°</td>
</tr>
<tr>
<td>SCUA 2000</td>
<td>Linear</td>
<td>0 to 2 m</td>
<td>Typical output voltage: 0-10 VDC for 0 - 2m</td>
</tr>
</tbody>
</table>

**Do Not Forget:** The sensor is the most important element when working in closed loop, and has to be accurate, with good repeatability.
- Place load cell in order to measure web tension, minimize the dead load and all other stress interferences on it.
- When using dancer solution create the desired tension with true force (pneumatic cylinder) and not with weight.
- When measuring distance avoid hysteresis in the movement. In general, the sensor must be the exact image of the value we have to measure.
**End shaft load cell type ES**

**END SHAFT LOAD CELLS** are normally used in new machines designed with the possibility to place the load cell directly on the sensing roll. The end shaft version offers the advantage of being able to easily place the load cell in any tension resultant direction.

This shaft end tension loadcell uses a high sensitivity beam structure as the sensing element, and tool steel material to increase overload capacity. End of shaft mounting makes it easy to install; it is accurate and durable for use in tension force measurement.

All end shaft load cells are based on the Wheatstone bridge principle. They have no built in amplifier. They are delivering a signal which is proportional to the voltage supply and tension applied. It is important to respect the measurement direction referenced on the load cell body (normally an arrow indicates the sensitive direction).

**Features:**

* Tool Steel Material
* Easy Installation
* Precision
* To 10, 25, 50, 100, 200, 350, 500 KG

**Installed Dimensions:**

**Specifications:**

- **Rated Output** .......................................................... 1m V/V
- **Total Error** .......................................................... 0.3% R.O.
- **Repeatability** ......................................................... 0.2% R.O.
- **Creep** .................................................................. 0.1%/20 min
- **Input Resistance** ................................................... 405 ± 25 Ω
- **Output Resistance** .................................................. 350 Ω
- **Max Excitation Voltage** .......................................... 20 v
- **Recommended Excitation Voltage** .......................... 10 v
- **Compensated Temperature Range** ......................... 10~50 °C
- **Safe Temperature Range** ....................................... 20~70 °C
- **Temp. Effect On Zero Balance** ............................... 0.05%/10 °C
- **Temp. Effect on Rated Output** ............................... 0.03%/10 °C
- **Zero Balance** ........................................................ ± 3% R.O.
- **Safe Overload Rating** ............................................. 300%
- **Cable Length** .......................................................... 300%
- **Cable Connection** .................................................. Input: Red (+) Black (-) / Output: Green (+) White (-)

<table>
<thead>
<tr>
<th>ALTRA EASY CONNECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CELL1</strong></td>
</tr>
<tr>
<td>RED (+ input)</td>
</tr>
<tr>
<td>Black (- input)</td>
</tr>
<tr>
<td>Green (+ output)</td>
</tr>
<tr>
<td>White (- output)</td>
</tr>
<tr>
<td>Shield</td>
</tr>
</tbody>
</table>
Foot Mounted Tension Load cell

This Tension force loadcell uses a highly sensitive shear beam as the sensing element and is hermetically sealed during construction. A specially designed overload protection device greatly increases overload capacity.

Features

* Overload Protection
* Hermetically Sealed
* Precision

TE-10, 25, 50, 100, 200, 350, 500, 1T, 2T, 3T, 4T, 5T, 10T kg

Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Output</td>
<td>1 mV/V</td>
</tr>
<tr>
<td>Total Error</td>
<td>0.3 %</td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.2 %</td>
</tr>
<tr>
<td>Creep</td>
<td>0.05%/20min</td>
</tr>
<tr>
<td>Input Resistance</td>
<td>430 or 405 ± Ω</td>
</tr>
<tr>
<td>Output Resistance</td>
<td>350 Ω</td>
</tr>
<tr>
<td>Max. Excitation Voltage</td>
<td>20V</td>
</tr>
<tr>
<td>Recommended Excitation Voltage</td>
<td>10V</td>
</tr>
</tbody>
</table>

Dimensions

<table>
<thead>
<tr>
<th>TE Wire colours</th>
<th>AltraEasy connection Load Cell 1</th>
<th>AltraEasy connection Load Cell 2, (if Fitted).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red (+ ve Input)</td>
<td>C10-1</td>
<td>C10-5</td>
</tr>
<tr>
<td>Black (- ve Input)</td>
<td>C10-4</td>
<td>C10-8</td>
</tr>
<tr>
<td>Green (+ ve Output)</td>
<td>C10-2</td>
<td>C10-6</td>
</tr>
<tr>
<td>White (- ve Output)</td>
<td>C10-3</td>
<td>C10-7</td>
</tr>
<tr>
<td>Shield</td>
<td>C9</td>
<td>C9</td>
</tr>
</tbody>
</table>
ALTRAЕASY ROTARY POSITION SENSOR

Type ALTRAЕASY RPS

- Power supply: 10VDC / 15 mA
- Detecting angle: 200° (or ± 100°)
- Sensitivity*: 2.5 mV/V°
  *Example: Detect. angle = ± 30° => Sensitivity = 3.0 VDC

2. WIRING

<table>
<thead>
<tr>
<th>ROTARY POSITION SENSOR</th>
<th>ALTRAЕASY CONNECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red (+10V)</td>
<td>C10-1</td>
</tr>
<tr>
<td>Green (signal)</td>
<td>C3-3</td>
</tr>
<tr>
<td>Blue (0V)</td>
<td>C3-4</td>
</tr>
<tr>
<td>Shield C9</td>
<td></td>
</tr>
</tbody>
</table>

3. SETTING

Signal output polarity can be selected with the switch on the back flange of the sensor.

4. NOTES

Align both black index (flange + shaft) to nominal dancer arm position.
No axial or radial effort admitted on the shaft.
The coupling used should accept any alignment error between the sensor shaft and the pivot point of the dancer arm.
Rotary sensors

Working in closed loop with the arm dancer principle is very popular, especially in the printing market where a flexibility of the system is required to absorb the eventual “tension peaks”. The rotary sensor is necessary to read the dancing roll movement.

DIMENSIONS - MOUNTING
In the tension control market ultrasonic sensors have two primary uses:
- For roll diameter reading when the system operates in open loop.
- For loop position reading when the system operates in closed loop with dancer arm principle.

1. FEATURES

**Type SCUA-2000:**
- Power supply: 15 to 30 V DC / 900mW
- Analogue output: See 'TEACH-IN'
- Min distance: 120 mm
- Max distance: 2000 mm
- Accuracy: ≤0.1%
- Housing: IP 65
- Accessory available: 5 m cable
- **Default settings:**
  - 400 mm = output 0V
  - 2500 mm = output 10V
  - +ve slope

**‘TEACH-IN’ SETTING:**
The output is 0-10 V or 10V to 0V for a measured distance between 120 and 2000 mm.

**Sensor Functions:** The sensor features a four pole Temperature/Teach-In plug that can be connected in four different positions as follows:

<table>
<thead>
<tr>
<th>Plug Position</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>To TEACH-IN Distance A1</td>
</tr>
<tr>
<td>A2</td>
<td>To TEACH-IN Distance A2</td>
</tr>
<tr>
<td>E2/E3</td>
<td>To Set the +ve or -ve Slope of Voltage or Current Output from the 0 point</td>
</tr>
<tr>
<td>T</td>
<td>Temperature Compensation</td>
</tr>
</tbody>
</table>

2. TEACH-IN PROCEDURE

**TO SET LIMITS 1 & 2:**
- Switch off the sensor supply.
- Remove the TEACH-IN plug.
- Restore the sensor supply (Reset).
- Set the target to the required minimum distance (Switch Point)
- Plug-in and then remove the TEACH-IN plug in position A1 and then in A2 with the second maximum distance required. This programs the device for min and max range.

**Caution:** Removing the TEACH-IN plug enters and saves the current value of A1 or A2 into the program.

The LED-Window provides a status indication. The Green LED flashes when an object is detected, and a Red LED flashes when an object is not detected.

Plug in the TEACH-IN plug in T to complete and save the values.

**TO SET THE SLOPE:**
- Switch off the sensor supply.
- Remove the TEACH-IN plug.
- Restore the sensor supply (Reset).
- Plug-in the TEACH-IN plug into position E2/E3. Repeat the unplugging then plugging action in this position, and three different ramp modes can be selected in the following sequence:
  - LED A2 Flashes – Rising +ve Slope
  - LED A1 Flashes – Falling –ve Slope
  - LED A1 & A2 Flashes – 0 Slope
- Plug in the TEACH-IN plug in T to complete and save the Slope.

**Note:** If the TEACH-IN plug has not been inserted into the T position within 5 minutes the unit will revert to the normal mode with the last stored values and without temperature compensation.
3. WIRING:

![Wiring Diagram]

Brown = positive (15 to 30VDC)
Gray = sync
White = 0 – 10 V
Black = 4 – 20mA
Blue = negative (0V)

The signal is compatible with any 0-10V input

4. DIMENSIONS:

![Dimension Diagram]

5. MAIN WIRING:

![Main Wiring Diagram]
6. TYPICAL APPLICATION:

To read roll diameter in a Open Loop Web Tension Control application, to exploit diameter information as a torque reference or as a PID compensation in a Closed Loop application. In these cases the settings should be:

Max roll diameter (min distance) = output 10V
Diameter zero (max distance) = output 0V

(These are typical cases where we need a negative curve)

7. REMARKS AND RECOMMENDATIONS:

In scaling phase, always start with minimum distance registration. This distance should be scaled to the centre line of the roll shaft.

For typical application where we need to sense the diameter of the roll we need negative curve in order to get zero dia.=0V and max. dia.=10V

After 5 minutes operating for scaling the process is blocked. Switch off the power supply and ON again to release another 5 minutes scaling time.

It is not recommended to use the sonic sensor on reflecting material such as moss, carpet etc.....
Wichita experience enables us to offer a tension guide as shown below. For any special material not included in the chart below, please consult Wichita.

### Tension selection

**PAPER WEIGHT**

\[ F = f \times \text{width [cm]} \]

**FOIL**

\[ F = f \times \text{width [cm]} \]

**WIRE**

\[ F = f \times \text{width [cm]} \]

---

**MATERIAL DENSITY**

<table>
<thead>
<tr>
<th>Material</th>
<th>kg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper</td>
<td>920</td>
</tr>
<tr>
<td>Paper board</td>
<td>1420</td>
</tr>
<tr>
<td>Alu foil</td>
<td>2720</td>
</tr>
<tr>
<td>Alu wire</td>
<td>2750</td>
</tr>
<tr>
<td>Cu wire</td>
<td>8550</td>
</tr>
<tr>
<td>PVC</td>
<td>400-1050</td>
</tr>
</tbody>
</table>
To enable us to assist you in selecting the best product type and specification to ensure reliable and accurate tension control, please submit this APPLICATION FORM.

Please complete this form as much as possible. Please also include any other information of interest.
**Worldwide distributors**

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Australia – Warner Electric Australia  
Tel: + 61 2989 40133 Fax: + 61 2989 40368  
Email: rita.verte@warnerelectric-ap.com

Austria – Bibus Austria GmbH  
Tel: + 43 2242 33388 Fax: + 43 2242 33388  
Email: info@bibus.at

Belgium – A.Z. Hollink b.v.b.a.  
Tel: +32 3722 1118 Fax: +32 3722 1119  
Email: info@azhollink.be

Czech Republic – Bibus s.r.o.  
Tel: + 420 5471 25300 Fax: + 420 5471 25301  
Email: bibus@bibus.cz

Denmark – AVN Automation AS  
Tel: + 45 7020 0411 Fax: + 45 8722 8100  
Email: avn.automation@avn.dk

Egypt – Itaco  
Tel: + 20 2272 5754 Fax: + 20 2273 7245  
Email: itaco@link.net

Eire – Torsion Dynamics  
Tel: +35 3184 61677 Fax: +35 3184 61688  
Email: torsion@iol.ie

Finland – Knorring Oy Ab  
Tel: +35 9 56 041 Fax: +35 9 565 2463  
Email: knorring@knorring.fi

France – Fogex  
Tel: +33 1 3434 4600 Fax: +33 1 3434 4601  
Email: info@fogex.com

France – Wichita Company Limited  
Tel: +33 4503 25226 Fax: +33 4503 25227  
Email: alberto.amoros@wichita.co.uk

Germany – Warner Electric Verwaltungs GmbH  
Tel: + 49 6221 3047 Fax: + 49 6221 3047 17  
Email: rolf.riesenacker@wichita.co.uk

Greece – Dimitrios Delliannis  
Tel: +30 1061 08581 Fax: +30 1061 08583  
Email: delathen@ath.forthnet.gr

Hong Kong – Warner Shui-Hing Ltd.  
Tel: +85 2261 5913 Fax: +85 2261 59162  
Email: William.lee@warnerelectric-ap.com

Hungary – Bibus Kft  
Tel: + 36 1265 2733 Fax: + 36 1264 8900  
Email: info@bibus.hu

India – Francis Klein & Co. Pvt. Ltd.  
Tel: + 91 2053 39770 Fax: + 91 2055 39771  
Email: francis@pn2.vsnl.net.in

Indonesia – Warner Electric Singapore Pte. Ltd.  
Tel: + 65 6487 4464 Fax: + 65 6487 6674  
Email: sales@warnerelectric.com.sg

Israel – Larom Marketing  
Tel: + 97 2499 37333 Fax: + 97 2505 239552  
Email: avi@larom-marketing.co.il

Italy – Bianchi Cuscinetti, Trasmissioni E  
Tel: + 39 0267 861 Fax: + 39 0267 01062  
Email: info@bianchicuscinetti.it

Japan – Japan Wichita Co Ltd  
Tel: + 81 3345 61461 Fax: + 81 3345 61484  
Email: info@japanwichita.co.jp

Malaysia – Warner Electric Singapore Pte. Ltd.  
Tel: + 65 6487 4464 Fax: + 65 6487 6674  
Email: sales@warnerelectric.com.sg

New Zealand – Warner Electric Australia  
Tel: + 64 9268 2600 Fax: + 64 9268 3601  
Email: info@paykel.co.nz

Norway – Betamo AS  
Tel: + 47 6927 5510 Fax: + 47 6927 4550  
Email: benghans@c2i.net

Netherlands – Stemine Machinefabriek b.v.  
Tel: +31 573 252 043 Fax: +31 573 257 113  
Email: info@stemin.nl

Philippines – Warner Electric Singapore Pte. Ltd.  
Tel: + 65 6487 4464 Fax: + 65 6487 6674  
Email: sales@warnerelectric.com.sg

Poland – Bibus Menos Sp. z.o.o  
Tel: + 48 5686 09570 Fax: + 48 5686 17132  
Email: info@bibusmenos.pl

Portugal – Pinhol Gomes & Gomes Lda  
Tel: + 35 1214 256850 Fax: + 35 1214 256859  
Email: import.export@pinhol.com.pt

Republic of South Africa – Sintech  
Tel: + 27 11823 2359 Fax: + 27 11 823 2387  
Email: david@sintech.co.za

Singapore – Warner Electric Singapore Pte. Ltd.  
Tel: + 65 6487 4464 Fax: + 65 6487 6674  
Email: sales@warnerelectric.com.sg

Sweden – Lonne Scandinavia AB  
Tel: +46 (0) 4238 0300 Fax: +46 (0) 4238 0309  
Email: info.sweden@lonne.com

Switzerland – Laesser AG  
Tel: +41 6279 16841 Fax: +41 6279 13903  
Email: info@laesser-ag.ch

Taiwan – Warner Electric (Taylor) Ltd.  
Tel: +88 6225 778156 Fax: +88 6225 706358  
Email: ken.wu@warnerelectric-ap.com

Thailand – Warner Electric (Thailand) Ltd.  
Tel: +66 2322 5527 Fax: +66 2320 2380  
Email: ktitpong.brahmasakha@warnerelectric-ap.com

Turkey – Ost Olgun Dis Ticaret AS1.5  
Tel: +90 2122 460136 Fax: +90 2122 479739  
Email: ostogun@ostogun.com

United States of America – Warner Electric U.S.A.  
Tel: + 1 815 389 3771 Fax: + 1 815 389 2582  
Email: info@warnerelectric.com

United States of America – Industrial Clutch  
Tel: +1 262 547 3537 Fax: +1 262 547 2949  
Email: info@indclutch.com