Thomson WhisperTrak™ Electric Linear Actuator
Quiet, Strong and Compact
Thomson WhisperTrak™

Thomson WhisperTrak™ are the quietest addition to our well-known electric linear actuator family. This actuator range sets a standard for personal mobility, medical, rehab, office and domestic applications. It is small, quiet, washdown-proof and created from the accumulated knowledge that Thomson has gathered by being the actuator industry leader for over 40 years.

Please visit:
www.thomsonlinear.com/whispertrak

- Technical Information
- Product Selector
- CAD Models
- TechTip Videos
Features and Benefits

Thomson WhisperTrak™ linear actuators were designed to incorporate features that enable machine builders the greatest flexibility in their design. A sleek and compact design, washdown protection, electronic limit switches, and a global sales and service organization are just some of the features offered. The result is the optimum actuator for the applications it is built to serve.

**Exceptionally Quiet**
Thomson WhisperTrak linear actuators boast a low sound level of less than 45 dBA, about the same as an average library. This quiet, consistent low sound level is conducive to personal mobility applications and provides unobtrusive linear motion in an elegant package.

**Maintenance Free**
The Thomson WhisperTrak is unique in that it requires zero maintenance throughout the entire life of the actuator. The average life is 10,000 cycles (one full stroke back and forth) at the maximum load. Once properly installed, the Thomson WhisperTrak linear actuator will provide trouble-free operation with zero maintenance, thereby reducing the total cost of ownership.

**Unique Options**
The Thomson WhisperTrak linear actuator is unique in that it offers a compact machine footprint and robust features that are unavailable anywhere else. The electronic limit switches (ELS) and feedback options are available off the shelf and fit within the compact envelope of the standard model. Mounting options include standard as pictured or rotated 90 degrees.

**Permanent Sealing for Environmental Protection**
The Thomson WhisperTrak linear actuator is rated for protection class IP67 and is able to operate in harsh conditions where it is exposed to washdown, rain, dust, or other particulate without the use of any additional cover.

**Compact and Compatible**
The Thomson WhisperTrak linear actuator is one of the most compact actuators on the market with similar performance and is pin to pin compatible with virtually all competitor actuators in this segment. This allows you to easily replace an existing actuator with the WhisperTrak and gain the space saving benefits while reducing weight.
Applications

Any application which requires a small footprint or quiet operation would benefit from the Thomson WhisperTrak electric linear actuator. Specifically, personal mobility, rehab, medical equipment, office and domestic machines are well suited as a result of its compact envelope, quiet operation and one piece housing.

**Rehab and Handicap Equipment**
Personal mobility is a growing area for linear actuators. Equipment designed to offer mobility or rehabilitation to disabled, elderly, or injured people can include wheel chairs, patient lifts, handicapped accessible cars/trucks, and other rehabilitation equipment.

**Medical and Hospital Equipment**
Patient beds, x-ray machines and examination chairs are just a few examples where linear actuators are used. In fact, every place where a simple, reliable and electrified movement is needed a linear actuator is likely the answer.

**Furniture**
The quiet operation and small footprint of the Thomson WhisperTrak linear actuator make it ideal for home or office furniture. Adjustable desks, beds, reclining chairs, and the positioning of heavy TV screens benefit from the quiet, precise actuation of the WhisperTrak linear actuator.

**Limitless Possibilities**
Whether the standard product meets your specifications or you require a more customized solution, Thomson engineers are available to discuss any of your application needs.

**Bath Chair Lift**
For simple and safe handling the lift movement is electrically actuated. The Thomson WhisperTrak linear actuator is lightweight and quiet and makes cleaning easy without worry of water ingestion or exposure to detergents.

**Wheel Chair**
Wheel chairs can have up to a dozen electrified movements. In this example the back of the seat, the seat tilt angle and the foot rest are adjustable using Thomson WhisperTrak linear actuators.

**Beds**
Beds in hospitals or at home are commonly equipped with actuators to adjust different functions. In this image the back and the leg angles are adjustable but actuators are also used to tilt, turn, and position beds in almost any way imaginable to make life easier for the patient, nurse and the cleaning staff.

www.thomsonlinear.com
## Specifications

<table>
<thead>
<tr>
<th>Technical Specification</th>
<th>2000 N / 450 lbs version</th>
<th>4000 N / 900 lbs version</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Voltage</strong></td>
<td></td>
<td></td>
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<tr>
<td>Input voltage</td>
<td>[VDC] 12</td>
<td>24</td>
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<tr>
<td><strong>Load</strong></td>
<td></td>
<td></td>
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<tr>
<td>Static load (Fx), maximum [N (lbs)]</td>
<td>2000 (450)</td>
<td>4000 (900)</td>
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<tr>
<td>Dynamic load (Fx), maximum [N (lbs)]</td>
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<td>4000 (900)</td>
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<td><strong>Stroke</strong></td>
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<td></td>
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<td>Stroke lengths, standard [cm (inch)]</td>
<td>10 (3.94), 20 (7.87), 30 (11.81), 40 (15.75)</td>
<td>1, 50 (19.69)</td>
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<tr>
<td><strong>Speed</strong></td>
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<td></td>
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<tr>
<td>Speed version</td>
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<td>58A 54A</td>
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<tr>
<td>Speed, no load [mm/s (inch/s)]</td>
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<td>4.0 (0.16) 8.0 (0.31) 4.0 (0.16) 8.0 (0.31) 4.0 (0.16) 4.0 (0.16)</td>
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<tr>
<td>Speed, rated load [mm/s (inch/s)]</td>
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<td>4.0 (0.16) 8.0 (0.31) 4.0 (0.16) 8.0 (0.31) 4.0 (0.16) 4.0 (0.16)</td>
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<td><strong>Current</strong></td>
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<td>14.0 21.0 8.0 11.0 21.0 11.0</td>
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<td>14.0 21.0 8.0 11.0 21.0 11.0</td>
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<td>End play, maximum [mm (inch)]</td>
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<td>180 90 180 90 90 90</td>
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<td>Life, average [cycles]</td>
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<td>10 000</td>
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<td>Analog feedback output signal linearity [%]</td>
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<td>Digital feedback input voltage [VDC]</td>
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<td>Digital feedback output resolution [pulses/mm]</td>
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<td>5</td>
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<td>CE (EN60601-1), UL (UL60601-1)</td>
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</table>

### Features
- Maintenance free
- Very high sealing degree due to ultrasonic welding of enclosure
- Anti rotation mechanism ²
- Washdown proof during operation and can be submerged when not operating

### Options
- Electronic limit switches (ELS) ³
- Low level switching ⁴
- Analog or digital position feedback
- Mounting adapters turned 90°

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² 4000 N / 900 lbs versions with stroke 40 or 50 cm can not be equipped with anti rotation mechanism.
³ Prevents the extension tube from rotating if it is not fixed in the end.
⁴ Shuts off power at the end of stroke and all along the stroke at overload conditions. ELS is normally set for 120% of the rated dynamic maximum load.
⁵ Allows low level signals to control the actuator movement instead of having to switch the high amperage motor voltage.

[www.thomsonlinear.com](http://www.thomsonlinear.com)
Dimensions and Performance: 2000 N / 450 lbs version

Stroke "S" [mm (inch)] 100 (3.94) 200 (7.87) 300 (11.81) 400 (15.75) 500 (19.69)
Retracted Length "L" [mm (inch)] 238 (9.37) 338 (13.31) 438 (17.24) 589 (23.19) 689 (27.13)
Weight [kg (lbs)] 1.20 (2.65) 1.35 (2.98) 1.5 (3.31) 1.65 (3.64) 1.80 (3.97)

A1: Cable, see available cable lengths and types in the ordering key on page 8

W••02-58A

W••02-54A

www.thomsonlinear.com
Dimensions and Performance: 4000 N / 900 lbs version

A1: Cable, see available cable lengths and types in the ordering key on page 8

<table>
<thead>
<tr>
<th>Stroke “S” [mm (inch)]</th>
<th>100 (3.94)</th>
<th>200 (7.87)</th>
<th>300 (11.81)</th>
<th>400 (15.75)*</th>
<th>500 (19.69)*</th>
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<tr>
<td>Retracted Length “L” [mm (inch)]</td>
<td>246 (9.69)</td>
<td>346 (13.62)</td>
<td>446 (17.56)</td>
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<td>Weight [kg (lbs)]</td>
<td>1.36 (3.00)</td>
<td>1.52 (3.35)</td>
<td>1.67 (3.68)</td>
<td>1.82 (4.01)</td>
<td>1.97 (4.34)</td>
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* Consult Thomson if UL 60601-1 is required for these strokes.

W• 04-58A

<table>
<thead>
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<th>Dynamic load [N (lbs)]</th>
<th>Speed [mm/s (in/sec)]</th>
<th>Current [A]</th>
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<td>0</td>
</tr>
<tr>
<td>10 10</td>
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www.thomsonlinear.com
Ordering Key

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<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>9</th>
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<tbody>
<tr>
<td>W12</td>
<td>02-</td>
<td>58A</td>
<td>10</td>
<td>-</td>
<td>N</td>
<td>A</td>
<td>1</td>
<td>B</td>
</tr>
</tbody>
</table>

1. Model and input voltage

W12 = WhisperTrak™, 12 VDC
W24 = WhisperTrak™, 24 VDC

2. Maximum dynamic force

02- = 2000 N (450 lbs)
04- = 4000 N (900 lbs)

3. Rated no load speed

58A = 5.8 mm/s (standard speed version)
54A = 11.0 mm/s (high speed version, only available for 2000 N version)

4. Maximum stroke length

10 = 100 mm
20 = 200 mm
30 = 300 mm
40 = 400 mm (consult Thomson for 4000 N versions)
50 = 500 mm (consult Thomson for 4000 N versions)

5. Retracted length

- = standard retracted length (see tables on page 6 and 7)
L = retracted length for units with 100 - 300 (400 - 500) mm maximum stroke length = max. stroke + 140 (191) mm

6. Onboard control options (see page 9 for descriptions and page 10 for possible combinations of actuator type and control option)

N = standard - no electronic control (for use with Thomson DCG Control)
X = electronic limit switches (ELS)
E = ELS + low level switching
P = analog position feedback
D = digital feedback
Y = ELS + digital feedback
Z = ELS + analog position feedback

7. Type, adapter position\(^1\) and anti-rotation mechanism

A = anti-rotation, adapter holes in standard position
M = anti-rotation, adapter holes turned 90°

8. Cable and Connector Options

1 = 1 meter long cable with flying leads (for customer supplied connectors)
3 = 2 meter long cable with Molex type connector (compatible with DCG control)
4 = 1 meter long cable with Pac Con type connector on motor leads only (includes mating connector)

9. Enclosure color

B = black
W = white

The Thomson Whispertrak™ is warranted to be free from defects in materials and workmanship for a period of twelve (12) months from date of delivery. The application of this product is the responsibility of the buyer and Thomson makes no representation or warranty as to the suitability of the product for any particular use or purpose. Please go to http://www.thomsonlinear.com/website/com/eng/support/terms_and_conditions.php for a copy of the entire warranty for this product that is contained in our standard terms and conditions of sale.
Onboard Control Options

**Standard - No Electronic Control (Option N)**
This option is to be selected when using the DCG controls. Without the DCG control, this option is only compatible with the 2kN standard speed (W2402-58A) actuator.

**Electronic Limit Switches (Option X)**
The Electronic Limit Switches (ELS) option turns off power to the actuator at end of stroke or during a mid-stroke overload condition. This option has just the two wires going to the actuator and the customer provided switch must be capable of switching full load current. The acceptable voltage range for this option is 11 - 18 VDC. The actuator will run slightly slower at the same voltage than with options E or N.

**Electronic Limit Switches + Low Level Switching (Option E)**
This control automatically turns off power to the motor when current exceeds a preset threshold either at ends of stroke or due to a mid-stroke overload condition. This current threshold is directly related to thrust and can be set at the factory during assembly to independently control extend and retract travel. The default setting is rated dynamic load plus 20% nominal which means 2400 N nominal for the 2000 N model and 4800 N nominal for the 4000 N model. This option also utilizes on board low level switching that allow the travel to be controlled by low current signals rather than having to switch the motor current. This makes it possible to control the actuator by means of microprocessors, push buttons or relays not capable of switching the motor current. The acceptable voltage range for this option is 9 - 16 VDC.

**Analog Position Feedback (Option P)**
This absolute analog position feedback option uses a non-contact sensor requiring a polarity sensitive 5.0 VDC ± 0.5 VDC supply input (wiring cannot be reversed). Default factory programming provides a nominal output of 0.5 VDC at full retract increasing to a nominal of 4.5 VDC at full extend for any stroke length. This output range can be used for external control sensing of shorts to ground (< 0.5 VDC) or shorts to battery (> 4.5 VDC). Other output ranges can be programmed upon request. Standard strokes offer an output resolution of 0.12 mm and independent linearity of 0.5%. For more information on signal position tolerances please see the Glossary in the back of this catalog.

**Digital Feedback (Option D)**
This option use a quadrature signal hall-effect device to allow the user to detect the direction, speed of and the amount of movement of the actuator. Direction of travel is determined by observing the phase relationship of the channel A and B outputs (channel A leads when retracting). Speed of travel is determined by counting the number of pulses from either output over a fixed time interval. Amount of actuator displacement is determined by counting the number of pulses from either input and multiplying by the feedback resolution (0.100 mm per count for 58A actuators, 0.200 mm per count for 54A actuators). The feedback circuit requires a polarity sensitive 3.8 - 24 VDC supply input (wiring cannot be reversed). Each of the channel outputs is configured as an open-collector, so external pull-up resistors are required. Each channel is capable of sinking up to 100 mA and can withstand up to 24 VDC.

**Electronic Limit Switches + Digital Feedback (Option Y)**
This option includes both the Electronic Limit Switches and Digital Feedback option. The acceptable voltage range for the12 VDC option is 11 - 18 VDC and the acceptable voltage range for the 24 VDC is 20 - 32 VDC. The actuator will run slightly slower at the same voltage than with options E or N.

**Electronic Limit Switches + Analog Position Feedback (Option Z)**
This option includes both the Electronic Limit Switches and Analog Feedback option. The acceptable voltage range for the12 VDC option is 11 - 18 VDC and the acceptable voltage range for the 24 VDC is 20 - 32 VDC. The actuator will run slightly slower at the same voltage than with options E or N.
Onboard Control Option Wiring Diagrams

Standard (option N) or Electronic Limit Switches (option X)

Electronic Limit Switches + Low Level Switching (option E)

Analog Position Feedback (option P) or Analog Feedback + Electronic Limit Switches (option Z)

Digital Feedback (option D) or Digital Feedback + Electronic Limit Switches (option Y)

Possible Combinations of Control Options and Actuator Types

<table>
<thead>
<tr>
<th>Option Name</th>
<th>Actuator Input Voltage, Max. Dynamic Force and Speed Version</th>
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<tbody>
<tr>
<td></td>
<td>12 VDC</td>
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<tr>
<td></td>
<td>2000 N</td>
</tr>
<tr>
<td></td>
<td>2000 N</td>
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<tr>
<td>Standard (for use with DCG control)</td>
<td>Standard</td>
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<tr>
<td>Electronic Limit Switches (ELS)</td>
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<tr>
<td>ELS + Low Level Switching</td>
<td>X</td>
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<tr>
<td>Analog Position Feedback</td>
<td>E</td>
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<tr>
<td>Digital Feedback</td>
<td>P</td>
</tr>
<tr>
<td>ELS + Digital Feedback</td>
<td>D</td>
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<tr>
<td>ELS + Analog Position Feedback</td>
<td>Y</td>
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<tr>
<td></td>
<td>Z</td>
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</table>

* From 0.5 V at fully retracted ( ) to 4.5 V at fully extended ( ).
** Channel A leads channel B when retracting ( ).
DCG Actuator Control - Specifications

**Features**
- Controls available for single actuator operation or dual actuators operated in parallel.
- Small and lightweight control operated via a control pendant or cable harness which is ordered separately.
- Built in Electronic Limit Switches (ELS) stop the actuator automatically at end of stroke or mid stroke stall.
- The control pendant or cable harness is ordered separately.
- Use of this control limits the duty cycle to the actuator to 10%.
- If you choose to use an alternative controller other than the DCG units specified, please contact Thomson for further information.

**Specifications**

<table>
<thead>
<tr>
<th></th>
<th>DCG-152</th>
<th>DCG-154</th>
<th>DCG-252</th>
<th>DCG-254</th>
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<td>W2402-58A•••N•3•</td>
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<td>W2402-58A•••D•3•</td>
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<td>1 × 230 ± 6%</td>
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<td>Input frequency [Hz]</td>
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<td>Output voltage [Vdc]</td>
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</table>

These controls are current limited. Review the current/load curves for the actuator you selected to make sure the control will provide enough current for the thrust you need. Control will shut off if duty cycle is exceeded and automatically reset when cooled off. Control pendant type DCG14-1H is recommended, see page 12.

**Dimensions**

**Actuator Connection**
Actuators with cable option 3 can be directly connected to the DCG control. See order key for more information.

**Power Cords and Plugs**
DCG24-1U has a 3 m long power supply cable with a US three prong power plug while DCG24-1M units has a 3 m long cable with an Europlug (CEE 7/16) power plug.
DCG Actuator Control - Accessories

DCG Control Pendant

Handy and light weight control pendant with spiral cord cable which connects to the DCG to control one or synchronous WhisperTrak linear actuators via momentary push buttons.

Control to Control Cable for DCG

This cable connects with its plug to the control pendant input on DCG in order to connect the control to another device than the DCG control pendant.

Specifications

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<thead>
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<th>Parameter</th>
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<td>Cable length [mm]</td>
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Specifications

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Acme Screw
Acme screws typically have low efficiencies, which self lock and resist back driving. The low efficiency suits applications with shock and vibration.

Actuator Housing
The actuator housing provides environmental protection for the internal components and may also be a structural member of the actuator.

Adapters (Front and Rear Clevis)
The front and rear adapters are the connection points for mounting most Thomson actuators. The front adapter is usually a cross hole but optionally may be a tapped hole, threaded rod, universal rod end, or slotted adapter with cross hole. The rear adapter may be cast into the actuator housing or held in place with a nut.

Analog Feedback Sensor Positional Error
Positional feedback from the actuator is derived from an embedded sensor. Due to the linearity tolerance the sensor signal may contain an offset (position error) from the standard mm/V specification.

\[
\text{Max. position error} = \pm \frac{(\text{input voltage} \times 0.005 \times \text{stroke length})}{\text{output voltage range}}
\]

Example:
Input voltage = 5 VDC
Stroke Length = 200 mm
Output voltage range = 4 VDC (0.5 - 4.5 VDC standard output)

\[
\text{Max. position error} = \pm \frac{(5 \text{ VDC} \times 0.005 \times 200 \text{ mm})}{4 \text{ VDC}} = \pm 1.25 \text{ mm}
\]

1 Maximum possible error due to sensor linearity only.

Analog Feedback Sensor Positional Resolution
Positional feedback from the actuator is derived from an embedded sensor. The actuator uses a non-contact device and is limited by the internal bit size of memory registers. This bit size controls the smallest amount of positional movement the actuator can detect and reflect in the sensor signal. For WhisperTrak actuators, all standard strokes have a 0.12 mm resolution.

Anti Rotation Mechanism
A feature available on some actuators that resolves the restraining torque within the actuator. The extension tube will not rotate on actuators with this feature.

Certificates
Standard actuator models that are CE and/or UL recognized component are marked accordingly.

Controls
Controls can be external to the actuator and provide the actuator with the correct voltage, have either membrane or pendant operators and some have position indicators. The Thomson WhisperTrak series of electric linear actuators also has optional internal controls that continuously monitor the operation of the actuator.

Cover Tube
The cover tube provides protection for the lead screw and provides protection and support for the extension tube. For the Thomson WhisperTrak actuators, the cover tube can also provide the rear mounting connection.

Customization
Even the most versatile actuator may not always suit all applications. But whatever your need is, our engineers are ready to help you to customize the actuators according to your requirements. We build more exclusive actuators than anyone else and have decades of experience of producing actuators to meet special needs.

Digital Feedback Quadrature Signal
A quadrature output is used to determine the direction of rotation of a rotating shaft. It consists of two rectangular-wave signals that transition from a HIGH to a LOW state every 180 degrees of rotation and the signal transitions of each output are offset by 90 degrees of rotation from each other.

Digital Feedback Open-Collector Output
An open collector is a common type of output found on many integrated circuits. The output essentially acts as either an open circuit (no connection to anything) or a connection to ground. The output usually has an external pull-up resistor, which raises the output voltage when the transistor is turned off. When the transistor connected to this resistor is turned on, the output is forced to nearly 0 volts. Because the pull-up resistor is external and need not be connected to the chip supply voltage, a lower or higher voltage can be used instead. Open collector circuits are therefore sometimes used to interface different families of devices that have different operating voltage levels.
Glossary

Duty Cycle

\[
\text{Duty cycle} = \frac{\text{on time}}{\text{(on time + off time)}}
\]

Example: 10 seconds on, 90 seconds off

\[
\frac{10 \text{ s}}{10 \text{ s} + 90 \text{ s}} = 10\% \text{ duty cycle}
\]

The duty cycle is a function of the maximum rated load and the ambient temperature. Ambient temperatures above the stated will affect the duty cycle negatively while lower temperatures and/or lower load will affect it positively.

Load Rating

The load rating is the minimum amount of force the actuator will provide during its lifetime. The load rating of all rod style actuators is the same for both compression and tension loads. Also see “dynamic load”, “static load” and “tension and compression load”.

Maximum On Time

The maximum amount of time an actuator may operate without stopping to “cool off”. For high load and long stroke actuators this may be one extend or retract cycle. The actuator should not exceed 10% duty cycle at full rated load.

Mounting

The actuators are quickly and easily mounted by slipping pins through the holes on each end of the unit and into brackets on the machine frame and the load. Roll or spring type mounting pins should be avoided. The mounting pins must be parallel to each other as shown below (Fig. a).

The load should act along the axis of the actuator since off center loads may cause binding (Fig. b).

Operating and Storage Temperature

The operating temperature is the range in which the actuator may be safely operated. At higher temperatures the duty cycle needs to be lower than 10%. All actuators can be stored or transported at the same temperature as the operating temperature. Contact customer support if the operating temperature will be exceeded during storage or transportation.

Output Voltage

Output voltage is the voltage from the control to run the actuator. The controls for dc actuators have 24 Vdc output. The controls for ac actuators have either 115 or 230 Vac output.

Feedback

Thomson WhisperTrak actuators have the option to be equipped with either an analog or a digital position feedback.

Input Voltage

The nominal voltage required to operate the actuator. All actuators will accept at least a ± 10% variation of the nominal voltage but a change in the voltage will result in a change of the speed of dc actuators. Controls are available that accept 115 or 230 Vac input and provide 24 Vdc output to operate 24 Vdc actuators.

Installation Instructions

Each actuator has an installation manual to answer typical questions about mounting and wiring the actuators.

Lifetime Expectancy

Life is a function of load and stroke length.

Linear Actuators

Actuators providing a linear thrust via an extension tube to lift, lower, push, pull or position a load.
Glossary

**Restraining Torque**
The torque which is developed between the clevis on the extension tube and rear mount (clevis or trunnion) when the unit extends or retracts (Fig. c). If the actuator is equipped with anti-rotation mechanism then there is no restraining torque, if not the application must resolve this torque for proper application function.

**RoHS Compliance**
All actuators, controls and accessories sold in the EU are RoHS compliant unless otherwise stated, while products sold outside of the EU may not be. If you order an actuator outside of the EU and need it to be RoHS compliant, contact the factory to verify availability and be sure to include the request on your order.

**Service and Maintenance**
Actuators are maintenance free.

**Sizing and Selection**
The Thomsonlinear.com web site includes a product advisor that can be used to walk through the decision process for picking the best actuator and to get the ordering data for your choice. Go to www.thomson.com/linear_actuator_advisor to find out more.

**Speed**
DC actuators have an inverse load/speed relationship. As the load increases, the speed of the dc actuators decreases. There are curves to show the speed from no load to full rated load.

**Static Load**
The static load rating is how much load the actuator will hold with power off. Also see “load rating”. If nothing else is stated the static load rating is for the actuator extension tube being fully retracted. The static load rating will decrease as the tube extends.

**Synchronous Operation**
Without feedback control the motor speed cannot be controlled with enough precision to ensure that the actuators will remain synchronized and a binding effect could take place. Actuators equipped with a digital feedback encoder can be synchronized using DCG controls designed for synchronous operation.

**Tension and Compression Load**
A tension load tries to stretch the actuator and a compression load tries to compress the actuator (Fig. d). Most actuators can manage the same tension and compression load. Also see “load rating”.

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**Trapezoidal Screw**
Screw type with similar characteristics as an acme screw. Also see “acme screw”.

**Vent**
The Thomson WhisperTrak electric actuator has a breather in the housing to allow the actuator to operate without creating a vacuum and drawing water through the seals on the cover tube.

**Voltage Drop**
Long leads/cables between the power source and the actuator will result in a voltage drop for DC units. This voltage drop can be avoided by sizing the leads in accordance with the following lead cross section selection table. The table is based on an ambient temperature of 30 °C or less. A higher ambient temperature may result in the need for a greater lead cross section.

### Lead Cross Section Selection Table [mm²]

<table>
<thead>
<tr>
<th>Current draw [A]</th>
<th>Cable length [m]</th>
<th>Actuator input voltage [Vdc]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>0 - 10</td>
<td>0 - 3</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>3 - 6</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>6 - 10</td>
<td>4</td>
</tr>
<tr>
<td>10 - 15</td>
<td>0 - 3</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>3 - 6</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>6 - 10</td>
<td>4</td>
</tr>
<tr>
<td>15 - 20</td>
<td>0 - 3</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>3 - 6</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>6 - 10</td>
<td>6</td>
</tr>
</tbody>
</table>

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