Actuator LA35
Data sheet
The LA35 is a very quiet and powerful actuator, and provides a practical and cost-effective solution with low power consumption. The actuator is designed for a variety of both indoor and outdoor applications.

**Features:**
- 12 or 24 V DC Permanent magnetic motor
- Thrust 6000 N in push and 4000 in pull
- Max. speed up to 19.5 mm/sec. depending on load and spindle pitch
- Stroke length from 100 to 600 mm
- Built-in endstop switches
- Stainless steel inner tube
- Protection class: IP66 (dynamic) and IP69K (static)

**Options in general:**
- Large variety of back fixtures and piston rod eyes
- Anti rotating piston rod eye
- Guided nut (only with 2mm pitch)
- Integrated brake for high self-locking ability
- Exchangeable cables in different lengths
- Long life absolute feedback
- Safety nut in push
- Special anodised housing for extreme environments
- Potential free endstop signals
- IC options including:
  - IC - Integrated Controller
  - Hall sensor
  - Analogue or digital feedback for precise positioning
  - Endstop signals (not potential free)
  - Ready signal for diagnostics

**Usage:**
- Duty cycle at 6000N and 3mm pitch is max. 10%
- Ambient operating temperature: -25°C to +60°C, full performance from +5°C to +40°C

This TECHLINE® actuator comes with IC - Integrated controllers. For more information on our IC options, please see: www.linak.com/techline
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Chapter 1

Specifications

Motor: Permanent magnet motor 12 or 24V *

Cable: Motor: 2 x 14 AWG PVC cable
       Control: 6 x 20 AWG PVC cable **

Housing: The housing is made of casted aluminium, coated for outdoor use and in harsh conditions

Spindle part: Outer tube: Powder coated steel
             Inner tube: Stainless steel AISI304/SS2333
             Acme spindle: Trapezoidal spindle with high efficiency

Temperature range: - 25°C to +60°C
                   - 13°F to +140°F
                   Full performance +5°C to +40°C

Weather protection: Rated IP66 for outdoor use. Furthermore, the actuator can be washed down with a high-pressure cleaner (IP69K).

Noise level: 48dB (A) measuring method DS/EN ISO 3743-1 actuator not loaded.

Compatibility: The LA35 IC is compatible with SMPS-T160 (For combination possibilities, please see the User Manual for SMPS-T160)

*  Modbus actuators only 24V - please see the Modbus installation guide http://www.linak.com/techline/?id3=2363.
** Special control cables for the Modbus actuator - please see the Modbus installation guide http://www.linak.com/techline/?id3=2363.

Be aware of the following two symbols throughout this product data sheet:

Recommendations
Failing to follow these instructions can result in the actuator suffering damage or being ruined.

Additional information
Usage tips or additional information that is important in connection with the use of the actuator.
## Technical specifications

### LA35 with 12V motor

<table>
<thead>
<tr>
<th>Order number</th>
<th>Push Max. (N)</th>
<th>Pull Max. (N)</th>
<th>Self-lock min. (N) Push</th>
<th>Self-lock min. (N) Pull</th>
<th>Pitch (mm/spindle rev.)</th>
<th>* Typical speed (mm/s)</th>
<th>Standard stroke lengths (mm) in steps of 50mm</th>
<th>* Typical amp. (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No load</td>
<td>Full load</td>
<td>No load</td>
<td>Full load</td>
<td>No load</td>
<td>Full load</td>
<td>No load</td>
<td>Full load</td>
</tr>
<tr>
<td>3510xx</td>
<td>6000</td>
<td>4000</td>
<td>6000</td>
<td>4000</td>
<td>3</td>
<td>4.7</td>
<td>3.3</td>
<td>100-300</td>
</tr>
<tr>
<td>3520xx</td>
<td>4000</td>
<td>4000</td>
<td>1500</td>
<td>1500</td>
<td>5</td>
<td>7.7</td>
<td>5.3</td>
<td>100-400</td>
</tr>
<tr>
<td>3521xx, push brake</td>
<td>4000</td>
<td>4000</td>
<td>2500</td>
<td>1500</td>
<td>5</td>
<td>7.2</td>
<td>5.4</td>
<td>100-400</td>
</tr>
<tr>
<td>3522xx, pull brake</td>
<td>4000</td>
<td>4000</td>
<td>1500</td>
<td>2500</td>
<td>5</td>
<td>6.9</td>
<td>5.9</td>
<td>100-400</td>
</tr>
<tr>
<td>3530xx</td>
<td>1500</td>
<td>1500</td>
<td>750</td>
<td>750</td>
<td>9</td>
<td>14.0</td>
<td>12.3</td>
<td>100-500</td>
</tr>
<tr>
<td>3531xx, push brake</td>
<td>1500</td>
<td>1500</td>
<td>1000</td>
<td>750</td>
<td>9</td>
<td>14.2</td>
<td>12.6</td>
<td>100-500</td>
</tr>
<tr>
<td>3532xx, pull brake</td>
<td>1500</td>
<td>1500</td>
<td>1000</td>
<td>750</td>
<td>9</td>
<td>14.4</td>
<td>11.2</td>
<td>100-500</td>
</tr>
<tr>
<td>3540xx</td>
<td>1000</td>
<td>1000</td>
<td>750</td>
<td>750</td>
<td>12</td>
<td>19.0</td>
<td>17.0</td>
<td>100-600</td>
</tr>
<tr>
<td>3541xx, push brake</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>750</td>
<td>12</td>
<td>17.9</td>
<td>16.9</td>
<td>100-600</td>
</tr>
<tr>
<td>3542xx, pull brake</td>
<td>1000</td>
<td>1000</td>
<td>750</td>
<td>900</td>
<td>12</td>
<td>16.9</td>
<td>15.4</td>
<td>100-600</td>
</tr>
</tbody>
</table>

* The typical values can have a variation of ±20% on the current values and ±10% on the speed values. Measurements are made with an actuator in connection with a stable power supply and an ambient temperature at 20°C.

### LA35 with 24V motor

<table>
<thead>
<tr>
<th>Order number</th>
<th>Push Max. (N)</th>
<th>Pull Max. (N)</th>
<th>Self-lock min. (N) Push</th>
<th>Self-lock min. (N) Pull</th>
<th>Pitch (mm/spindle rev.)</th>
<th>* Typical speed (mm/s)</th>
<th>Standard stroke lengths (mm) in steps of 50mm</th>
<th>* Typical amp. (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No load</td>
<td>Full load</td>
<td>No load</td>
<td>Full load</td>
<td>No load</td>
<td>Full load</td>
<td>No load</td>
<td>Full load</td>
</tr>
<tr>
<td>3510xx</td>
<td>6000</td>
<td>4000</td>
<td>6000</td>
<td>4000</td>
<td>3</td>
<td>5.1</td>
<td>4.0</td>
<td>100-300</td>
</tr>
<tr>
<td>3520xx</td>
<td>4000</td>
<td>4000</td>
<td>1500</td>
<td>1500</td>
<td>5</td>
<td>8.3</td>
<td>6.6</td>
<td>100-400</td>
</tr>
<tr>
<td>3521xx, push brake</td>
<td>4000</td>
<td>4000</td>
<td>2500</td>
<td>1500</td>
<td>5</td>
<td>8.0</td>
<td>6.7</td>
<td>100-400</td>
</tr>
<tr>
<td>3522xx, pull brake</td>
<td>4000</td>
<td>4000</td>
<td>1500</td>
<td>2500</td>
<td>5</td>
<td>8.0</td>
<td>7.0</td>
<td>100-400</td>
</tr>
<tr>
<td>3530xx</td>
<td>1500</td>
<td>1500</td>
<td>750</td>
<td>750</td>
<td>9</td>
<td>15.0</td>
<td>13.9</td>
<td>100-500</td>
</tr>
<tr>
<td>3531xx, push brake</td>
<td>1500</td>
<td>1500</td>
<td>1000</td>
<td>750</td>
<td>9</td>
<td>14.5</td>
<td>14.1</td>
<td>100-500</td>
</tr>
<tr>
<td>3532xx, pull brake</td>
<td>1500</td>
<td>1500</td>
<td>1000</td>
<td>750</td>
<td>9</td>
<td>14.7</td>
<td>13.9</td>
<td>100-500</td>
</tr>
<tr>
<td>3540xx</td>
<td>1000</td>
<td>1000</td>
<td>750</td>
<td>750</td>
<td>12</td>
<td>19.5</td>
<td>18.9</td>
<td>100-600</td>
</tr>
<tr>
<td>3541xx, push brake</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>750</td>
<td>12</td>
<td>18.9</td>
<td>17.8</td>
<td>100-600</td>
</tr>
<tr>
<td>3542xx, pull brake</td>
<td>1000</td>
<td>1000</td>
<td>750</td>
<td>900</td>
<td>12</td>
<td>18.7</td>
<td>18</td>
<td>100-600</td>
</tr>
</tbody>
</table>

* The typical values can have a variation of ±20% on the current values and ±10% on the speed values. Measurements are made with an actuator in connection with a stable power supply and an ambient temperature at 20°C.

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**Self locking ability**

To ensure maximum self-locking ability, please be sure that the motor is shorted when stopped. Actuators with integrated controller have this feature incorporated.

- When using soft stop on a DC-motor, a short peak of higher voltage will be sent back towards the power supply. It is important when selecting the power supply that it does not turn off the output, when this backwards load dump occurs.
Load versus Stroke Length

Safety factor 2.

Stroke and built-in tolerances

<table>
<thead>
<tr>
<th>Platform options</th>
<th>Descriptions</th>
<th>Stroke tolerance</th>
<th>Example for 150 mm stroke</th>
<th>BID tolerance</th>
<th>Example for 350 mm BID</th>
</tr>
</thead>
<tbody>
<tr>
<td>3XXXXXXXXXXXXXXX</td>
<td>All variants</td>
<td>+2/-2 mm</td>
<td>148 to 152 mm</td>
<td>+2/-2 mm</td>
<td>348 to 352 mm</td>
</tr>
</tbody>
</table>

LA35 Dimensions

Installation dimension
Stroke =<300 = 200 + Stroke
Stroke >300 = 250 + Stroke
Minimum installation dimension = 300 mm
The Piston Rod Eye is only allowed to turn 0 - 90 degrees.
LA35 Back fixtures

Option "A" and "B"
AISI 304

Option "C" and "D"
AISI 304

Option "E" and "F"
Stainless steel

Option "G" and "H"
Stainless steel
LA35 Back fixture orientation

Option A = 0°

Option B = 90°
Cable dimensions

Y-cable dimensions:

Brown: Ø 2.8mm
Blue: Ø 2.8mm
Violet: Ø 1.5mm
Black: Ø 1.5mm
Red: Ø 1.5mm
Yellow: Ø 1.5mm
Green: Ø 1.5mm
White: Ø 1.5mm

Brown: Ø 2.0mm  AWG*: 14mm
Blue: Ø 2.0mm  AWG : 14mm
Violet: Ø 0.5mm  AWG : 20mm
Black: Ø 0.5mm  AWG : 20mm
Red: Ø 0.5mm  AWG : 20mm
Yellow: Ø 0.5mm  AWG : 20mm
Green: Ø 0.5mm  AWG : 20mm
White: Ø 0.5mm  AWG : 20mm

*AWG: American Wire Gauge

Power cable dimensions:

Ø 2.8mm
Ø 2.8mm

Ø 2.0mm  AWG*: 14mm
Ø 2.0mm  AWG : 14mm

*AWG: American Wire Gauge
Cable dimensions

Signal cable dimensions:

Violet: Ø 1.5mm
Black: Ø 1.5mm
Red: Ø 1.5mm
Yellow: Ø 1.5mm
Green: Ø 1.5mm
White: Ø 1.5mm

Violet: Ø 0.5mm  AWG*: 20mm
Black: Ø 0.5mm  AWG: 20mm
Red: Ø 0.5mm  AWG: 20mm
Yellow: Ø 0.5mm  AWG: 20mm
Green: Ø 0.5mm  AWG: 20mm
White: Ø 0.5mm  AWG: 20mm

*AWG: American Wire Gauge
**Speed and current curves - 12V motor**

The values below are typical values and made with a stable power supply and an ambient temperature of 20°C.
Speed and current curves - 24V motor

The values below are typical values and made with a stable power supply and an ambient temperature of 20°C.
### I/O specifications: Actuator without feedback

<table>
<thead>
<tr>
<th>Input/Output</th>
<th>Specification</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Permanent magnetic DC motor.</td>
<td></td>
</tr>
</tbody>
</table>
| Brown        | 12 or 24VDC (+/-) | To extend actuator: Connect Brown to positive  
To retract actuator: Connect Brown to negative |
|              | 12V ± 20%      |          |
|              | 24V ± 10%      |          |
|              | Under normal conditions: |          |
| Blue         | 12V, max. 10A depending on load  
24V, max. 5A depending on load | To extend actuator: Connect Blue to negative  
To retract actuator: Connect Blue to positive |
| Red          | Not to be connected |  |
| Black        | Not to be connected |  |
| Green        | Not to be connected |  |
| Yellow       | Not to be connected |  |
| Violet       | Not to be connected |  |
| White        | Not to be connected |  |
### I/O Specifications: Actuator with potential free endstop signal output

<table>
<thead>
<tr>
<th>Input/Output</th>
<th>Specification</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>The actuator is equipped with potential free endstop signals out. The micro switches are normally open.</td>
<td></td>
</tr>
</tbody>
</table>
| **Brown** | 12 or 24VDC (+/-)  
12V ± 20%  
24V ± 10%  
Under normal conditions:  
12V, max. 10A depending on load  
24V, max. 5A depending on load | To extend actuator:  
Connect Brown to positive  
To retract actuator:  
Connect Brown to negative |
| **Blue** | 12V, max. 10A depending on load  
24V, max. 5A depending on load | To extend actuator:  
Connect Blue to negative  
To retract actuator:  
Connect Blue to positive |
| **Red** | Potential free signal power supply (+)  
10-28VDC | Switching capacity:  
Minimum 10mA  
Maximum 1A |
| **Black** | Not to be connected | |
| **Green** | Endstop signal out | Output voltage is the same as the input voltage |
| **Yellow** | Endstop signal in | |
| **Violet** | Not to be connected | |
| **White** | Not to be connected | |
## I/O specifications: Actuator with potential free endstop signals and relative positioning - Single Hall

<table>
<thead>
<tr>
<th>Input/Output</th>
<th>Specification</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>The actuator is equipped with potential free endstop signals and Single Hall that gives a relative positioning feedback signal when the actuator moves.</td>
<td></td>
</tr>
<tr>
<td><strong>Brown</strong></td>
<td>12 or 24VDC (+/-)  &lt;br&gt; 12V ± 20%  &lt;br&gt; 24V ± 10%  &lt;br&gt; Under normal conditions:</td>
<td>To extend actuator:  &lt;br&gt; Connect Brown to positive  &lt;br&gt; To retract actuator:  &lt;br&gt; Connect Brown to negative</td>
</tr>
<tr>
<td><strong>Blue</strong></td>
<td>12V, max. 10A depending on load  &lt;br&gt; 24V, max. 5A depending on load</td>
<td>To extend actuator:  &lt;br&gt; Connect Blue to negative  &lt;br&gt; To retract actuator:  &lt;br&gt; Connect Blue to positive</td>
</tr>
<tr>
<td><strong>White</strong></td>
<td>Signal power supply (+)  &lt;br&gt; 10-28VDC</td>
<td>Current consumption:  &lt;br&gt; Max. 40mA, also when the actuator is not running</td>
</tr>
<tr>
<td><strong>Black</strong></td>
<td>Signal power supply GND (-)</td>
<td></td>
</tr>
<tr>
<td><strong>Green</strong></td>
<td>Endstop signal out</td>
<td>Output voltage is the same as the input voltage</td>
</tr>
<tr>
<td><strong>Yellow</strong></td>
<td>Endstop signal in</td>
<td></td>
</tr>
<tr>
<td><strong>Violet</strong></td>
<td>Single Hall output (PNP)  &lt;br&gt; Movement per Single Hall pulse:  &lt;br&gt; 3mm pitch = 0.38mm per pulse  &lt;br&gt; 5mm pitch = 0.63mm per pulse  &lt;br&gt; 9mm pitch = 1.13mm per pulse  &lt;br&gt; 12mm pitch = 1.5mm per pulse  &lt;br&gt; Frequency:  &lt;br&gt; Frequency is 30-125 Hz on Single Hall output depending on load and spindle.  &lt;br&gt; Overvoltage on the motor can result in shorter pulses.</td>
<td>Output voltage min. ( V_{OL} ) - 2V  &lt;br&gt; Max. current output: 12mA  &lt;br&gt; Max. 680nF  &lt;br&gt; N.B. For more precise measurements, please contact LINAK A/S.  &lt;br&gt; Low frequency with a high load. Higher frequency with no load.</td>
</tr>
<tr>
<td><strong>Red</strong></td>
<td>Potential free signal power supply (+)  &lt;br&gt; 10-28VDC</td>
<td>Switching capacity:  &lt;br&gt; Minimum 10mA  &lt;br&gt; Maximum 1A</td>
</tr>
</tbody>
</table>
### I/O specifications: Actuator with potential free endstop signals and absolute positioning
- **Analogue feedback**

<table>
<thead>
<tr>
<th>Input/Output</th>
<th>Specification</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>The actuator is equipped with potential free endstop signals and an electronic circuit that gives an analogue feedback signal when the actuator moves.</td>
<td></td>
</tr>
</tbody>
</table>
| **Brown** | 12 or 24VDC (+/-)  
12V ± 20%  
24V ± 10%  
Under normal conditions: | To extend actuator:  
Connect Brown to positive  
To retract actuator:  
Connect Brown to negative |
| **Blue** | 12V, max. 10A depending on load  
24V, max. 5A depending on load | To extend actuator:  
Connect Blue to negative  
To retract actuator:  
Connect Blue to positive |
| **White** | Signal power supply (+)  
10-28VDC | Current consumption:  
Max. 40mA, also when the actuator is not running |
| **Black** | Signal power supply GND (-) | |
| **Green** | Endstop signal out | Output voltage is the same as the input voltage |
| **Yellow** | Endstop signal in | |
| **Violet** | Analogue feedback  
0-10V (Option A)  
0.5-4.5V (Option B) | Tolerances +/- 0.5V  
Max. current output: 1mA  
Ripple max. 200mV  
Transaction delay 100ms  
Linear feedback 0.5%  
It is recommendable to have the actuator to activate its limit switches on a regular basis, to ensure more precise positioning |
| **Red** | Potential free signal power supply (+)  
10-28VDC | Switching capacity:  
Minimum 10mA  
Maximum 1A |
### I/O specifications: Actuator with IC

<table>
<thead>
<tr>
<th>Input/Output</th>
<th>Specification</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Easy to use interface with integrated power electronics (H-bridge). The actuator can also be equipped with electronic circuit that gives an absolute or relative feedback signal. The version with “IC option” cannot be operated with PWM (power supply).</td>
<td></td>
</tr>
<tr>
<td><strong>Brown</strong></td>
<td>12-24VDC + (VCC) Connect Brown to positive 12V ± 20% 24V ± 10% 12V, current limit 18A 24V, current limit 9A</td>
<td>Note: Do not change the power supply polarity on the brown and blue wires! Power supply GND (-) is electrically connected to the housing If the temperature drops below 0°C, all current limits will automatically increase to maximum (no limits)</td>
</tr>
<tr>
<td><strong>Blue</strong></td>
<td>12-24VDC - (GND) Connect Blue to negative 12V ± 20% 24V ± 10% 12V, current limit 18A 24V, current limit 9A</td>
<td></td>
</tr>
<tr>
<td><strong>Red</strong></td>
<td>Extends the actuator</td>
<td>On/off voltages: &gt; 67% of ( V_{IN} ) = ON &lt; 33% of ( V_{IN} ) = OFF Input current: 10mA</td>
</tr>
<tr>
<td><strong>Black</strong></td>
<td>Retracts the actuator</td>
<td></td>
</tr>
<tr>
<td><strong>Green</strong></td>
<td>Endstop signal out</td>
<td>Output voltage min. ( V_{IN} ) - 2V Source current max. 100mA</td>
</tr>
<tr>
<td><strong>Yellow</strong></td>
<td>Endstop signal in</td>
<td>Endstop signals are NOT potential free</td>
</tr>
<tr>
<td><strong>Violet</strong></td>
<td>Analogue feedback: Configure any high/low combination between 0-10V or 0.5-4.5V 0-10V (Option A) 0.5-4.5V (Option B)</td>
<td>Tolerances +/- 0.5V Max. current output: 1mA Ripple max. 200mV Transaction delay 100ms Linear feedback 0.5% It is recommendable to have the actuator to activate its limit switches on a regular basis, to ensure more precise positioning</td>
</tr>
<tr>
<td>Single Hall output (PNP)</td>
<td>Movement per Single Hall pulse: 3mm pitch = 0.38mm per pulse 5mm pitch = 0.63mm per pulse 9mm pitch = 1.13mm per pulse 12mm pitch = 1.5mm per pulse</td>
<td>Output voltage min. ( V_{IN} ) - 2V Max. current output: 12mA Max. 680nF N.B. For more precise measurements, please contact LINAK A/S. Low frequency with a high load. Higher frequency with no load.</td>
</tr>
<tr>
<td><strong>White</strong></td>
<td>Ready</td>
<td>The signal is constantly high when the actuator is in ready mode. Failure modes: The signal goes low when: - The current cuts off - The temperature is out of range (high duty cycle protection)</td>
</tr>
</tbody>
</table>
## Environmental tests - Climatic

<table>
<thead>
<tr>
<th>Test</th>
<th>Specification</th>
<th>Comment</th>
</tr>
</thead>
</table>
| **Cold test**     | EN60068-2-1 (Ab) | Storage at low temperature:  
                          Temperature: -40°C  
                          Duration: 72h  
                          Not connected  
                          Tested at room temperature.  
                          Storage at room temperature:  
                          Temperature: -25°C  
                          Duration: 12h  
                          Tested at low temperature. |
|                   | EN60068-2-1 (Ad) | Storage at low temperature:  
                          Temperature: -40°C  
                          Duration: 72h  
                          Not connected  
                          Tested at room temperature.  
                          Storage at low temperature:  
                          Temperature: -25°C  
                          Duration: 12h  
                          Tested at room temperature. |
| **Dry Heat**      | EN60068-2-2 (Bb) | Storage at high temperature:  
                          Temperature: +90°C  
                          Duration: 72h  
                          Actuator not powered during test  
                          Tested at room temperature.  
                          Storage at high temperature:  
                          Temperature: +70°C  
                          Duration: 1,000h  
                          Actuator not powered during test  
                          Tested at high temperature.  
                          Operating at high temperature:  
                          Temperature: +60°C  
                          Int. max. 17%  
                          Duration: 700h  
                          Actuator is activated  
                          Tested at high temperature. |
|                   | EN60068-2-2 (Bd) | Storage at high temperature:  
                          Temperature: +90°C  
                          Duration: 72h  
                          Actuator not powered during test  
                          Tested at room temperature.  
                          Storage at high temperature:  
                          Temperature: +70°C  
                          Duration: 1,000h  
                          Actuator not powered during test  
                          Tested at high temperature.  
                          Operating at high temperature:  
                          Temperature: +60°C  
                          Int. max. 17%  
                          Duration: 700h  
                          Actuator is activated  
                          Tested at high temperature. |
| **Change of**     | EN60068-2-14 (Na) | Rapid change of temperature:  
                          High temperature: +100°C in 60 minutes  
                          Low temperature: -30°C in 60 minutes  
                          Transition time: <10 seconds  
                          Duration: 100 cycles  
                          Actuator not powered during test  
                          Tested at room temperature.  
                          Controlled change of temperature:  
                          Temperature change 5°C pr. minute  
                          High temperature: +70°C in 60 minutes  
                          Low temperature: -30°C in 30 minutes  
                          130 minutes pr. cycle  
                          Duration: 1,000 cycles (90 days)  
                          Actuator not powered during test.  
                          Tested at 250, 500 and 1,000 cycles at low and high temperatures. |
| **Damp heat**     | EN60068-2-30 (Db) | Damp heat, Cyclic:  
                          Relative humidity: 93-98%  
                          High temperature: +55°C in 12 hours  
                          Low temperature: +25°C in 12 hours  
                          Duration: 21 cycles * 24 hours  
                          Actuator not powered during test  
                          Tested within 1 hour after condensation  
                          That means after the upper temperature has been reached.  
                          Damp heat, Steady state:  
                          Relative humidity: 93-95%  
                          Temperature: +40 ±2°C  
                          Duration: 56 days  
                          Actuator not powered during test  
                          Tested within one hour after exposure. |
| **Salt mist.**    | EN60068-2-52 (Kb) | Salt spray test:  
                          Salt solution: 5% sodium chloride (NaCl)  
                          4 spraying periods, each of 2 hours  
                          Humidity storage: 7 days after each  
                          Actuator not powered during test  
                          Exposure time: 500 hours |
## Environmental tests - Climatic

<table>
<thead>
<tr>
<th>Degrees of protection</th>
<th>EN60529 – IP66</th>
<th>DIN40050 – IP69K</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IP6X - Dust:</strong></td>
<td>Dust-tight, No ingress of dust. Actuator is not activated during test.</td>
<td></td>
</tr>
<tr>
<td><strong>IP6X – Water:</strong></td>
<td>Ingress of water in quantities causing harmful effects is not allowed. Duration: 100 litres pr. minute in 3 minutes. Actuator is not activated during test.</td>
<td></td>
</tr>
<tr>
<td><strong>IP6X – Connected actuator:</strong></td>
<td>Actuator is driving out and in for 3 min. 100(l/min) jet of water is placed at the wiper ring for 3 min.</td>
<td></td>
</tr>
<tr>
<td><strong>IP6X – Connected actuator and push 6000 (N):</strong></td>
<td>Actuator is driving out and in for 3 min. and push 6000(N) at the end-pos. 100 (l/min.) jet of water is placed at the wiper ring for 3 min.</td>
<td></td>
</tr>
<tr>
<td><strong>High pressure cleaner:</strong></td>
<td>Water temperature: +80°C. Water pressure: 80 bar. Spray angle: 45°. Spray distance: 100mm. Duration: From any direction in 4x30 seconds. Actuator is not activated during test. Ingress of water in quantities causing harmful effects is not allowed.</td>
<td></td>
</tr>
</tbody>
</table>

| DUNK test | The actuator has been warmed up to 85°C for 4 hours. After this it is cooled down in 20°C saltwater. Cooling time: 2 hours. Opened for checking salt deposit and water. |                     |

| Chemicals | BS7691 / 96hours |                     |
|-----------|-----------------|                     |
|           | Diesel 100%     |                     |
|           | Hydraulic oil 100% |                     |
|           | Ethylene Glucol 50% |                     |
|           | Urea Nitrogen saturated solution |                     |
|           | Liquid lime 10% (Super-Cal) |                     |
|           | NPK Fertilizer (NPK 16-4-12) saturated |                     |
|           | Tested for corrosion. |                     |
### Environmental tests - Mechanical

<table>
<thead>
<tr>
<th>Test</th>
<th>Specification</th>
<th>Comment</th>
</tr>
</thead>
</table>
| Free fall |               | Free fall from all sides:  
Height of fall: 0.8 meter onto linoleum covered concrete  
Actuator not powered during test. |
| Vibration | EN60068-2-64  | EN 60068-2-6 (Fc)  
Random vibration:  
Short time test: 6.29g RMS  
Actuator is not connected  
Long time test: 7.21g RMS  
Actuator is not powered during test  
Duration: 2 hours in each direction  
Sinus vibration:  
Frequency 5-200Hz  
Displacement: 3.3mm pp, B 25Hz  
Acceleration 4g  
Number of directions: 3 (X-Z-Y)  
Duration: 2 hours in each direction  
Actuator is not powered during test. |
| Bump      | EN60068-2-29 (Eb) | Bump test:  
Level: 25g  
Duration: 6 milliseconds x 1000 times in each direction pr. axis  
Actuator is not powered during test. |
| Shock     | EN60068-2-27 (Ea) | Shock test:  
Level: Half sinus 100g  
Duration: 6 milliseconds  
Number of bumps: 3 shocks in each of 6 directions  
Actuator is not powered during test. |

### Environmental tests - Electrical

<table>
<thead>
<tr>
<th>Test</th>
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<th>Comment</th>
</tr>
</thead>
</table>
| Power supply       |               | Operating voltages +7V - +27V  
Over voltage +29(V) / 5min.  
Reverse polarity +7 and +27(V) / 5min. |
| Electromagnetic fields | EN61000-4-3 | 30 V/m, 80%AM, 1 kHz 20 - 2.700 Mhz  
10 V/m, 80% AM, 1kHz 80 - 1000 Mhz  
3 V/m, 80% AM, 1 kHz 1.4 - 2.0 GHz  
1 V/m, 80% AM 2.0 - 2.7 GHz |
| Fast transients    | EN61000-4-4  | ± 2 kV |
| Surge transients   | EN61000-4-5  | ± 2 kV (42Ω output) |
| Radio frequency    | EN61000-4-6  | 10 Vrms, 80% AM 0.15 - 80 MHz |

All electrical tests are conducted and radiated emission (EMC) tests.
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For mounting instructions and guidance in usage, please see the relevant user’s manuals.