The ability to do work and verify its accuracy at the same time.
SMAC Product Overview

Cylinder

- **CAL12**
  - Stroke [mm]: 10
  - Force [N]: 1.5

- **CAL36**
  - Stroke [mm]: 15, 25, 50
  - Force [N]: 12 - 18

- **CAL75**
  - Stroke [mm]: 15, 25, 50
  - Force [N]: 25 - 90

Linear & Linear/Rotary Actuators

- **LCA25**
  - Stroke [mm]: 10 up to 200
  - Force [N]: 8 - 22

- **LCA50**
  - Stroke [mm]: 25
  - Force [N]: 40, 50

- **LAL15 / LAR15**
  - Stroke [mm]: 15
  - Force [N]: 5

- **LAL20 / LAR20**
  - Stroke [mm]: 10, 15, 25
  - Force [N]: 8, 7, 5

- **LAR31**
  - Stroke [mm]: 17, 27, 31
  - Force [N]: 14, 12, 11

- **LAL35 / LAR35**
  - Stroke [mm]: 25, 50, 100
  - Force [N]: 12, 10, 6

- **LAL55 / LAR55**
  - Stroke [mm]: 50, 100, 150
  - Force [N]: 25, 16, 13

- **LAL95 / LAR95**
  - Stroke [mm]: 50
  - Force [N]: 100, 60

- **LAL300**
  - Stroke [mm]: 50
  - Force [N]: 202

- **LAL500**
  - Stroke [mm]: 25, 50
  - Force [N]: 500

Linear Slide Actuators

- **LCS25**
  - Stroke [mm]: 10
  - Force [N]: 8, 12

- **LAS15**
  - Stroke [mm]: 15
  - Force [N]: 5

- **LAS20**
  - Stroke [mm]: 10, 15, 25
  - Force [N]: 8, 7, 5

- **LASW20**
  - Stroke [mm]: 11
  - Force [N]: 8

- **LAS35**
  - Stroke [mm]: 25, 50, 100
  - Force [N]: 12, 10, 6

- **LAS55**
  - Stroke [mm]: 50, 100, 150
  - Force [N]: 25, 16, 13

- **LAS95**
  - Stroke [mm]: 50
  - Force [N]: 100, 60

Grippers

- **GRP20**
  - Stroke [mm]: 10
  - Force [N]: 8

- **GRP35**
  - Stroke [mm]: 30
  - Force [N]: 25

- **GRP50**
  - Stroke [mm]: 30
  - Force [N]: 45

XY Stages

- **LXY15**
  - Stroke [mm]: 15
  - Force [N]: 22

- **LXY25**
  - Stroke [mm]: 25
  - Force [N]: 42

- **LXYM15**
  - Stroke [mm]: 15
  - Force [N]: 14 - 27

Controllers & Amplifier

- **LCC-10 (LCC-11)**
  - Single axis brushless controller

- **LAC-1**
  - Single axis controller

- **LAC-25**
  - 2 axis controller with built in amplifier

- **LAC-15/LAC-20**
  - Single or double axis brushless controller.

- **LAC-45**
  - 4 axis controller with built in amp

- **MAAC4-7**

- **Built-in Controller**

- **LAA-5**
  - Amplifier for 1 axis

- **LAD-1**
  - Smart drive for 1 axis

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The SMAC Advantages

- Absolute control over: force, position, acceleration and velocity
- Direct drive actuator, therefore a very high degree of accuracy & repeatability
- Integrated position measuring system with glass scale and optical reader head (no wear)
- Very long lifetime due to oversized linear guides
- Force measurement through monitoring of current
- Digital and analog in/output channels
- Ability to switch between operations - force, position and velocity mode - at any time
- Extremely high acceleration and velocity
- Unique “Soft-Land” function

Programmable Features

The actuator is totally programmable for force, acceleration and velocity, and can operate in three different modes:

**Force Mode:** Force Mode is open loop, using no feedback from the encoder. The actual position is still monitored but has no effect upon the output.

**Velocity Mode:** Velocity Mode allows the actuating rod to be moved with a given velocity, acceleration, force and direction. Typically used for a “Soft-Land” routine.

**Position Mode:** Position Mode will allow the actuating rod to be moved to various positions along the stroke using acceleration, velocity and force. It is possible to perform absolute, relative and “learned position” moves.

What is a Soft-Land?

The “Soft-Land” is a routine which allows the actuator rod or gripper jaw to land on the surface of a component with a low programmed force. This is particularly useful for handling delicate or high value components.

The routine consists of a controlled low force approach in velocity mode, whilst the position error is constantly monitored. Once contact is made the position error builds up until a pre-programmed figure is reached - resulting in the rod maintaining position on the surface of the component.
Electric Cylinder

The CA range of multi patented electric cylinders have been designed with the most demanding & arduous of automation tasks in mind. That’s why they are ideal for high speed packaging, labelling & bottling applications, pick & place systems, parts feeders & electronic assembly machines along with many, many others where the need for speed, accuracy, precision & repeatability is paramount. They have been designed to replace & fit exactly where standard pneumatic cylinders are currently used but need continuous repair, replacement & maintenance due to high cycle rates, shock & wear. With the SMAC CA range these shortcomings are eradicated.

Linear:

- Stroke up to 50mm, force up to 90N, position encoder resolution 5µm standard, 1 and 0.1µm option for most actuators.
- Programmable force, position, acceleration and velocity.
Linear and Linear / Rotary Moving Coil Actuators

Linear:
- Stroke up to 200mm, force up to 500N, position encoder resolution 5µm standard, 1 and 0.1µm option for most actuators.
- Programmable force, position, acceleration and velocity.

Rotary:
- Multi-turn servo motor, torque up to 1Nm (Gearbox), velocity up to 5000 rpm, resolution up to 50,000 increments per revolution.
- Programmable force, position, acceleration and velocity.
Moving Coil Technology
(Voice Coil)

At the heart of all SMAC actuators is the moving coil, also described as a voice coil actuator. The essential principle is the same as you will find in any permanent magnet loudspeaker. The coil is enclosed in a magnet housing, and by passing a current through the coil, a magnetic field is generated.

The amount of force generated is governed by the equation
\[ F \propto N I B \]
where;
- \( F \) is the force generated
- \( N \) is the number of turns in the winding (Constant)
- \( I \) is the current flowing through the winding and
- \( B \) is the magnetic flux (Constant)

Therefore, doubling \( I \) (current) doubles \( F \) (Force).

Hardware Configuration

Hardware with SMAC Controllers

Hardware with SMAC Amplifier
# Part Numbering System

<table>
<thead>
<tr>
<th>MODEL</th>
<th>SERIES</th>
<th>STROKE</th>
<th>VOLT</th>
<th>ENCODER</th>
<th>VACUUM</th>
<th>SPRING</th>
<th>Mounting</th>
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### Part Number Examples:

**LAS20-010-55**

LAS20 linear slide, 10mm stroke, 24volt single coil, 5 micron encoder.

**LAL300-050-85-F**

LAL300 linear actuator, 50mm stroke, 48volt double coil, 5 micron encoder, female rod end.

**LAR55-100-75-MS-MOD674**

LAR55 linear/rotary actuator, 100mm stroke, 48 volt single coil, 5 micron encoder, male thread, spring, mod 674 specification.

**CAL36-015-55F3A**

CAL36 electric cylinder, 36mm dia., 15mm stroke, 24volt single coil, 5 micron encoder, female shaft end, flying lead and front mount.

### Notes:

- Series will not have leading zeros (e.g. LAL95).
- Stroke must include zeros (e.g. 050).
- Spring must be specified as full return or counterbalance, payload and orientation (vertical or horizontal).
Electric Cylinder

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NOTE: SMAC requires that each CA series unit must be operated at less than suggested duty cycle (%). Please see page 8.

We manufacture actuators to suit our customers’ requirements. Please call us if you do not find the right actuator in this list.

Options & Modifications (Consult factory for availability):

- Encoder resolutions: 5µm standard, 1µm, 0.1µm and 0.05µm optional for most units.
- Shaft ends: Male, Female, Blank and Custom
- Return spring: Prevents the shaft from dropping during vertical operation when power is cut.
- Vacuum: Vacuum through the shaft or on the shaft for pick and place applications.
- Mount: Face mount (standard), foot mount or threaded mount (CAL12 series only)

Specifications subject to change.
Linear Actuators

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NOTE: SMAC requires that all units must be operated at less than 40% maximum duty cycle. Please see page 15 or user manual for further explanation on how to calculate duty cycle.

We manufacture actuators to suit our customers’ requirements. Please call us if you do not find the right actuator in this list. Linear actuators are also available as linear slides (LAS series).

Options & Modifications (Consult factory for availability):

- **Linear encoder resolutions:** 5µm standard (20µm standard for LCA25), 1µm and 0.1µm optional for most units. Consult factory for availability.
- **Shaft ends:** Male, Female, Blank and Custom (check availability of custom option)
- **Return spring:** Prevents the shaft from dropping during vertical operation when power is cut.
- **Vacuum:** Vacuum through the shaft or on the shaft for pick and place applications.
- **Extended nose bushing:** For tighter shaft run-out and higher side load onto the shaft.
- **Increase of maximum force & acceleration:** 48 volt coil and double coil options are available for some units with 24 volt single coil.
- **Increase of force accuracy & lifetime:** Extra long life linear guide / Low friction linear guide

Specifications subject to change.

www.smac-mca.com
# Linear & Rotary Actuators

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<td>LAR95-050-7</td>
</tr>
<tr>
<td>LAR300-050-8</td>
</tr>
</tbody>
</table>

**NOTE:** SMAC requires that all units must be operated at less than 40% maximum duty cycle. Please see page 15 or user manual for further explanation on how to calculate duty cycle.

We manufacture actuators to suit our customers’ requirements. Please call us if you do not find the right actuator in this list.

## Options & Modifications (Consult factory for availability):

- **Linear encoder resolutions:** 5µm standard, 1µm and 0.1µm optional for most units. Consult factory for availability.
- **Shaft ends:** Male, Female, Blank and Custom (check availability of custom option)
- **Return spring:** Prevents the shaft from dropping during vertical operation when power is cut.
- **Vacuum:** For pick and place applications
- **Extended nose bushing:** For tighter shaft run-out and higher side load onto the shaft.
- **Increase of maximum force and acceleration:** 48 volt coil and double coil options are available for some units with 24 volt single coil.
- **Increase of torque/gear ratio:** Alternative geared motors are available for some units.
- **Rotary encoder resolution:** Consult factory for higher resolution.
- **Increase of force accuracy & lifetime:** Extra long life linear guide, Low friction linear guide

*Torque and velocity can vary based on your specific application.*
# Linear Slide Actuators

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
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<tbody>
<tr>
<td>LCS25-010-5</td>
<td>24 55x70x25</td>
<td>10</td>
<td>8</td>
<td>3</td>
<td>6</td>
<td>0.04</td>
<td>0.27</td>
</tr>
<tr>
<td>LCS25-010-7</td>
<td>48 55x70x25</td>
<td>10</td>
<td>12</td>
<td>3</td>
<td>8</td>
<td>0.04</td>
<td>0.27</td>
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<tr>
<td>LAS15-015-5</td>
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<td>5</td>
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<td>2.7</td>
<td>0.05</td>
<td>0.23</td>
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<td>8</td>
<td>3.2</td>
<td>5.5</td>
<td>0.07</td>
<td>0.34</td>
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<tr>
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<td>15</td>
<td>7</td>
<td>2.8</td>
<td>5</td>
<td>0.07</td>
<td>0.34</td>
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<td>LAS20W-015-6</td>
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<td>15</td>
<td>12</td>
<td>4.8</td>
<td>5.8</td>
<td>0.122</td>
<td>0.54</td>
</tr>
<tr>
<td>LAS20-025-5</td>
<td>24 85x65x20</td>
<td>25</td>
<td>5.5</td>
<td>2</td>
<td>2.8</td>
<td>0.07</td>
<td>0.34</td>
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<td>LASW20-011-5</td>
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<td>11</td>
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<td>0.07</td>
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</tr>
<tr>
<td>LAS35-025-6</td>
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<td>25</td>
<td>31.5</td>
<td>12.6</td>
<td>15.5</td>
<td>0.19</td>
<td>1.06</td>
</tr>
<tr>
<td>LAS35-025-7</td>
<td>48 150x90x35</td>
<td>25</td>
<td>18</td>
<td>7</td>
<td>10</td>
<td>0.15</td>
<td>0.95</td>
</tr>
<tr>
<td>LAS35-050-5</td>
<td>24 135x90x35</td>
<td>50</td>
<td>10</td>
<td>4</td>
<td>7</td>
<td>0.13</td>
<td>1.1</td>
</tr>
<tr>
<td>LAS35-050-7</td>
<td>48 135x90x35</td>
<td>50</td>
<td>12.5</td>
<td>5</td>
<td>10</td>
<td>0.13</td>
<td>1.1</td>
</tr>
<tr>
<td>LAS35-100-5</td>
<td>24 135x90x35</td>
<td>100</td>
<td>6</td>
<td>2.4</td>
<td>3.5</td>
<td>0.13</td>
<td>1.7</td>
</tr>
<tr>
<td>LAS35-100-7</td>
<td>48 135x90x35</td>
<td>100</td>
<td>7.5</td>
<td>3</td>
<td>5</td>
<td>0.1</td>
<td>1.3</td>
</tr>
<tr>
<td>LAS55-050-5</td>
<td>24 250x110x55</td>
<td>50</td>
<td>25</td>
<td>10</td>
<td>19</td>
<td>0.3</td>
<td>3</td>
</tr>
<tr>
<td>LAS55-050-7</td>
<td>48 250x110x55</td>
<td>50</td>
<td>40</td>
<td>16</td>
<td>24.5</td>
<td>0.31</td>
<td>3</td>
</tr>
<tr>
<td>LAS55-100-5</td>
<td>24 250x110x55</td>
<td>100</td>
<td>16</td>
<td>6.4</td>
<td>13</td>
<td>0.3</td>
<td>3.8</td>
</tr>
<tr>
<td>LAS55-100-7</td>
<td>48 250x110x55</td>
<td>100</td>
<td>35</td>
<td>10</td>
<td>19</td>
<td>0.31</td>
<td>3.8</td>
</tr>
<tr>
<td>LAS55-150-5</td>
<td>24 250x110x55</td>
<td>150</td>
<td>13</td>
<td>5</td>
<td>10</td>
<td>0.4</td>
<td>4.5</td>
</tr>
<tr>
<td>LAS55-150-7</td>
<td>48 250x110x55</td>
<td>150</td>
<td>19.5</td>
<td>8</td>
<td>13</td>
<td>0.31</td>
<td>4.58</td>
</tr>
<tr>
<td>LAS95-015-7</td>
<td>48 90x70x95</td>
<td>15</td>
<td>84</td>
<td>33</td>
<td>53</td>
<td>0.25</td>
<td>2.1</td>
</tr>
<tr>
<td>LAS95-015-8</td>
<td>48 147x70x95</td>
<td>15</td>
<td>195</td>
<td>78</td>
<td>60</td>
<td>0.5</td>
<td>4</td>
</tr>
<tr>
<td>LAS95-025-8</td>
<td>48 180x70x95</td>
<td>25</td>
<td>162</td>
<td>65</td>
<td>52</td>
<td>0.5</td>
<td>3.78</td>
</tr>
<tr>
<td>LAS95-050-7</td>
<td>48 147x70x95</td>
<td>50</td>
<td>65</td>
<td>26</td>
<td>41</td>
<td>0.25</td>
<td>3</td>
</tr>
<tr>
<td>LAS300-050-8</td>
<td>48 210x85x120</td>
<td>50</td>
<td>202</td>
<td>80</td>
<td>86</td>
<td>0.8</td>
<td>8.8</td>
</tr>
</tbody>
</table>

**NOTE:** SMAC requires that all units must be operated at less than 40% maximum duty cycle. Please see page 15 or user manual for further explanation on how to calculate duty cycle.

We manufacture actuators to suit our customers’ requirements. Please call us if you do not find the right actuator in this list.

## Options & Modifications (Consult factory for availability):

**Linear encoder resolutions:** 5µm standard (20µm standard for LCS25) , 1µm and 0.1µm optional for most units. Consult factory for availability.

**Return spring:** Prevents the shaft from dropping during vertical operation when power is cut.

**Increase of maximum force & acceleration:** 48 volt coil and double coil options are available for some units with 24 volt single coil.

**Increase of force accuracy & lifetime:** Extra long life linear guide
Low friction linear guide

Specifications subject to change.
We manufacture actuators to suit our customers’ requirements. Please call us if you do not find the right actuator in this list.

**Options & Modifications (Consult factory for availability):**

**Linear encoder resolutions:**
- GRP20: 1µm standard and 0.1µm optional.
- GRP35 & GRP50: 5µm standard, 1µm and 0.1µm optional.

**Increase of the maximum force & acceleration:**
48 volt coil and double coil options are available for some units with 24 volt single coil.

**Increase of the force accuracy & lifetime:**
- Extra long life linear guide
- Low friction linear guide

---

**XY Stages**

<table>
<thead>
<tr>
<th></th>
<th>Axis 1</th>
<th>Axis 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Voltage [V]</td>
<td>Size: LxWxH [mm]</td>
</tr>
<tr>
<td></td>
<td>[N]</td>
<td>[mm]</td>
</tr>
<tr>
<td>LXY15-015-7</td>
<td>48</td>
<td>111x112x86</td>
</tr>
<tr>
<td>LXY25-025-8</td>
<td>48</td>
<td>125x125x65</td>
</tr>
<tr>
<td>LXYM15-015</td>
<td>24/48</td>
<td>230x242.5x55</td>
</tr>
</tbody>
</table>

**NOTE:** SMAC requires that all units must be operated at less than 40% maximum duty cycle. Please see page 15 or user manual for further explanation on how to calculate.

We manufacture actuators to suit our customers’ requirements. Please call us if you do not find the right actuator in this list.

**Options & Modifications (Consult factory for availability):**

**Linear encoder resolutions:**
- 5µm standard, 1µm and 0.1µm optional for most units. Consult factory for availability.

**Increase of maximum force & acceleration:**
48 volt coil and double coil options are available for some units with 24 volt single coil.

---

**Grippers**

<table>
<thead>
<tr>
<th></th>
<th>Axis 1</th>
<th>Axis 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Voltage [DC]</td>
<td>Size: LxWxH [mm]</td>
</tr>
<tr>
<td></td>
<td>[N]</td>
<td>[mm]</td>
</tr>
<tr>
<td>GRP20-010-5</td>
<td>24</td>
<td>80x90x23</td>
</tr>
<tr>
<td>GRP35-030-5</td>
<td>24</td>
<td>93x110x38</td>
</tr>
<tr>
<td>GRP50-030-7</td>
<td>48</td>
<td>90x125x55</td>
</tr>
</tbody>
</table>

**NOTE:** SMAC requires that all units must be operated at less than 40% maximum duty cycle. Please see page 15 or user manual for further explanation on how to calculate.

We manufacture actuators to suit our customers’ requirements. Please call us if you do not find the right actuator in this list.
SMAC is pleased to introduce its range of multi-axis control solutions. These systems are able to learn and follow a 3D contour or motion path, with a high degree of speed, precision, accuracy and repeatability. All combinations of SMAC actuators can be used: linear, linear/rotary, linear slide, and XY stage axis.

Ideal applications are measuring and testing (QC), dispensing (Bonding), machining (CNC), scoring and cutting, to name a few. SMAC multi-axis 3D systems are unique - they enable total programmability of speed, position and force all at the same time with an exceptional degree of accuracy and repeatability. SMAC multi-axis systems offer a wide range of solutions with a number of highly flexible control interfaces.

Multi-Axis System

Multi-Axis System

Multi-Axis System

Multipole Actuators

These actuators are equipped with several coils and magnets. This allows us to increase the stroke up to 600mm and increases the acceleration up to 10G. A typical application for the multipole actuator is the transport of a smaller actuator, and can achieve very short cycle times with pick & place applications.

Please contact our technical office for further information on multipole actuators.
Cables

Why Use Them?
SMAC actuators are used in numerous high speed, high cycle applications and are guaranteed for millions of cycles. For this reason, it is imperative that the cables used to connect with our actuators are capable of similar arduous duty cycles and life span. Only cables manufactured by SMAC can be guaranteed to meet the rigorous standards required during use. Many years of experience has taught us that cheaper third party cables simply are not up to the task required. They are, in fact, one the most common causes of all the technical problems experienced by our customers.

Cable Chart for the CA series Electric Cylinder

<table>
<thead>
<tr>
<th>Actuator</th>
<th>Single Axis Controller</th>
<th>Dual Axis Controller</th>
<th>Amplifier</th>
<th>Smart Driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAL12</td>
<td>LAC-1</td>
<td>LAC-20</td>
<td>LAA-5</td>
<td>LAD-1</td>
</tr>
<tr>
<td>CAL36</td>
<td>Flying lead type or CAH-LOD26-03 for pigtail type</td>
<td>N/A</td>
<td>CAH-LAD26-03</td>
<td>CAH-LSD26-03</td>
</tr>
<tr>
<td>CAL75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2x CAL12 '*'1</td>
<td></td>
<td>LAT-26C-0003-03 for pigtail type</td>
<td>CAH-LTD26-03</td>
<td>N/A</td>
</tr>
<tr>
<td>2x CAL36</td>
<td>N/A</td>
<td>LAT-26C-0003-03 for pigtail type</td>
<td>CAH-LTD26-03</td>
<td>N/A</td>
</tr>
<tr>
<td>2x CAL75</td>
<td>LAT-26C0003-03 for pigtail type</td>
<td>CAH-LTD26-03 for pigtail type</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Superflex is available as an option. Suitable for robotic applications.
### Cable Chart for the LCA series Actuator

<table>
<thead>
<tr>
<th>Actuator</th>
<th>Single Axis Controller</th>
<th>Dual Axis Controller</th>
<th>Amplifier</th>
<th>Smart Driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCA25</td>
<td></td>
<td>LAC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single or Double Coil</td>
<td>Flying lead type or CAH-LOD26-03 for pigtail type</td>
<td>Flying lead type or CAH-LAD26-03 for pigtail type</td>
<td>Flying lead type or CAH-LSD26-03 for pigtail type</td>
<td></td>
</tr>
<tr>
<td>LCA50</td>
<td></td>
<td>LAC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single or Double Coil</td>
<td>Flying lead type or MAH-LOD26-03 for pigtail type</td>
<td>Flying lead type or CAH-LAD26-03 for pigtail type</td>
<td>Flying lead type or CAH-LSD26-03 for pigtail type</td>
<td></td>
</tr>
<tr>
<td>LCA25 6 Coil</td>
<td></td>
<td>LAC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LCA50 6 Coil</td>
<td></td>
<td>LAC-1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Cable Chart for the LA series Actuator

<table>
<thead>
<tr>
<th>Actuator</th>
<th>Single Axis Controller</th>
<th>Dual Axis Controller</th>
<th>Amplifier</th>
<th>Smart Driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAL15 (*1)</td>
<td>LAC-1</td>
<td>LAC-20</td>
<td>LAC-25</td>
<td>LAA-5</td>
</tr>
<tr>
<td>LAL20</td>
<td>LAC-20</td>
<td>LAC-20</td>
<td>LAA-5</td>
<td>LAD-1</td>
</tr>
<tr>
<td>LAL35</td>
<td>LAC-20</td>
<td>LAC-20</td>
<td>LAA-5</td>
<td>LAD-1</td>
</tr>
<tr>
<td>LAL55</td>
<td>LAC-20</td>
<td>LAC-20</td>
<td>LAA-5</td>
<td>LAD-1</td>
</tr>
<tr>
<td>LAL95</td>
<td>LAC-20</td>
<td>LAC-20</td>
<td>LAA-5</td>
<td>LAD-1</td>
</tr>
<tr>
<td>LAL300</td>
<td>LAC-20</td>
<td>LAC-20</td>
<td>LAA-5</td>
<td>LAD-1</td>
</tr>
<tr>
<td>LAL500</td>
<td>LAC-20</td>
<td>LAC-20</td>
<td>LAA-5</td>
<td>LAD-1</td>
</tr>
</tbody>
</table>

| LAR15 (*1)   | LAC-1                  | LAC-20               | LAC-25    | LAA-5        |
| LAR20        | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |
| LAR31        | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |
| LAR35        | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |
| LAR55        | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |
| LAR95        | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |
| LAR300       | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |

| 2 x LAL15(*1)| LAC-1                  | LAC-20               | LAC-25    | LAA-5        |
| 2 x LAL20    | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |
| 2 x LAL35    | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |
| 2 x LAL55    | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |
| 2 x LAL95    | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |
| 2 x LAL300   | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |
| 2 x LAL500   | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |

| 2 x LAL15(*)1| LAC-1                  | LAC-20               | LAC-25    | LAA-5        |
| 2 x LAL20    | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |
| 2 x LAL35    | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |
| 2 x LAL55    | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |
| 2 x LAL95    | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |
| 2 x LAL300   | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |
| 2 x LAL500   | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |

| GRP20        | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |
| GRP35        | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |
| GRP50 (*2)   | LAC-20                 | LAC-20               | LAA-5     | LAD-1        |

### Additional Notes

- All cables are 3m standard, optional lengths are available from 1 to 10m.
- Superflex is available as an option. Suitable for robotic applications.
- *1 Requires LAH-PT30-25 (Jumper to 25 pin cable) or LAH-PT30-26 (Jumper to 26 pin cable) as supplement.
- *2 Old type of GRP50 requires LAH-GRP26-03 cable.
Controllers / Amplifiers

SMAC supplies a range of single and multi axis controllers together with stand alone amplifiers and stepper driven driver. Controllers are programmed by mnemonic type command instructions via an RS-232 interface into NVRAM. They require no supplementary software.

**LCC-10** (LCC-11)  
Single axis brushless controller  
Built-in amplifier  
Easy expansion to multi-axis  
Mode:  
- Position  
- Velocity  
- Force  
10 bit analogue output  
(16 bit option available as Model # LCC-11)  
1 Port per axis  
RS232 up to 115200 bps  
CAN bus 2.0B up to 1MB/s

**LAC-20**  
Double axis brushless controller  
Built-in amplifier  
Easy expansion to multi-axis  
Mode:  
- Position  
- Velocity  
- Force  
- Step/Direction  
1 Port per axis  
RS232 up to 115200 bps  
CAN bus 2.0B up to 1MB/s

**LAC-1**  
Single axis controller  
Built-in amplifier  
Mode:  
- Position  
- Velocity  
- Force  
8 input/8 output TTL general purpose I/O's  
RS232 Interface  
3 analog INPUT

**LAC-25**  
2 axis controller  
Built-in amplifier  
Mode:  
- Position  
- Velocity  
- Force  
- Gearing  
Independent or coordinated 2 axis motion  
4 input/4 output  
Opto-isolated general purpose I/O's  
2 analog input/output  
RS232 Interface

**LAC-45**  
4 axis controller  
Built-in amplifier  
Mode:  
- Position  
- Velocity  
- Force  
- Gearing  
Independent or coordinated 4 axis motion  
8 input/8 output  
Opto-isolated general purpose I/O's  
6 analog input/4 analog output  
RS232 Interface

**MAAC4-7**  
4 axis controller brushed/ brushless  
Integrated high end amplifier  
Advanced math capability  
Circular interpolation  
Teach path function  
Additional controllers can be added to work together on systems requiring more than 4 axes.

**LAA-5**  
Single axis amplifier  
+/- 10 Volt input  
3 Amp output

**LAD-1**  
Smart Driver for single axis stepper input to servo output  
RS232 Interface

**MIOE-8/8**  
Expansive I/O modual  
8 input/8 output  
Opto-isolated general purpose I/O

**Built-in Controller**  
Consult factory for available actuator

www.smac-mca.com
## Select Your Actuator

In order to select the correct actuator for your application following parameters should be known.

<table>
<thead>
<tr>
<th>Machine Function:</th>
<th>Mount Details:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Available [mm]: x= y= z=</td>
<td>Mount surface: Axis side surface / Actuator side surface</td>
</tr>
<tr>
<td>Orientation: Horizontal / Vertical rod down / Vertical rod up</td>
<td>Environment: Debris / Dust / Vapor / Temperature / Harsh Cleaning Chemicals</td>
</tr>
</tbody>
</table>

### Specifications

<table>
<thead>
<tr>
<th>Linear</th>
<th>Rotary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke [mm]:</td>
<td>Degree of Rotation:</td>
</tr>
<tr>
<td>Max. Velocity:</td>
<td>Max. Rot. Velocity:</td>
</tr>
<tr>
<td>Min. Velocity:</td>
<td>Min. Rot. Velocity:</td>
</tr>
<tr>
<td>Max. Acceleration:</td>
<td>Max. Rot Acceleration:</td>
</tr>
<tr>
<td>Max Force [N]:</td>
<td>Continues force [N]:</td>
</tr>
<tr>
<td>Force Resolution [N]:</td>
<td>Max Torque:</td>
</tr>
<tr>
<td>Force Repeatability [N]:</td>
<td>Torque Resolution:</td>
</tr>
<tr>
<td>Encoder Resolution [µm]: 5 / 1 / 0.1 / other ( )</td>
<td>Torque Repeatability:</td>
</tr>
<tr>
<td>Repeatability [µm]:</td>
<td>Encoder Resolution</td>
</tr>
<tr>
<td>Cycles/sec:</td>
<td>Cycles/sec:</td>
</tr>
<tr>
<td>Expected Cycle Life:</td>
<td>Expected Cycle Life:</td>
</tr>
</tbody>
</table>

### Rod

<table>
<thead>
<tr>
<th>Moving part: Rod / Slide</th>
<th>Rod Length (Full Retract) [mm]:</th>
<th>Tip: Male / Female / Blank / Custom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material requirement:</td>
<td>Vacuum through shaft: Yes / No</td>
<td>Thread of shaft: Standard / M ….</td>
</tr>
</tbody>
</table>

### Special Features

|-----------------------------------|-----------------------------|--------------------------------------|----------------------------------|

### Controller or Amplifier

<table>
<thead>
<tr>
<th>Location: Built In / External at … [m]</th>
<th>Cable: Standard / flying lead</th>
<th>I/O: Number and TTL / 24V</th>
<th>Smart Driver: Yes / No</th>
</tr>
</thead>
</table>

### Payload

<table>
<thead>
<tr>
<th>Weight [gram]:</th>
<th>Size: (LxWxH)</th>
<th>Inertia:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape:</td>
<td>Relation to rod/slide: Fixed / Push only / Other</td>
<td>Remarks:</td>
</tr>
</tbody>
</table>
Installation Guideline

**Duty cycle**
SMAC requires that all units must be operated at less than 40% maximum duty cycle. This does not apply to CA series and can be calculated as follows:

\[
\% \text{ of max force applied} \times \% \text{ of cycle time it is applied} = \% \text{ duty cycle}
\]

For example:
- 100% force x 40% of cycle time = 40% duty cycle.
- 60% force x 50% of cycle time = 30% duty cycle.
- 40% force x 100% of cycle time = 40% duty cycle.

Recommendation from SMAC is that the duty cycle must not be exceeded over a one second time period.

NOTE: Failure to observe this duty cycle recommendation may result in the actuator sustaining damage through overloading. Overloading will overheat the coil and may cause deformation or an impact on the magnet housing.

All CA series units must be operated at less than below suggested duty cycle (%).

<table>
<thead>
<tr>
<th></th>
<th>24V</th>
<th>48V</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAL12</td>
<td>80%</td>
<td>40%</td>
</tr>
<tr>
<td>CAL36</td>
<td>80%</td>
<td>40%</td>
</tr>
<tr>
<td>CAL75</td>
<td>80%</td>
<td>40%</td>
</tr>
</tbody>
</table>

**Continuous Force**
Peak force applied for duration shorter than 0.4 sec. in one second interval.
(force mode): 40% of peak force, continuous

**Safety Considerations**
Unintentional full force may be applied continuously under the following conditions:
- missed target position
- excessive friction
- equipment malfunction, i.e. jam

If left undetected, this can cause destruction of the coil in some units. A servo program should perform the following checks regularly:
- Re-home: to assure target position has not shifted beyond end of stroke
- Time-outs: to shut power down within 10 seconds of error detection
- Following Error Limits: software safety
- Check limit switches
- Check temperature sensor

**Mounting**
If the actuator is mounted vertically, the shaft drops down when the actuator is powerless. It is possible that other moving parts of the machine may damage the actuator at this position.

A return spring would hold the actuator in an upper position when it is powerless.

A safety function in your machine should check the actuator’s current position before other components may move into the working area of the actuator.
Individual Modifications

Many of our standard actuators listed on previous pages are compatible with both add-on options and modifications. In addition to the standard vacuum and spring option SMAC can offer the following modifications subject to approval by the factory.

**Linear Guide Options**
Increased rigidity and side load tolerance can be gained by using a higher specification “wide guide”. Additionally, in force sensitive applications we can fit a low friction guide.

**Double Coil**
Integrating an extra coil can enhance both force and acceleration.

**Custom Nose-Bush**
An extended nose bush with increased side load tolerance are available on many models. We can also offer scraper and wiper seals around the shaft to protect the bearings from excessive wear in harsh environments.

**Custom Shafts**
In addition to the standard male/female rod ends we can also offer options such as “breakaway” shafts and custom shaft diameters.

**10µm T.I.R.**
Total indicator run-out under 10µm is available on several linear/rotary models.

**Rotary**
Increased torque/gear ratio can be gained by using alternative geared motors or direct drive motors.

Higher rotary encoder resolutions are optional. Please consult factory for availability.

If a longer life rotary is required, then we can fit a brushless rotary motor.

**Flying Lead**
Instead of the standard chassis connector we can offer a flying lead option. The flying lead is standard for all the CA series actuators, except the CAL35 series.

**Cable Options**
Whenever an SMAC actuator is mounted to any 3rd party device such as a gantry or multi-axis robot, SMAC strongly recommends that a superflex cable is used. Cable lengths with a standard of 3 meters up to a maximum of 10 meters can be offered.
Sample Applications

Switch Test

Application Examples
- Automotive switch test
- Cell phone keypads, membrane keypads
- Touch screens
- Valves, sensors and relays
- PC Keyboards, ATM keypads
- Springs, door latches, etc...

The SMAC Advantage
- Verify hysteresis and switch differential
- Accurate simulation of human motion profiles
- Combined force and position measurement
- High speed life testing
- 1,000,000 cycles in 8 hours
- QA reporting functions to verify 100% test

100% Automated Thread Check

Verification of:
- Oversized / undersized thread
- Number of threads
- Cross thread
- Thread depth
- No thread or dislocated thread
- Pitch measurement
- Shallow / blocked hole

Increase of torque/gear ratio or higher rotary encoder resolutions are available.

Measuring, Bore Gauging and Groove Inspection

- Airbag components
- Fuel Injector Plug
- Assembly part inside the fuel injector
- XYZ-Mini CMM
- Internal and External Diameter Gauging
- Height Gauging
- Thickness Gauging
- Multiple Point Gauging

Resolution: 5µm (0.0002 inch) to 0.05µm (1.968x10^-7 inch)

- Verifying the depth and diameter of 50µm x 50µm small pockets in a drum for cigarette manufacturing.

Problem:
The previous inspection system included a vision system that measured the diameter of each hole but not the depth. The depth could only be verified by manual spot checks.

SMAC Advantage:
- Precision & contact measuring; the previous system could only measure diameter, but not the depth.
- Fully automate the verification process
**Pick & Place**

**Problem:**
- Different pick up height due to mechanical tolerances
- Low throughput of the machine
- Position accuracy – linear and rotary
- Constant force for positioning needed

**SMAC Solution:**
- Finding the chip surface with the Soft-Land function to avoid damages on the parts
- High speed positioning with a direct drive system
- High resolution positioning up to 0.1 micron
- Up to 50000 counts/revolution - 0.007 degrees
- Controlled precise force
- Shaft run-out 20µm standard. (>10micron option)
- Accurate repeatable positioning at +/- 2 encoder counts
- Programmable force/torque, position and velocity in all axes

**Pick & Place Application Examples**
- Die bonding
- Smart Card (IC chip mounting)
- Gauging & sorting parts
- Handling small and fragile components

---

**Tapping**

**Application**
0.38mm Diameter Smart Tapping for a watch manufacture by using LAR35-050-55F
The diameter of the part is about 3.5mm and the hole to tap is about 0.38mm.

**Key Features**
- Precise force control
- Soft-Land capability
- Precise position control
- Verify thread as the part being tapped.

---

**Screw Driver**

**Application**
Simplifying the disc drive assembly system by replacing three devices with one linear rotary actuator.

**Problem:**
- Difficult to keep precise height alignment at pick and place locations.
- The manual tuning since the end of stroke is a physical adjustment and not programmable.
- The rotary axis is not able to determine position or the linear movement, thus neither the pitch, the number of rotations nor the first thread CCW can be confirmed.
- The cost of the combination, an electric screw driver attached with 2 pneumatic slide, can run up to US$10,000.

**The SMAC Advantage**
- SMAC linear rotary electric actuator is an all in one, off the shelf solution.
- A long stroke with fast approach.
- Soft-Landing function at both linear and rotary positions.
- Constant accurate force control while threading.
- Monitoring the torque and pitch verification: Good, shallow, cross, or no threads as well as the precision of the thread are detected through linear position feedback.
- SMAC provides this at 50% less the cost of the previous method.
Packaging

- **Cup dispensing**: High speed dispensing at 400+ per minute. Replaces pneumatic cylinders for higher speed, longer life and quiet operation.
- **De-blistering**: Popping pills is the machine which automates dispensing of tablets from foil and plastic containers. Key points are speed, force control, stroke adjustment and noise.
- **Capping of bottles**: Cap rotates to engage slot. Detect and report no/obstructed nozzle. SMAC actuators can adjust force and torque, show the different quality check capabilities such as cap height, torque limit, force required to press in, and even check the clicks on child proof caps.
- **High Speed on the Fly Labeling**: The label applicator (SMAC actuator) matches the speed of the conveyor as the product through. Adjustable speed and height for the different kind of products and then Soft-Land with controlled force.
- **The Bottle/Carton Ejector for Filling Lines**: Programmable force & speed control adapt easily to different size of bottles and fill level. Total out and back is 50ms, 1200/min.
- **Parts Feeding**: 50,000 cycles/hour, 24/7 operation.

Glass

**Measuring Thickness of Thin Flexible Glass**

**Problem**: Accuracy of the current air cylinder, LVDT and force control system.

**Solution**: The customer used the Soft-Land feature of the SMAC LAL20 in conjunction with a load cell mounted on the rod of the SMAC actuator. The LAL20 is controlled by a dual-axis LAC25.

**Glass Grinding**

**Problem**: The grinding process produces a 125µm finish with less than a 50µm variation. Damage to the glass at the beginning and end of the grinding cycle is caused by inadequate force control of the air cylinder which is driving the grind wheel. The force required is 2 to 4 Newtons, with a 5mm stroke.

**Solution**: Customer was able to land softly on the glass panel and provide a constant force using the "force mode" of the LAL55 at both beginning and end of the stroke.

**Glass Scoring (V-Cutting)**

- Scoring Organic Light Emitting Display (OLED) which measures only 0.5mm thick by using CAL36 series of electric actuator. Precise force control of less than 0.05N required. Soft-Land capability and low friction are key.

**Glass Application Examples**

- Glass cutting, de-burring, positioning
- Glass scoring (V-Cutting) for solar panels and LCDs
- Chamfering and bevelling
- Measuring surface profile

Medical & Bio-Science

- Pull test on medical stent used in Catheters
- Automated screwing caps on a syringe
- Catheter Tube Welding
- Push/Pull testing of Hypodermic Needles
- Measuring cells height in two conditions, dry and saturated.
- Measuring the amount of wear on a knee replacement plate over x amount of time.
- Medical catheter assembly
- Soft contact lens moulding

Welding

**Key Operation**: Applying even and consistent pressure for EDM assembly electronic-welding equipment.

**SMAC Advantage**: Precise control of the contact force to avoid damaging the parts. Soft-landing profile uses a high speed approach to save time. Precise and repeatable positioning.

Scanning

**Key Operation**: Moving camera/micro scope lens to focus material for inspection or analyse

**SMAC Advantage**: Accurate and repeatable force control and positioning with sub-micron resolution. Compact size. Easy set up and programming.
SMAC Corporation designs and manufactures advanced electric actuators. All SMAC actuators are quality products specifically designed and built for long service. Therefore, all actuators appearing in this catalogue are guaranteed for a period of twelve months from the original date of shipment from our factory.

This guarantee is limited to a one-time replacement or rebuilding of any actuator which should fail to operate properly. Actuators must be returned with transportation prepaid and received at our factory within the guarantee period. They will be returned to the customer at the expense of SMAC.

No claims for labour, material, time, damage or transportation are allowable. Actuators damaged as a result of misapplication by the customer are excluded from this guarantee. The guarantee does not apply to loss or damage caused by fire, theft, riot, explosion, labor dispute, act of God or other causes beyond the control of SMAC. SMAC shall in no event be liable for remote, special or consequential damages, under the SMAC guarantee or under any implied warranty.

The above guarantee is our manner of extending the engineering and service resources of the SMAC organization to assure our customers long and continued satisfaction.

Actuators no longer covered by the SMAC guarantee can be rebuilt under the SMAC rebuild program. Our continued research and development program extends the life of our actuators making them even more reliable under adverse operating conditions. Actuators returned under this program are completely disassembled, inspected and rebuilt to current operating standards wherever possible, tested and returned within a few days for a reasonable charge (typically 35% of standard list price). For 90 days from date of shipment from our factory, all rebuilt actuators carry the same guarantee as provided for new actuators.

SMAC products have been tested and found to be fully compliant with EN 50082-2 & EN 55011 Group 1, Class A.

SMAC manufactures and sells actuators, controllers and cables. It has a standard warranty policy covering these products.
SMAC does not offer integration services. These are the responsibility of SMAC distribution and their customers. This means SMAC takes no responsibility for software programming, mechanical designs and all other engineering involved in a project using SMAC devices.
SMAC may, at its discretion, offer technical recommendations or suggestions to help its customer, the distributor, on a particular application. SMAC will only do this once a signed release of responsibility is received from its customer.

U.S. and world wide patents issued & applied for. SMAC improves its product line on a continuing basis. Specifications and mechanical dimensions are subject to change without notice. Please consult factory before proceeding with your design.
National & International Offices

North America
SMAC Midwest (MI)
Suite 175
4595 Broadmoor Ave. S.E.
Grand Rapids, MI 49512
Tel: +1 616-554-5672
Fax: +1 616-554-5762
Email: s_curtiss@sbcglobal.net

SMAC Midwest (IL)
Tel: +1 312-446-8643
Email: haidos@gmail.com

SMAC Mexico
Tel: +52 462-155-17-69 (international)
045-462-155-17-69 (inside Mexico)
Email: hlecona-smac@prodigy.net.mx

Europe
SMAC Europe Ltd.
Ikon House, Rutherford Way
Crawley, West Sussex
United Kingdom RH10 9PB
Tel: +44 (0)1293-520147
Fax: +44 (0)1293-539829
Email: info@smac-mca.co.uk

SMAC The Netherlands
Steenovenweg 5
5708 HN Helmond
Postbus 172, 5700 AD Helmond
Tel: +31 (0)492-472494
Fax: +31 (0)492-472600
Email: info@smac-mca.nl

SMAC Germany
Tumstr. 22c
75228 Ispringen
Tel: +49 (0)7231 8008-760
Fax: +49 (0)7231 8008-744
Email: info@smac-mca.de

SMAC Switzerland
En Chamard 55b
CH-1442 Montagny-près-Yverdon
Tel: +41 (0)79-629-17-49
Fax: +41 (0)24-430-11-17
Email: martin.frei@smac-mca.ch

SMAC Italy
Tel: +39 (0)338 9069289
massimiliano.trabucchi@smac-mca.it

Asia
SMAC Japan
Shinwa Bldg.
2-6-8 Hamamatsu-Chō
Minato-Ku, Tokyo
Japan, 105-0013
Tel: +81 (0)3-5733-2450
Fax: +81 (0)3-5733-2470
Email: smacjapan@smac-mca.co.jp

SMAC Taiwan
1F, 110-1, Cheng Gong Road, San Chong City, Taipei County, Taiwan
Tel: +886-2-2974-9732
Fax: +886-2-2974-3706
Email: sales@smac-mca-com.tw

SMAC Korea
3F, 275-12, YoungHyun-Dong, UlJungBu-Si
Gyunggi-Do
S. Korea
Tel: +82-70-8784-9006
Fax: +82-31-851-6015
Mobile: +82-10-3934-9006
Email: smac.korea@yahoo.com

SMAC China (Shanghai)
Shanghai ZIZHU Science-based Industrial Park
5004,5005 Room, 5th Floor, 2 Bldg. 555 Dongchuan Road
Shanghai 200240
Tel: +86 (0)21-6435-1661
Fax: +86 (0)21-3429-0092
Mob: +86 (0)133-1186-5359
Email: smac.sh@163.com

SMAC China (Beijing)
Tel: +86-(0)10-84965726
Fax: +86-(0)10-84965726
Email: emily@smac-china.com

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