



MOVING COIL ACTUATORS

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]: 15, 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]: 15, 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
Multi axes [4] Gallil based controller



Built-in Controller



LAA-5
Amplifier for 1 axis



LAD-1
Smart drive for 1 axis

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 feed back from the encoder. The actual position is still monitored but has no effect upon the output.

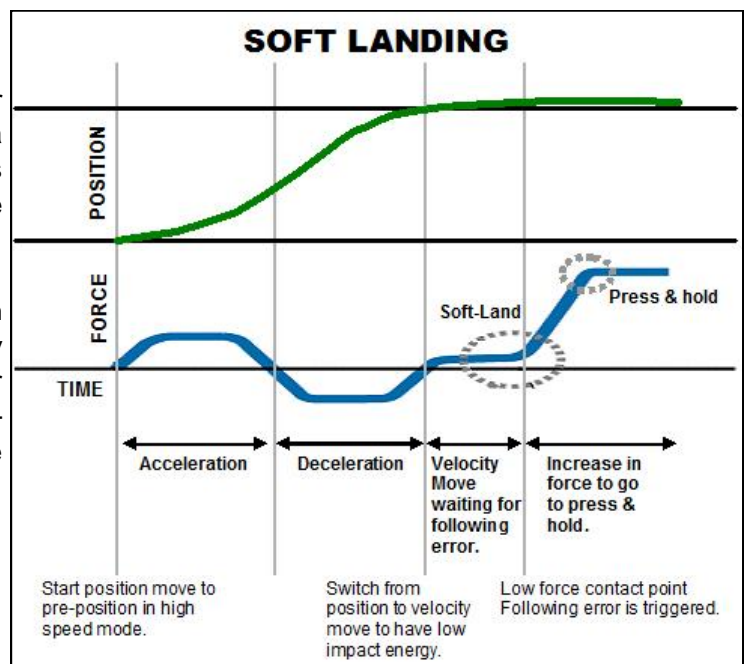
Velocity Mode: Velocity Mode allows the actuating rod to be moved with a given velocity, acceleration, force and direction. Typically used for a “Soft-Land” routine.

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.

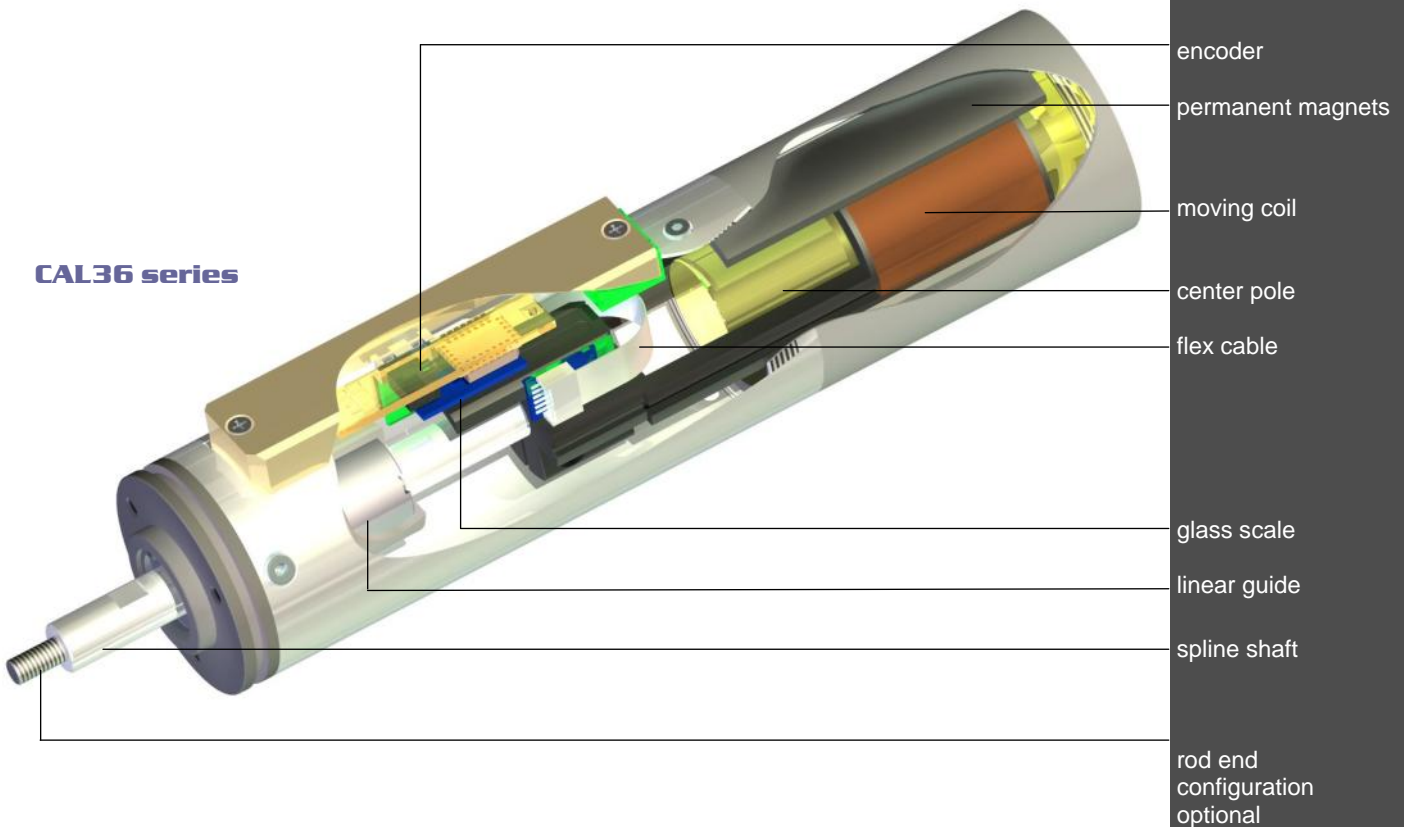


Electric Cylinder

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 5 μ m standard, 1 and 0.1 μ m option for most actuators.
- Programmable force, position, acceleration and velocity.



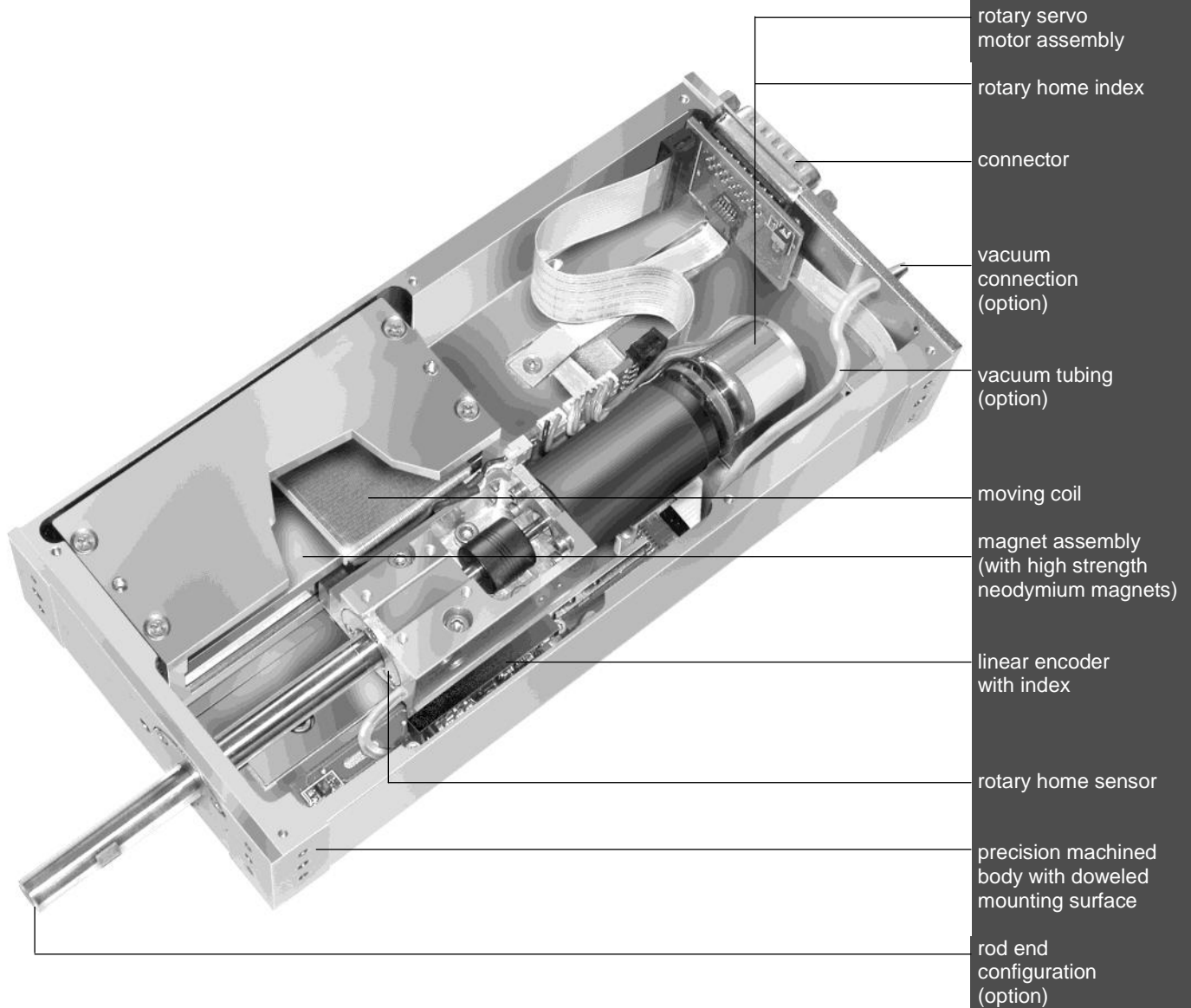
Linear and Linear / Rotary Moving Coil Actuators

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.

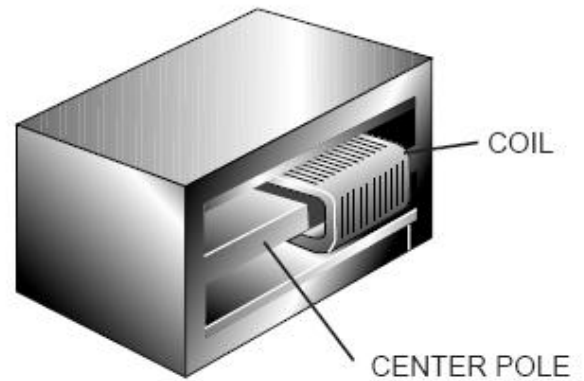
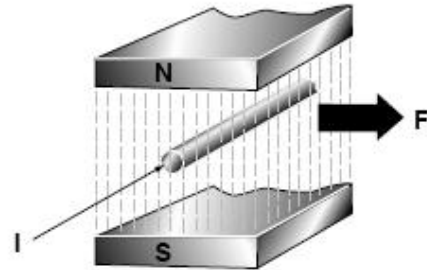
The amount of force generated is governed by the equation

$$F \propto N I B$$

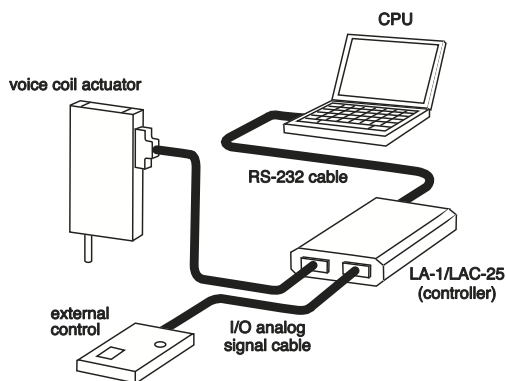
where;

- 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)

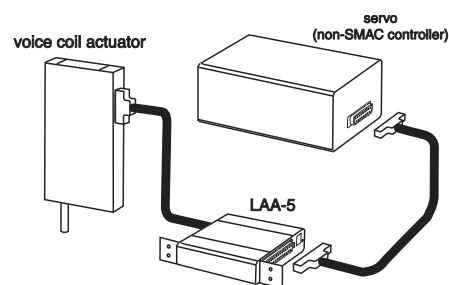
Therefore, doubling **I (current)** doubles **F (Force)**.



Hardware Configuration



Hardware with SMAC Controllers



Hardware with SMAC Amplifier

Part Numbering System

	MODEL	SERIES	STROKE	VOLT	ENCODER	SHAFT	VACUUM	SPRING	*** Cable	*** Mounting	
	[][][][][][]	[][][][][][]	[][][][][][]	[][][][][][]	[][][][][][]	[][][][][][]	[][][][][][]	[][][][][][]	[][][][][][]	[][][][][][]	[][][][][][]
CYLINDER	C A L	3 6	0 2 5								
LINEAR	L A L 3	0 0	0 5 0								
	L C A	2 5	0 1 0								
LINEAR/ ROTARY	L A R	3 5	0 5 0								
SLIDE	L A S	5 5	1 0 0	1							= 24 volt 6 coil *
XY TABLE	L X Y			3							= 48 volt 6 coil *
GRIPPER	G R P			5							= 24 volt single coil
				6							= 24 volt double coil**
				7							= 48 volt single coil
				8							= 48 volt double coil**
				1							= 1.0µm
				2							= 0.1µm**
				3							= 0.05µm**
				5							= 5.0µm
				7							= 20µm
						B					= BLANK (standard)
						F					= FEMALE
						M					= MALE
						C					= CUSTOM
							V				= VACUUM
								S			= SPRING
									3		= Flying Lead
									5		= Pigtail
										A	= Front Mount
										B	= Base Mount

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

*LCA series only
**Check availability
*** CA and LCA series only

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

	Voltage [DC]	Size: Dia x L [mm]	Stroke [mm]	Maximum Force [N]	Force Constance [N/A]	Moving Mass [kg]	Max Current [Amp]	Weight [kg]
CAL12-010-5	24	Ø12x112	10	1.5	1	0.01	1.5	0.08
CAL36-015-5	24	Ø36x145	15	18	18	0.08	1	0.8
CAL36-025-5	24	Ø36x155	25	15	15	0.08	1	0.95
CAL36-050-5	24	Ø36x230	50	12	12	0.095	1	1.15
CAL75-015-5	24	Ø75x249	15	40	31	0.44	1.3	4.8
CAL75-015-7	48	Ø75x249	15	62	48	0.44	1.3	4.8
CAL75-025-5	24	Ø75x262	25	27	22	0.44	1.3	5.1
CAL75-025-7	48	Ø75x262	25	53	44	0.44	1.3	5.1
CAL75-050-5	24	Ø75x283	25	25	19	0.44	1.3	5.6
CAL75-050-7	48	Ø75x283	50	40	32	0.44	1.3	5.6
CAL75-050-8	48	Ø75x385	50	90	33.5	0.81	2.7	8



CAL12



CAL36



CAL75

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)

Linear Actuators

	Voltage [DC]	Size: LxWxH [mm]	Stroke [mm]	Maximum Force [N]	Continuous Force [N]	Force Constant [N/A]	Moving Mass [kg]	Weight [kg]
LCA25-010-5	24	55x70x25	10	8	3	6	0.04	0.27
LCA25-010-7	48	55x70x25	10	12	5	8	0.04	0.27
LCA25-010-1	24	60x115x25	10	18	7	13	0.08	0.5
LCA25-010-3	48	60x115x25	10	22	9	14.5	0.08	0.5
LCA25-025-1	24	60x130x25	25	18	7	13	0.08	0.55
LCA25-025-3	48	60x130x25	25	22	9	14.5	0.08	0.55
LCA25-050-1	24	60x155x25	50	18	7	13	0.08	TBV
LCA25-050-3	48	60x155x25	50	22	9	14.5	0.08	TBV
LCA25-100-1	24	60x205x25	100	18	7	13	0.08	TBV
LCA25-100-3	48	60x205x25	100	22	9	14.5	0.08	TBV
LCA25-150-1	24	60x255x25	150	18	7	13	0.08	TBV
LCA25-150-3	48	60x255x25	150	22	9	14.5	0.08	TBV
LCA25-200-6	24	60x310x25	200	18	7	13	0.08	TBV
LCA25-200-8	48	60x310x25	200	22	9	14.5	0.08	TBV
LCA50-025-5	24	100x125x50	25	40	16	30	0.335	2.157
LCA50-025-7	48	100x125x50	25	50	20	40	0.335	2.157
LAL15-015-5	24	120x58x15	15	5	2	2.7	0.05	0.23
LAL20-010-5	24	65x85x20	10	8	3.2	5.5	0.07	0.30
LAL20-015-5	24	65x115x20	15	7	2.8	5	0.07	0.34
LAL20-015-6	24	65x115x20	15	12	4.8	5.8	0.08	0.34
LAL20-025-5	24	65x115x20	25	5.4	2	3.4	0.08	0.36
LAL35-025-6	24	135x90x35	25	31.5	12.6	15.5	0.19	1.06
LAL35-025-7	48	135x90x35	25	18	7	10	0.12	0.95
LAL35-050-5	24	135x90x35	50	10	4	7	0.13	1.1
LAL35-050-7	48	135x90x35	50	12.5	5	10	0.13	1.1
LAL35-100-5	24	135x90x35	100	6	2.4	3.5	0.1	1.7
LAL55-050-5	24	250x110x55	50	25	10	19	0.3	3
LAL55-050-7	48	250x110x55	50	40	16	24.5	0.3	3
LAL55-100-5	24	250x110x55	100	16	6.4	13	0.3	3.8
LAL55-100-7	48	250x110x55	100	25	10	17	0.3	3.8
LAL55-150-5	24	250x110x55	150	13	5	10	0.4	4.5
LAL55-150-7	48	250x110x55	150	19.5	8	12.5	0.4	4.5
LAL95-015-7	48	90x70x95	15	84	33	53	0.25	2.2
LAL95-015-8	48	147x70x95	15	195	78	60	0.5	4
LAL95-025-8	48	180x70x95	25	162	65	52	0.58	3.75
LAL95-050-7	48	147x70x95	50	65	26	41	0.25	3
LAL300-050-8	48	210x85x120	50	202	80	86	0.8	8.8
LAL500-025-8	48	300x140x200	25	500	200	166	1.6	26.5
LAL500-050-8	48	300x140x200	50	500	200	100	1.6	26.5



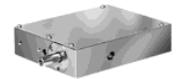
LCA25



LCA50



LAL15



LAL20



LAL35



LAL55



LAL95



LAL300



LAL500

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.

Linear & Rotary Actuators

	Voltage [DC]	Size: LxWxH [mm]	Stroke [mm]	Maximum Force [N]	Continuous Force [N]	Force Constant [N/A]	Moving Mass [kg]	Weight [kg]	Maximum Torque* [Nm]	Rotary type	Rotary Encoder Resolution	Velocity* [rpm]
LAR15-015-5	24	120x58x15	15	5	2	2.7	0.095	0.25	0.008	direct	20K	500
LAR20-015-5	24	115x65x20	15	7	2.8	5	0.09	0.41	0.008	direct	20K	500
LAR31-017-5	24	140x77.25x35	17	14	5.6	10	0.22	0.85	0.066	direct	20K	500
LAR31-027-5	24	140x77.25x35	27	12	4.8	7	0.2	0.85	0.066	direct	20K	500
LAR31-031-5	24	140x77x35	31	11	4	7	0.19	0.84	0.06	Direct	40.98K	2000
LAR35-025-5	24	190x90x35	25	12	4.8	7	0.14	1.2	0.085	direct	20K	500 - 5000
LAR35-050-5	24	190x90x35	50	10	4	7	0.29	1.4	0.085	direct	20K	500 - 5000
LAR55-050-5	24	250x110x55	50	25	10	19	0.5	3.1	0.2 - 2.5	direct or gear box	2K-28K	500 - 5000
LAR55-050-7	48	250x110x55	50	40	16	27	0.31	2.8	0.2 - 2.5		2K-28K	500 - 5000
LAR55-100-5	24	250x250x55	100	16	6.4	13	0.5	3.85	0.2 - 2.5		2K-28K	500 - 5000
LAR55-100-7	48	250x250x55	100	25	10	18	0.5	3.85	0.2 - 2.5		2K-28K	500 - 5000
LAR95-015-7	48	304x90x115	15	84	33	53	0.9	3.5	0.2 - 4.5		2K-132K	75 - 5000
LAR95-050-7	48	304x90x115	50	65	26	41	0.9	4.2	0.2 - 4.5		2K-132K	75 - 5000
LAR300-050-8	48	284x85x160	50	202	80	86	1	9.5	0.2 - 4.5		2K-132K	75 - 5000



LAR15



LAR20



LAR31



LAR35



LAR55



LAR95



LAR300

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

	Voltage [DC]	Size: LxWxH [mm]	Stroke [mm]	Maximum Force [N]	Continuous Force [N]	Force Constant [N/A]	Moving Mass [kg]	Weight [kg]
LCS25-010-5	24	55x70x25	10	8	3	6	0.04	0.27
LCS25-010-7	48	55x70x25	10	12	3	8	0.04	0.27
LAS15-015-5	24	120x58x15	15	5	2	2.7	0.05	0.23
LAS20-010-5	24	85x65x20	10	8	3.2	5.5	0.07	0.34
LAS20-015-5	24	65x115x20	15	7	2.8	5	0.07	0.34
LAS20W-015-6	24	75x135x20	15	12	4.8	5.8	0.122	0.54
LAS20-025-5	24	85x65x20	25	5.5	2	2.8	0.07	0.34
LASW20-011-5	24	85x75x23	11	8	3.2	5.5	0.07	0.3
LAS35-025-6	24	135x90x35	25	31.5	12.6	15.5	0.19	1.06
LAS35-025-7	48	150x90x35	25	18	7	10	0.15	0.95
LAS35-050-5	24	135x90x35	50	10	4	7	0.13	1.1
LAS35-050-7	48	135x90x35	50	12.5	5	10	0.13	1.1
LAS35-100-5	24	135x90x35	100	6	2.4	3.5	0.13	1.7
LAS35-100-7	48	135x90x35	100	7.5	3	5	0.1	1.3
LAS55-050-5	24	250x110x55	50	25	10	19	0.3	3
LAS55-050-7	48	250x110x55	50	40	16	24.5	0.31	3
LAS55-100-5	24	250x110x55	100	16	6.4	13	0.3	3.8
LAS55-100-7	48	250x110x55	100	35	10	19	0.31	3.8
LAS55-150-5	24	250x110x55	150	13	5	10	0.4	4.5
LAS55-150-7	48	250x110x55	150	19.5	8	13	0.31	4.58
LAS95-015-7	48	90x70x95	15	84	33	53	0.25	2.1
LAS95-015-8	48	147x70x95	15	195	78	60	0.5	4
LAS95-025-8	48	180x70x95	25	162	65	52	0.5	3.78
LAS95-050-7	48	147x70x95	50	65	26	41	0.25	3
LAS300-050-8	48	210x85x120	50	202	80	86	0.8	8.8



LAS15



LAS20



LASW20



LAS35



LAS55



LAS95

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

Grippers

	Voltage [DC]	Size: LxWxH [mm]	Stroke per Axis [mm]	Axis 1				Axis 2				Weight [kg]	Maximum Opening
				Maximum Force [N]	Continuous Force [N]	Force Constant [N/A]	Moving Mass [kg]	Maximum Force [N]	Continuous Force [N]	Force Constant [N/A]	Moving Mass [kg]		
GRP20-010-5	24	80x90x23	5	8	3.2	5.5	0.065	8	3.2	5.5	0.065	0.5	10
GRP35-030-5	24	93x110x38	15	25	10	17	0.1	25	10	17	0.1	1.5	30
GRP50-030-7	48	90x125x55	15	45	18	22.5	0.47	45	18	22.5	0.47	2.5	30



GRP20



GRP35



GRP50

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 our 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

	Voltage [DC]	Size: LxWxH [mm]	Stroke per Axis [mm]	Axis 1				Axis 2				Weight [kg]
				Maximum Force [N]	Continuous Force [N]	Force Constant [N/A]	Moving Mass [kg]	Maximum Force [N]	Continuous Force [N]	Force Constant [N/A]	Moving Mass [kg]	
LXY15-015-7	48	111x112x86	15	22	11	13	0.13	25	12	12	0.22	1.65
LXY25-025-8	48	125x125x65	25	42	17	14	0.19	42	17	14	1.5	3.2
LXYM15-015	24/48	230x242.5x55	15	14.7/24.5	5.9/9.8	12.7	0.36	16.4/27.4	6.6/11	13	0.51	2.7



LXY15



LXY25



LXYM 15

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.

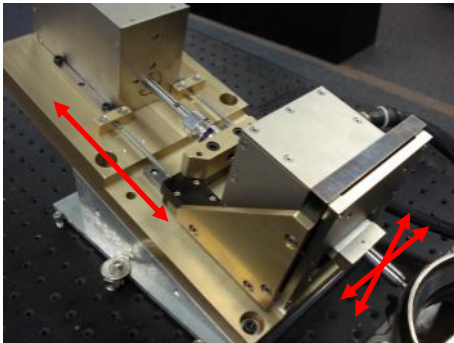
Options & Modifications (Consult factory for availability):

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.

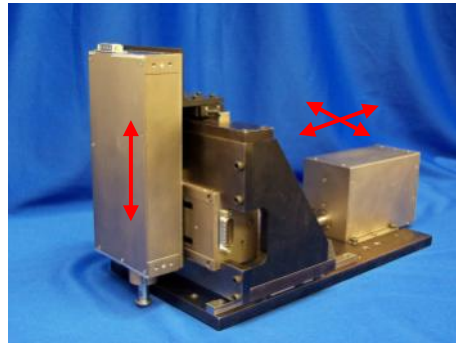
Multi-Axis System

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.

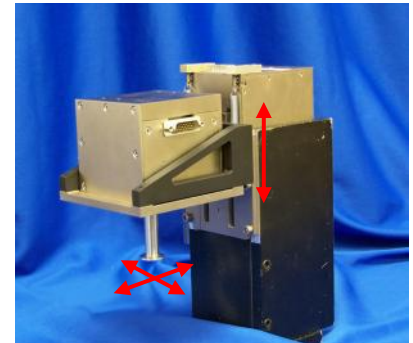
Ideal applications are measuring and testing (QC), dispensing (Bonding), machining (CNC), scoring and cutting, to name a few. SMAC multi-axis 3D systems are unique - they enable total programmability of speed, position and force all at the same time with an exceptional degree of accuracy and repeatability.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



LXY15 & LAL95



LAL35, LAL95 & LAS95

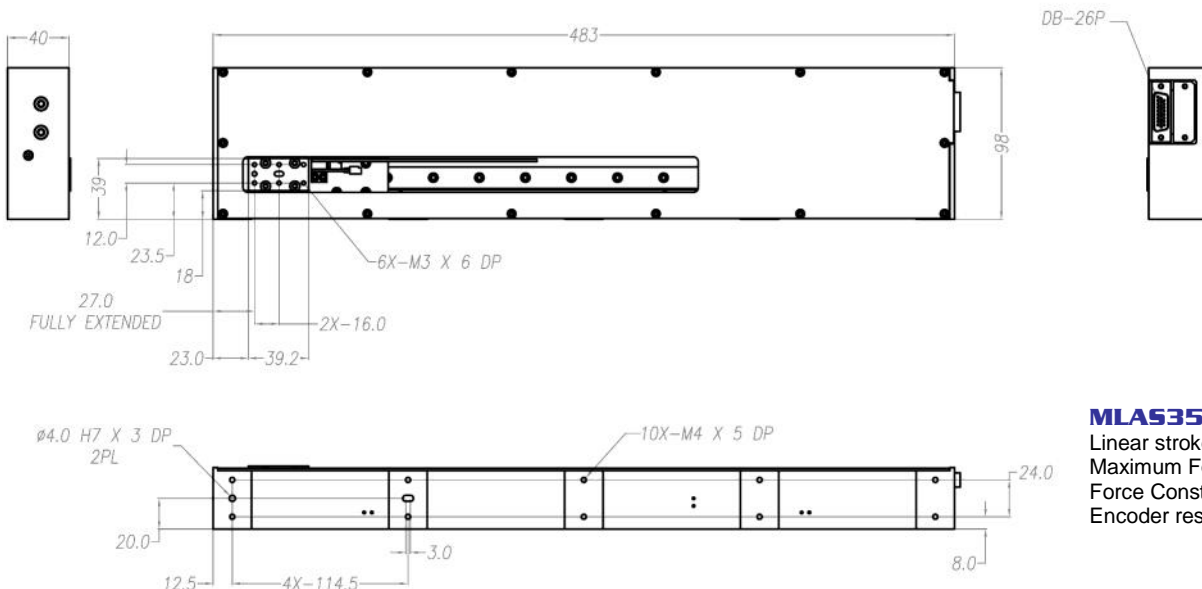


LXY15 & LAS95

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.



MLA535-250

Linear stroke [mm]: 250
 Maximum Force [N]: 60
 Force Constant [N/A]: 11
 Encoder resolution [µm]: 5

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.

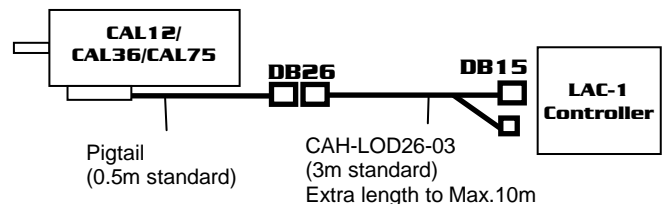
Cable Chart for the CA series Electric Cylinder

	Single Axis Controller	Dual Axis Controller		Amplifier	Smart Driver
Actuator	LAC-1	LAC-20	LAC-25	LAA-5	LAD-1
CAL12	Flying lead type or CAH-LOD26-03 for pigtail type	N/A	N/A	CAH-LAD26-03	CAH-LSD26-03
CAL36					
CAL75					
2x CAL12(*1)	N/A	LAT-26C-0003-03 for pigtail type	CAH-LTD26-3	N/A	N/A
2x CAL36		LAT-26C-0003-03 for pigtail type	CAH-LTD26-03 for pigtail type	N/A	N/A
2x CAL75		LAT-26C0003-03 for pigtail type	CAH-LTD26-03 for pigtail type.	N/A	N/A

Standard Flying Lead



Pigtail



Superflex is available as an option. Suitable for robotic applications.

Cable Chart for the LCA series Actuator

	Single Axis Controller	Single Axis Controller	Amplifier	Smart Driver
Actuator	LCC-10	LAC-1	LAA-5	LAD-1
LCA25 Single or Double Coil	Flying lead type or MAH-LOD26-03 for pigtail type	Flying lead type or CAH-LOD26-03 for pigtail type	Flying lead type or CAH-LAD26-03 for pigtail type	Flying lead type or CAH-LSD26-03 for pigtail type
LCA50 Single or Double Coil				
LCA25 6 Coil		N/A	N/A	N/A
LCA50 6 Coil				

Cable Chart for the LA series Actuator

	Single Axis Controller	Dual Axis Controller		Amplifier	Smart Driver
Actuator	LAC-1	LAC-20	LAC-25	LAA-5	LAD-1
LAL15 (*1)	LAH-LOD26-03			LAH-LAD26-03	LAH-LSD26-03
LAL20	LAH-LOD26-03			LAH-LAD26-03	LAH-LSD26-03
LAL35	LAH-LOD26-03			LAH-LAD26-03	LAH-LSD26-03
LAL55	LAH-LOD-03			LAH-LAD-03	LAH-LSD-03
LAL95	LAH-LOD26-03			LAH-LAD26-03	LAH-LSD26-03
LAL300	LAH-LOD-03			LAH-LAD-03	LAH-LSD-03
LAL500	LAH-LOD-03			LAH-LAD-03	LAH-LSD-03
LAR15 (*1)		LAT-26C-0005-03	LAH-RTD26-03	LAH-RAD26-03	LAH-RSD26-03
LAR20		LAT-26C-0005-03	LAH-RTD26-03	LAH-RAD26-03	LAH-RSD26-03
LAR31					
LAR35		LAT-26C-0005-03	LAH-RTD26-03	LAH-RAD26-03	LAH-RSD26-03
LAR37					
LAR55		LAT-25C-0005-03	LAH-RTD-03	LAH-RAD-03	LAH-RSD-03
LAR95		LAT-25C-0005-03	LAH-RTD-03	LAH-RAD-03	LAH-RSD-03
LAR300		LAT-25C-0005-03	LAH-RTD-03	LAH-RAD-03	LAH-RSD-03
2 x LAL15(*1)		LAT-26C-0003-03	LAH-LTD26-03		
2 x LAL20		LAT-26C-0003-03	LAH-LTD26-03		
2 x LAL35		LAT-26C-0003-03	LAH-LTD26-03		
2 x LAL55		LAT-25C-0003-03	LAH-LTD-03		
2 x LAL95		LAT-26C-0003-03	LAH-LTD26-03		
2 x LAL300		LAT-25C-0003-03	LAH-LTD-03		
2 x LAL500		LAT-25C-0003-03	LAH-LTD-03		
GRP20		LAT-26C-0005-03	LAH-RTD26-03	LAH-RAD26-03	
GRP35		LAT-26C-0005-03	LAH-RTD26-03	LAH-RAD26-03	
GRP50 (*2)		LAT-26C-0005-03	LAH-RTD26-03	LAH-RAD26-03	
LXY15			LAH-GRP26-03	LAA-GRP26-03	
LXY25			LAH-GRP26-03	LAA-GRP26-03	
LXYM15			LAH-GRP26-03	LAA-GRP26-03	

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 modular
8 input/8 output
Opto-isolated general purpose I/O



Built-in Controller

Consult factory for available actuator

Select Your Actuator

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

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

Specifications

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

Rod

Moving part: Rod / Slide	Rod Length (Full Retract) [mm]:	Tip: Male / Female / Blank / Custom
Material requirement:	Vacuum through shaft: Yes / No	Thread of shaft: Standard / M

Special Features

Plating: Standard / Black anodized	Cable: Standard / Superflex	Spring: Full return / Counter balance	Linear Guide: Standard / Long life
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Controller or Amplifier

Location: Built In / External at ... [m]	Cable: Standard / flying lead	I/O: Number and TTL / 24V	Smart Driver: Yes / No
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Payload

Weight [gram]:	Size: (LxWxH)	Inertia:
Shape:	Relation to rod/slide: Fixed / Push only / Other	Remarks:

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 (%).

	24V	48V
CAL12	80%	40%
CAL36	80%	40%
CAL75	80%	40%

Continuous Force

Peak force applied for duration shorter than 0.4 sec. in one second interval.

(force mode): 40% of peak force, continuous

Force Mode

The specified current may be applied continuously to generate the desired force. However, the recommended continuous force limit should be set in the control program.

In vertical operation, the actuator rod will drop when power is cut off. The rod in a lowered position may be damaged by other moving parts in the machine. A return spring (optional feature) will keep the rod raised. A safety lock-out should be installed in the machine program to confirm the rod location before another interfering component can be moved.

SMAC actuators are equipped with these safety features:

- Limit switches: indicate end-of-stroke
- Index line/home position: used to monitor absolute position
- Breakaway shaft (optional)

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

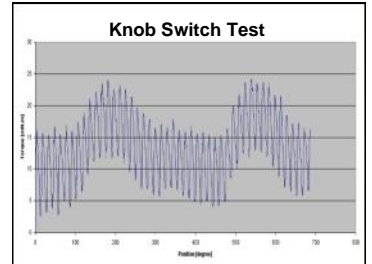
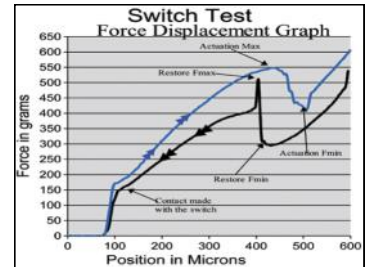


Application Examples

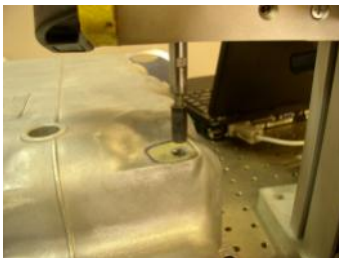
- Automotive switch test
- Cell phone keypads, membrane keypads
- Touch screens
- Valves, sensors and relays
- PC Keyboards, ATM keypads
- Springs, door latches, etc...

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

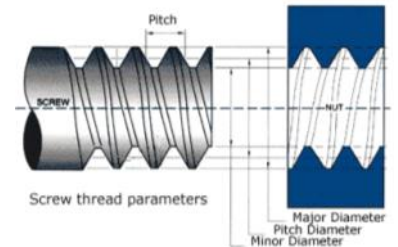


100% Automated Thread Check



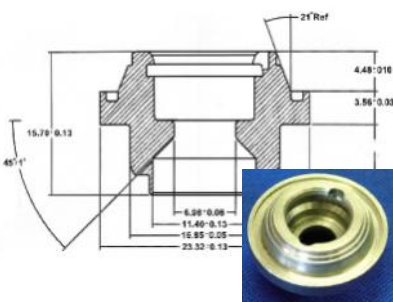
Verification of:

- 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.

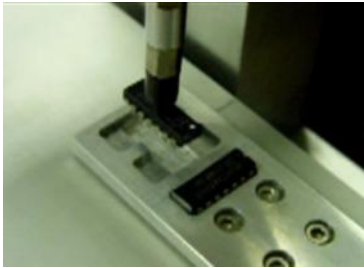
Problem:

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:

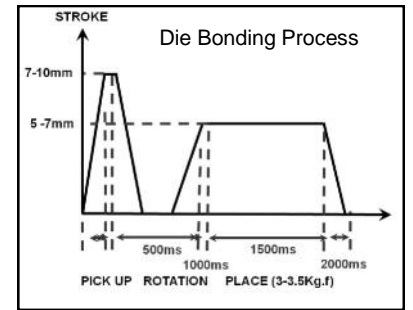
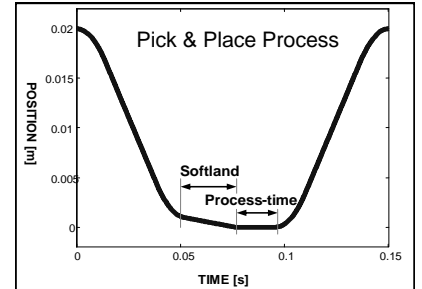
- Different pick up height due to mechanical tolerances
- Low throughput of the machine
- Position accuracy – linear and rotary
- Constant force for positioning needed

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 image with a LAR31 series linear rotary actuator

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

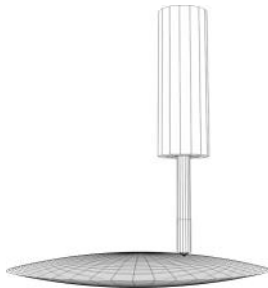
- SMAC linear rotary electric actuator is an all in one, off the shelf solution.
- A long stroke with fast approach.
- Soft-Landing function at both linear and rotary positions.
- Constant accurate force control while threading.
- Monitoring the torque and pitch verification: Good, shallow, cross, or 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.

The SMAC 12 Month Product Guarantee

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.

The SMAC Rebuild Program

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.

Terms & Conditions of Sale

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.



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