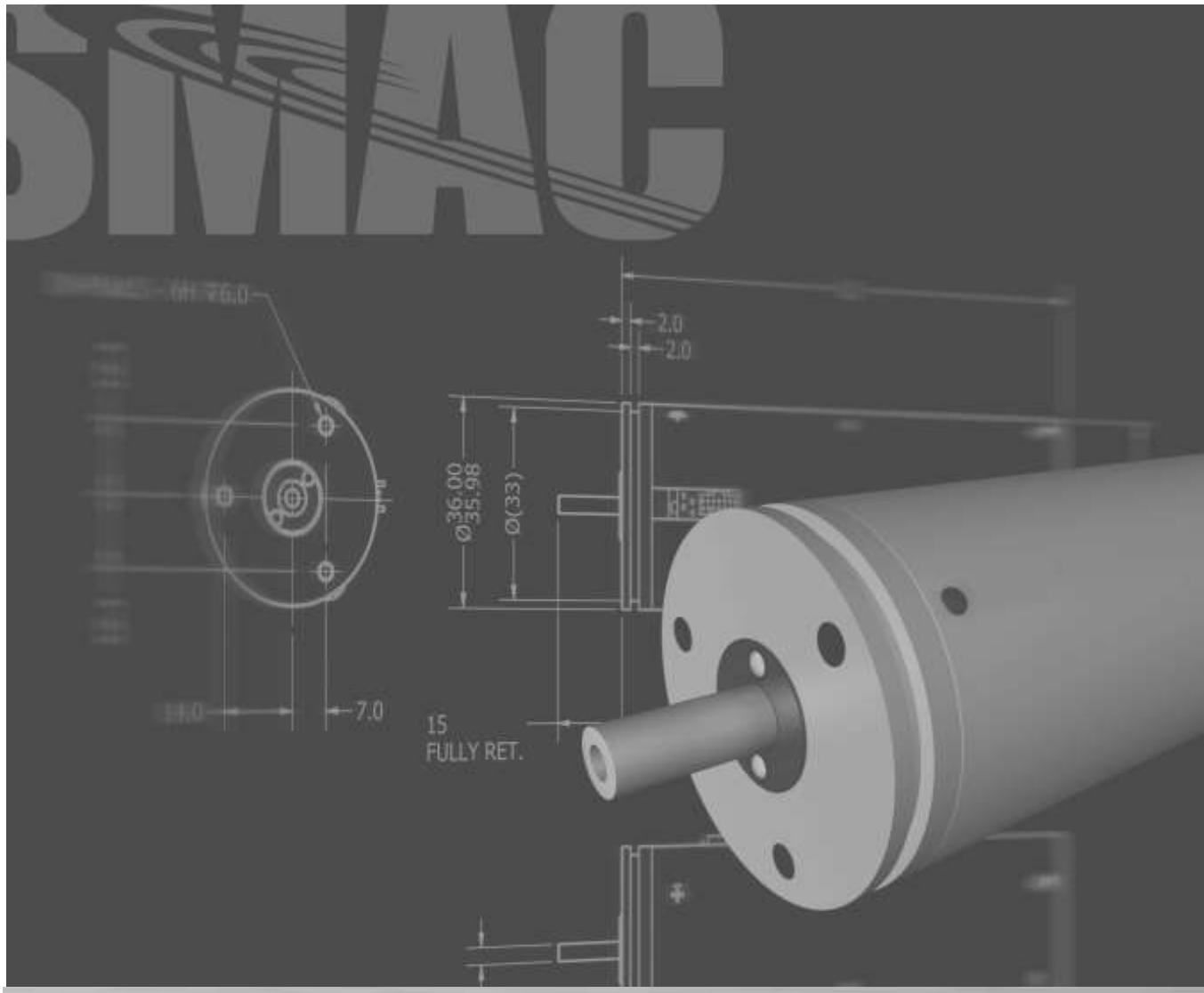
SMAC



Moving Coil Actuators

CA Series

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

2009 Rev.3

Product Overview

Electric Cylinder

CA Series

CAL12
Stroke [mm]: 10
Force [N]: 1.5
12mm diameter

50G acceleration

CAL36
Stroke [mm]: 15, 25, 50
Force [N]: 12 - 18
36mm diameter

CAL35
Stroke [mm]: 15, 25, 50
Force [N]: 4.5 - 34
35mm diameter

NEW

LAC-15 / LAC-20
Single or double axis brushless controller.
Easy expansion to multi-axis

CAL75
Stroke [mm]: 15, 25, 50
Force [N]: 25 - 90
75mm diameter

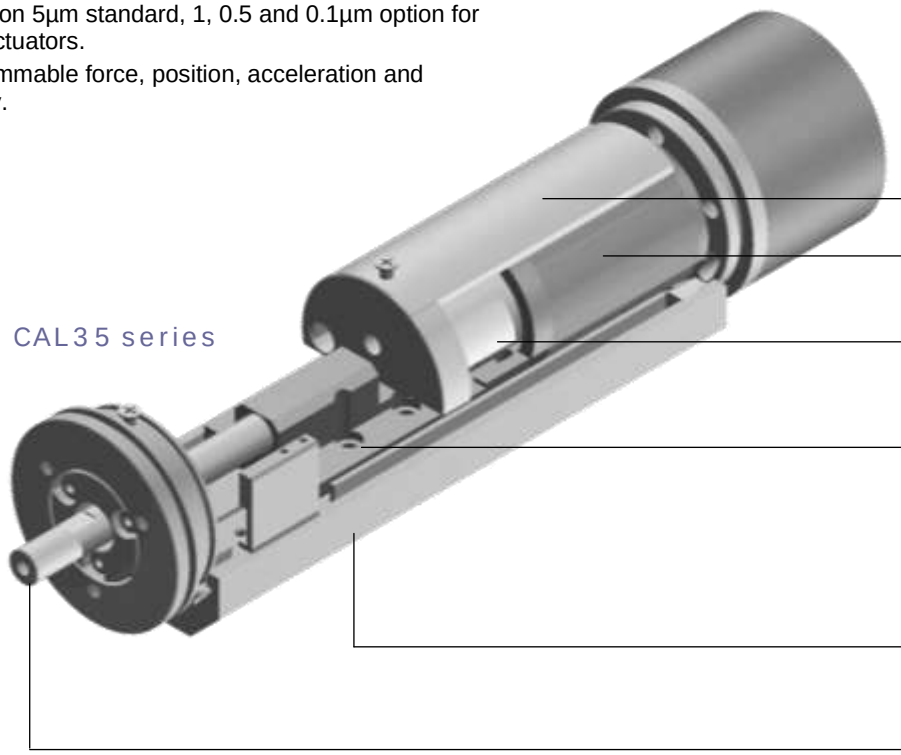
Electric Cylinder

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 50N, position encoder resolution 5µm standard, 1, 0.5 and 0.1µm option for most actuators.
- Programmable force, position, acceleration and velocity.

CAL35 series

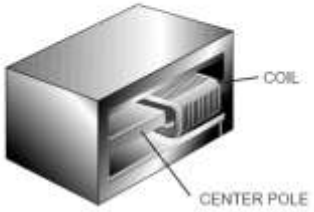


Moving Coil Technology (Voice Coil)

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 α 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)



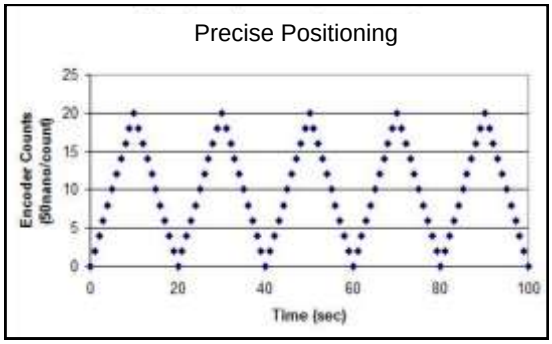
Therefore, doubling **I (current)** doubles **F (Force).**

The SMAC Advantages

- 40G Acceleration - light moving mass produces high rate of acceleration
- “Soft-land” capability
- Long life (100 million+ cycle)
- Compact direct drive electric linear actuator
- High degree of speed & position repeatability
- Controlled precise force - Centered piston reduces moment effect
- Programmable positioning
- Easy to mount
- 100% Data capture & feedback facility
- Very quiet. No air exhaust = No air expense
- No external sensors or switches required (reducing wiring & labour costs)
- Energy efficient - 1.8 amps & 24 volts - low power consumption
- Cost Effective Performance and competitive price range

Programmable Force

	10gf	750gf	1500gf
AVE	9.5	749.6	1499.1
STDEV	0.13	0.19	1.05



Programmable Features

The actuator is totally programmable for force, acceleration and velocity. It 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.

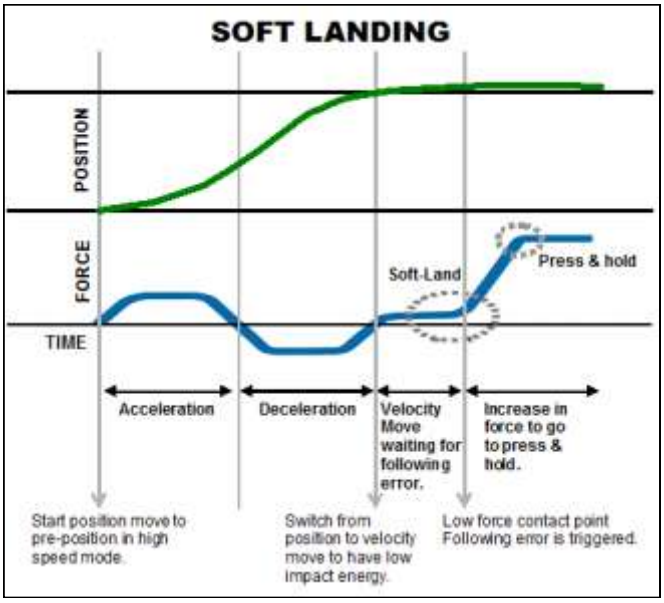
Velocity Mode: Velocity Mode allows the actuating rod to be moved with a given velocity, acceleration, force and direction. Typically used for a “Soft-Land” routine.

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.



Part Numbering System

MODEL	SERIES	STROKE	VOLT	ENCODER	SHAFT	VACUUM	SPRING	CONNECTOR	MOUNTING			
										M	O	D
CYLINDER LINEAR	C A L	3 5	0 1 5									

5	= 24 volt single coil
6	= 24 volt double coil*
7	= 48 volt single coil
8	= 48 volt double coil*
0	**= 0.5µm**
1	**= 1.0µm**
5	**= 5.0µm (standard)**
2	**= 0.1µm***
B	= BLANK
F	= FEMALE
M	= MALE
C	= CUSTOM
V	= VACUUM
S	= SRPING
1	= STRAIGHT
2	= 90°
3	= Flying Lead (straight)
4	= Flying Lead 90°
5	= Pigtail
A	= Front Mount
B	= Base Mount

* check availability

Part Number Examples:

CAL35-015-55F1A

CAL35 linear actuator, 35mm dia., 15mm stroke, 24volt single coil, 5 micron encoder, female shaft end, straight connector.

CAL35-050-71MVS2B

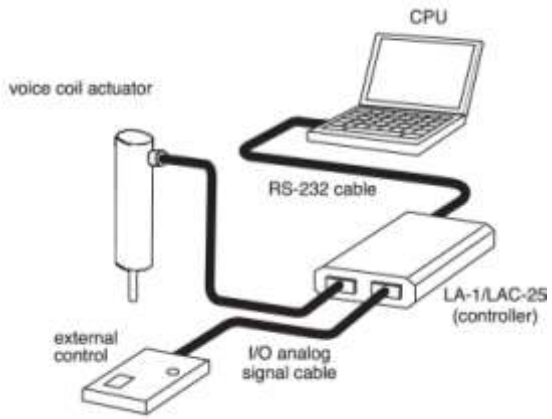
CAL35 linear actuator, 35mm dia., 50mm stroke, 48volt single coil, 1 micron encoder, male shaft end, vacuum, spring, 90° connector.

NOTES:

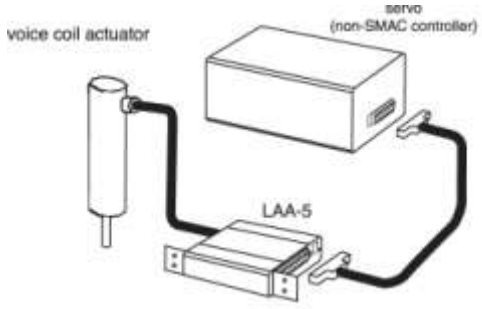
Series will not have leading zeros (e.g. LAL35).
Stroke must include zeros (e.g. 050).

Spring must be specified as full return or counterbalance, payload and orientation (vertical or horizontal).

Hardware Configuration



Hardware with SMAC Controllers



Hardware with SMAC Amplifier

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
CAL35-015-5	24	Ø35x149	15	12	7.2	0.065	1.7	0.52
CAL35-015-7	48	Ø35x149	15	17	9.1	0.065	2	0.52
CAL35-015-6	24	Ø35x209	15	24	7.2	0.09	3.4	0.75
CAL35-015-8	48	Ø35x209	15	34	9.1	0.09	4	0.75
CAL35-025-5	24	Ø35x169	25	8	6	0.075	1.7	0.65
CAL35-025-7	48	Ø35x169	25	11	6.8	0.075	2	0.65
CAL35-025-6	24	Ø35x229	25	16	6	0.108	3.4	0.874
CAL35-025-8	48	Ø35x229	25	22	6.8	0.108	4	0.874
CAL35-050-5	24	Ø35x253	50	4.5	4	0.093	1.7	0.849
CAL35-050-7	48	Ø35x253	50	6.5	4.5	0.093	4	0.849
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

CAL35

NEW

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, 0.5µm, 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:	For pick and place applications.
Mount:	Face mount (standard) , foot mount or threaded mount (CAL12 series only)
Connector (CAL35 series only):	Straight (standard) or 90 degrees (Side connector).

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.

LAC-15 / LAC-20

Single or 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 1Mbit/s

LAC-1

Single axis controller, built-in amplifier

Mode:

- Position
- Velocity or Continuous
- 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, 2 analog output, RS232 Interface

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

Cables

	Single Axis Controller		Dual Axis Controller		Amplifier	Smart Driver
Actuator	LAC-1	LAC-15	LAC-20	LAC-25	LAA-5	LAD-1
CAL12 (*1)	CAH-LOD26-3	LAT-26C-0004-03			CAH-LAD26-03	CAH-LSD26-03
CAL35	CAH-LOD-03	N/A			CAH-LAD-03	CAH-LSD-03
CAL36	No additional cable for flying lead type. or CAH-LOD26-03 for pigtail type.	No additional cable for flying lead type. or LAT-26C-0004-03 for pigtail type.			No additional cable for flying lead type. or CAH-LAD26-03 for pigtail type.	No additional cable for flying lead type. or CAH-LSD26-03 for pigtail type.
CAL75	No additional cable for flying lead type. or CAH-LOD26-03 for pigtail type.	No additional cable for flying lead type. or LAT-26C-0004-03 for pigtail type.			No additional cable for flying lead type. or CAH-LAD26-03 for pigtail type.	No additional cable for flying lead type. or CAH-LSD26-03 for pigtail type.
2 x CAL12(*1)			LAT-26C-0003-03 for pigtail type.	CAH-LTD26-3	N/A	N/A
2 x CAL35			N/A	CAH-LTD-03	N/A	N/A
2 x CAL36			No additional cable for flying lead type. or LAT-26C-0003-03 for pigtail type.	No additional cable for flying lead type. or CAH-LTD26-03 for pigtail type.	N/A	N/A
2 x CAL75			No additional cable for flying lead type. or LAT-26C0003-03 for pigtail type.	No additional cable for flying lead type. or CAH-LTD26-03 for pigtail type.	N/A	N/A

All cables are 3m standard, optional lengths from minimum 1m up to maximum 10m.

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

*1: Requires CAH-PT14-26 cable (1Ft / 3m) as supplement.

Installation Guideline

Duty cycle

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

	24V	48V
CAL12	80%	40%
CAL35	40% (single coil) 20% (double coil)	40% (single coil) 20% (double coil)
CAL36	80%	40%
CAL75	80%	40%

This can be calculated as follows:
% of max force applied x % of cycle time it is applied = % 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.

Recommendations from SMAC are that this duty cycle must not be exceeded over a one second time period.

NOTE: Failure to observe this duty cycle recommendation will usually result in the actuator sustaining damage through overloading. Overloading will overheat the coil and may cause it to deform and touch on the magnet housing.

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. A 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
- Break away 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.

Double Coil

Integrating an extra coil can enhance both force and acceleration.

Custom Shafts

In addition to the standard male/female rod-ends we can also offer options such as "break-away" shafts and custom shaft diameters.

Flying Lead

Instead of the standard chassis connector we can offer a flying lead option.

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.

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 the one-time replacement or rebuilding of any actuator which should fail to operate properly. Actuators must be returned 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 abnormal customer application 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

Actuaters 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 disassembeld, 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). All rebuilt actuators carry for 90 days from date of shipment from our factory 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.

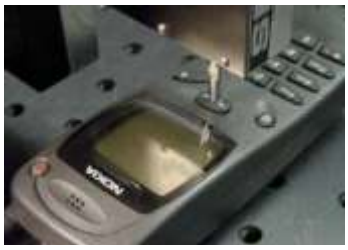
SMAC does not offer integration services. These are the responsibility of SMAC distribution and their customers. This means SMAC takes no responsibility for software programming, mechanical designs and all other engineering involved in a project using SMAC devices.

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.

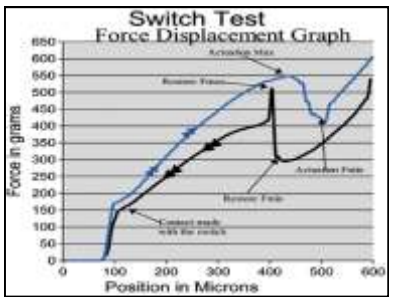
Sample Applications

Switch Test



Application Examples

- Automotive switch test
- Cell phone keypads
- Membrane keypads
- Valves, sensors and relays
- PC Keyboards
- ATM keypads



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

Measuring & Gauging

Key Operation :

Contact measurement of pockets machined in rollers. Each pocket is only 50microns in diameter and 50microns deep and each roller contains approx 30,000.

SMAC Advantage:

Contact measure. Previous system was vision which could only measure diameter and not depth.

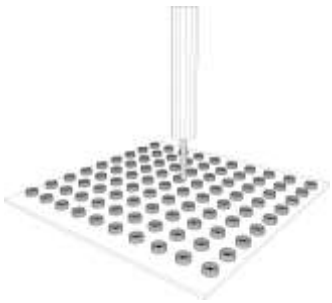
Key Operation :

Measuring OD of metal bush and roundness at cycle time of 3 sec. Solt-land on the parts and inspect the roundness by rotating the part 360° with encoder feedback.

SMAC Advantage:

Compact size, long life cycle, reliable position control, soft-land.

Pick & Place



Key Operation :

Pick and place electronic components from a feeder to the semiconductor finishing equipment at 15Hz.

SMAC Advantage:

High cycle operation, soft-land = precise force control, long life cycle.

Glass

- Scoring (V-Cutting) for solar panels and LCDs
- Glass cutting, de-burring, positioning
- Measuring thickness
- Chamfering and bevelling

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.

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