SMAC

Moving Coil Actuators

PRODUCT CATALOG

www.smac-mca.com

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

SMAC Corporate Headquarters and Factory

About SMAC

SMAC was founded in 1990 in Carlsbad, California, USA with the target of developing devices that would automate work done by hands and fingers. By combining this capability with competitive prices SMAC believes it can eventually replace older technologies such as pneumatic cylinders and electric ball screw actuators.

SMAC now manufactures a wide range of precision programmable electric actuators based on its patented moving coil technology. These proprietary moving coil linear motor based designs are technically far ahead of old generation pneumatic and other electric actuators, including moving magnet linear motors. Our technological edge, combined with continuous cost-down/quality-up processes and its worldwide sales basis makes SMAC a leading mechatronics manufacturer in the world today.

SMAC devices have the ability to find surfaces without disturbing them, i.e., "Soft-Land™ capability." This makes them "Mechatronic Actuators."

SMAC Moving Coil Actuators are much more sophisticated than the simple devices such as solenoids or air cylinders. The variables involved in the work are programmable. So force, distance, and speed all can be varied as needed. The devices also have built-in feedback sensing that can report if the desired work was accomplished or not. The devices have the ability to find surfaces without disturbing them, i.e., "Soft-Land™ capability." This makes them "Mechatronic Actuators."

SMAC determined early in its development that there were key technologies it must control to be successful. These include designing and manufacturing high torque brushless DC motors and optical encoders. In 2008, SMAC began an in-house capability to design and produce incremental linear optical encoders. That effort led to the establishment of SMAC Electronics Manufacturing Center in New Hampshire. The group includes engineers and technicians with more than 35 years of experience designing and building encoder products.

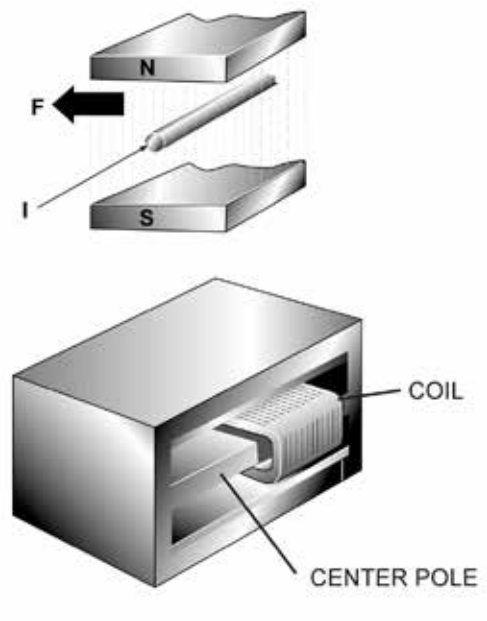
SMAC Moving Coil Actuators
LCA series Linearl Actuators

Encoders

High Torque Brushless
DC Motors

How Moving Coil Actuators Work

Moving coil actuators work on the same principle as an audio loudspeaker. They consist of a moving carriage with an attached coil surrounding a powerful, permanent magnet. Current passing through the coil induces an electro-magnetic force, according to Fleming's left-hand rule. Varying the direction and amplitude of the current varies the induced force, allowing you to control the motion. The result is a device with few moving parts, low friction and zero backlash with excellent dynamic properties.



$$F \propto N\,I\,B$$

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).**

Other voice coil actuators give no provision for position feedback, but all SMAC actuators include a precision, non-contact linear encoder. This allows closed-loop servo control of motion in position and velocity modes and real time monitoring of position in all operating modes.

These unique features allowed SMAC to develop the Soft-Land™ routine, which has permitted applications simply not possible with other technologies.

Benefits of Moving Coil Technology

- Lower moving mass with the moving coil actuator means extremely high acceleration and velocity, as opposed to the heavier "moving magnet" technology used in most linear motors.
- Safe and energy efficient: operates at low current, typically at 1.5 amps at 24 volt DC.
- Quiet (< 55dB), airless operation: no expensive compressed air generation required. No air consumption or air leaks to attend to. No compressed air generating environmental particulate contamination.
- Force control is precise and repeatable since there is no pressure valves, no force fluctuations caused by air pressure fluctuations.

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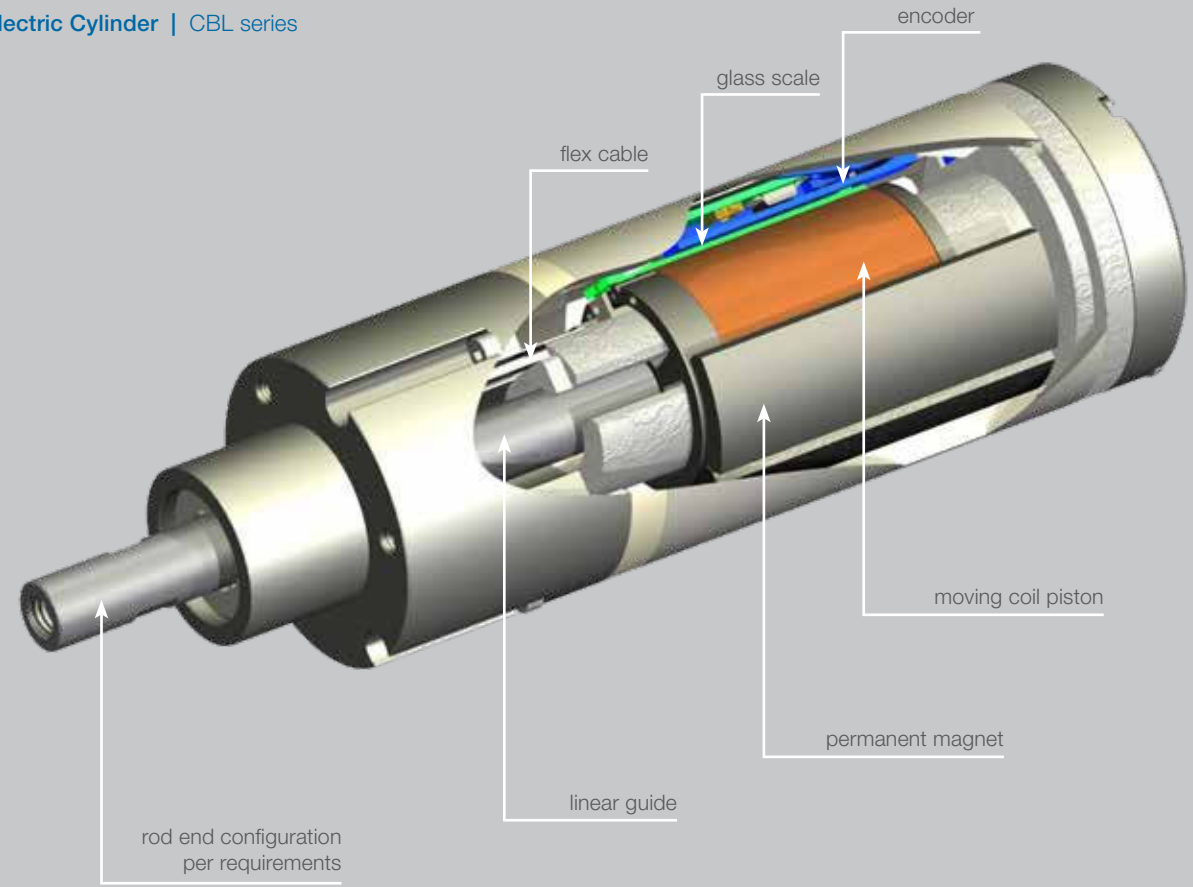
Electric Cylinder Actuators

High speed, compact and price-competitive cylinder actuators that provide an alternative to pneumatic cylinders with superior performance. The conventional cylinder actuator shape and multiple mounting points allow the electric cylinders to be directly retrofitted in most cases. When you take into account the operating cost of compressed air, unit life expectancies, replacement costs, downtime and changeover times, SMAC's actuators often have a significantly lower total cost than air cylinders and electromechanical alternatives.

Linear:

- Stroke up to 25mm, force up to 66N, position encoder resolution 5µm standard, 1µm option.
- Programmable force, position, acceleration and velocity.
- Built-in controller type is available for simple installation and effective use of space. (See page 13)
- Optional IP65 and IP67, dust-proof and waterproof features, are available.

Electric Cylinder | CBL series



SMAC Moving Coil Actuators

Linear and Linear Rotary Actuators

A comprehensive selection of programmable linear actuators are offered in a wide range of sizes, styles and options to satisfy your most demanding application requirements.

The precision Z-theta motion within one small actuator, providing a convenient pick, orient and place. A wide variety of linear rotary actuators are also offered with either direct drive or gearbox equipped rotary units.

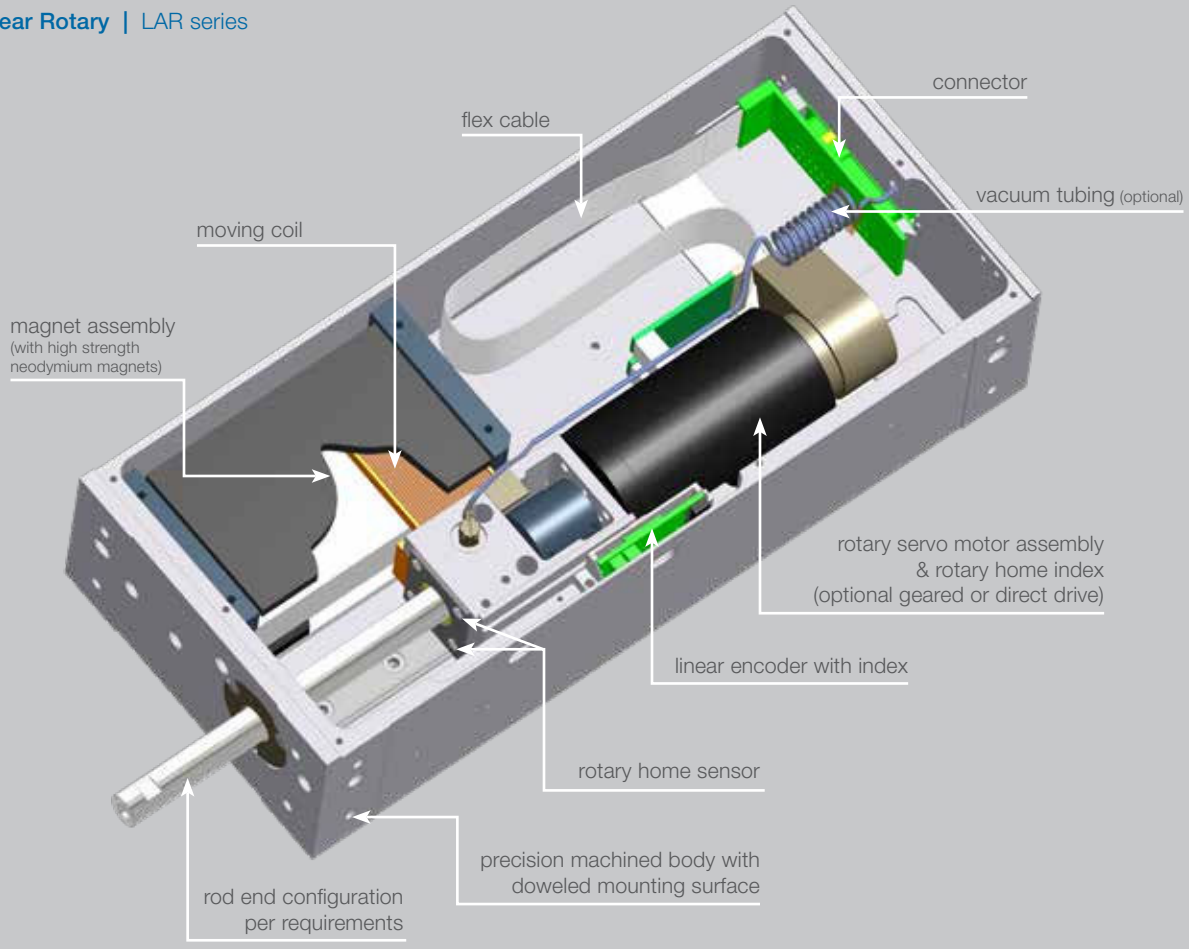
Linear:

- Stroke up to 250mm, 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 4.5Nm, velocity up to 5000 rpm, resolution up to 132,000 increments per revolution.
- Programmable force/torque, and position.
- The vacuum passage built in the shaft through the rotary motor prevents dust build up in the unit.

Linear Rotary | LAR series



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Programmability and Operating Modes

By using SMAC controllers all of our products are programmable using 3 different modes independently and controlling position, velocity, and force. This allows their performance characteristics to be tightly monitored. Pass/fail windows for any of these parameters can be set - useful for error reporting and testing applications.

Position mode

Position mode will allow the actuator to be moved to any position along the stroke using a given acceleration, velocity and force. It is possible to make absolute, relative and “learned position” moves. The force necessary to hold a given position can also be measured. This is called “holding force” and is used in applications such as switch testing.

Velocity mode

Velocity mode allows the actuator to be moved with a given velocity, acceleration, force and direction. Velocity (i.e. position vs. time) is closed-loop using feedback from the encoder, giving precise velocity control. Position and position error (the difference between actual position and desired position at a given time) can be interrogated in real time during motion. Typically used for constant speed scanning applications and Soft-Land™ routines.

Force mode

In Force mode, current in the coil is controlled to give a programmed force output. Position and velocity are open loop, using no feedback from the encoder, but actual position can still be monitored in real time. Used in applications such as tensile and compression testing.

SMAC Unique Features and Advantages

- **Fully programmable** in **Position**, **Acceleration**, **Velocity** and **Force**.
- **Soft-Land™** capability: apply controlled light force without damaging parts/material being handled.
- Direct drive = no backlash, a very high degree of accuracy & repeatability.
- Sub-micron resolution (5µm to 100nm).
- **Long operation life** = typical MTBF of over 100 million cycles.

SMAC Actuators Give You Flexibility

- Integrated position measuring system with glass scale and optical reader head (non contact).
- Ability to switch between operations - force, position and velocity mode - at any time.
- “On the fly” adjustable movement allows quick changeover.
- Constant force monitoring and control.
- Digital and analog input/output channels.
- SMAC linear motors are a servo system, hence they can be programmed to decelerate smoothly and quickly. Mechanical slamming can be totally eliminated.
- Competitively priced electric actuators that offer all of the above features and benefits.

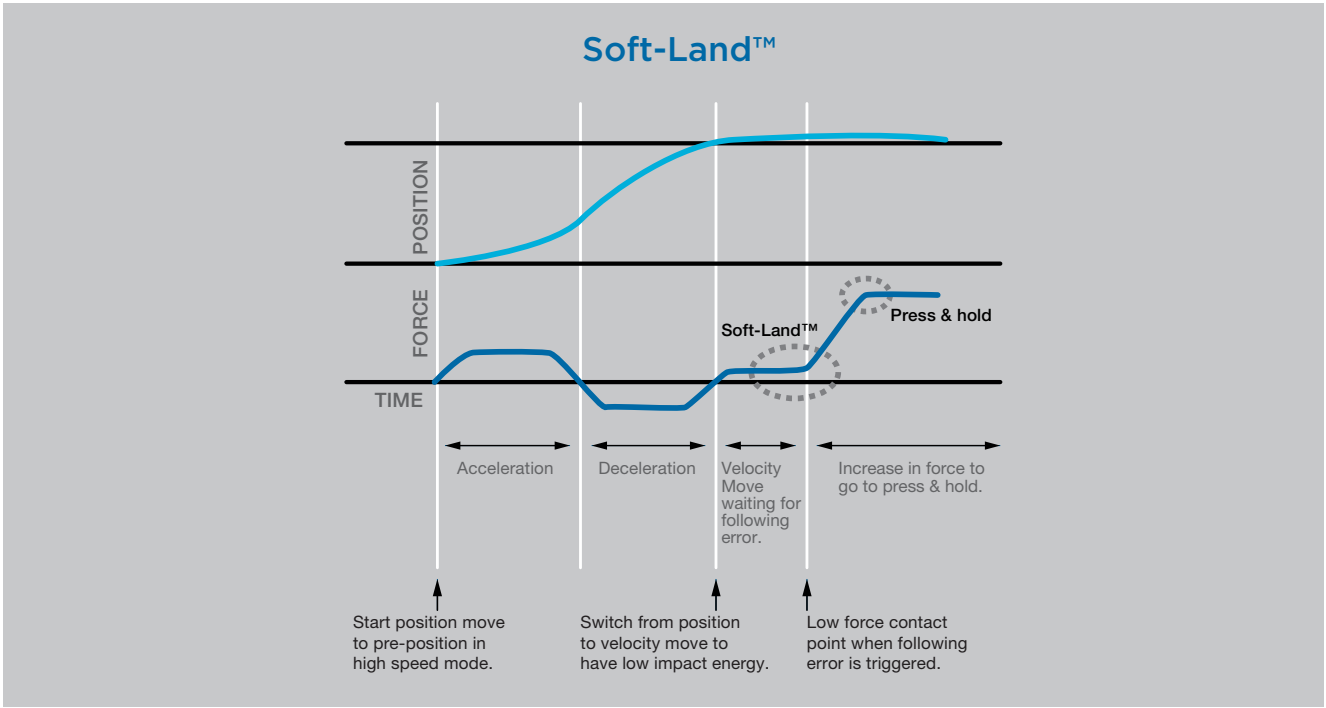
Soft-Land™

What is a Soft-Land™?

The Soft-Land™ is a patented unique software routine which allows an SMAC actuator to approach a surface at an unknown distance and land on it with a programmed force that can be as low as 0.1N. It gives extremely accurate sensing of product location or dimensions. This is particularly useful for handling delicate or high value components, such as surface mount chips, but other uses are emerging all the time. The routine takes advantage of the SMAC actuator's unique ability to control applied force while monitoring position in real time and is available for use with all SMAC actuators.

Soft-Land™ is a patented unique capability that allows actuators to approach a surface at an unknown distance and land on it with a programmed force.

The routine consists of a controlled low force approach in velocity mode, while 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.



A typical Soft-Land™ routine might be as follows:

1. High speed approach in Position mode to a "safe" distance from the part.
2. Switch to Velocity mode, setting a low force and velocity.
3. Slowly approach the part, monitoring position error.
4. If position error goes outside of a programmed window, the actuator has met an obstruction (i.e. landed on the part) and the Soft-Land™ routine is completed.
5. It is also possible to set a position window where the component should be located, if it is not located within a certain position, the actuator will retract.

P.30

CONTROLLERS & AMPLIFIERS

VLCI-R1
Built-in type single-axis controller/servo Drive

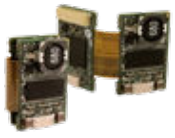
VLC-M1
Single-axis controller/ servo drive

VLCI-X1
Single-axis DC brushed/ brushless controller

VLC-ETC
Single-axis EtherCAT Servo Drive

VLC-1-07/13
Single-axis DC Brushed/ Brushless Controller

VLC-25-07/13
Dual-axis controller/ servo drive



CBC
Built-in type single-axis miniature controller with amplifier

CBC-I-3/6
Built-in type single-axis miniature controller with amplifier

CBC-EIP / CBC-ECT
Integrated single axis servo motor controller/ driver with Ethernet/ IP and EtherCAT connectivity

LCC-10 (LCC-11)
Single-axis brushless controller with built-in amplifier

LAC-1/LAC-1D
Single-axis controller with a built-in amplifier

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

LAD-1
Single-axis smart driver

MIOE-8/8
Expansion I/O module for LAC-1 and LAC-25

PART NUMBERING SYSTEM

Model	
CBL	Electric Cylinders
CTL	
LDL	Linear Actuators
LCA	
LCB	
LBL	
LAL	
LBR	Linear Rotary Actuators
LCR	
LAR	
LCS	Linear Slides
LBS	
SLA	
LAS	
GRP	Grippers
LXY	XY Stages
MLA	Gaging Actuators
MSA	

Series

Built-In Controller	
C	Option available for CBL, LCA, LCB, LBL and LDL

Stroke

Voltage	
1	24VDC Multi Phase
3	48VDC Multi Phase
5	24VDC Single Phase
7	48VDC Single Phase

Encoder Resolution	
0	0.5 µm
1	1.0 µm
2	0.1 µm
3	0.05 µm
5	5.0 µm

Number of Coil	
1	1 Coil
2	2 Coils
3	3 Coils
6	6 Coils
12	12 Coils

Shaft	
B	Blank (standard)
F	Female
M	Male
C	Custom

Vacuum	
V	Vacuum through the shaft or on the shaft

Spring	
S	Spring
SA	0g payload, vertical, full return
SB	50g payload, vertical, full return
SC	100g payload, vertical, full return
SD	0g payload, vertical, counter balance
SE	50g payload, vertical, counter balance
SF	100g payload, vertical, counter balance

Cable	
3	Flying lead
5	Pigtail

Applicable for CBL and LCA Series

Mounting	
A	Front mount (standard)
B	Base mount

Available for CAL, CBL Series

Modification	
MOD	Mod number for custom modification or IP protection option

Part Number Examples

CBL35C-010-75-1-F3
CBL35 series electric cylinder with built-in controller, 10mm stroke, 48volt single phase, 5 micron encoder, single coil, female shaft end, and flying lead

LCA25-200-31-6-F3
LCA25 series linear actuator, 200mm stroke, 48volt multi phase, 1 micron encoder, 6-coil, female shaft end, and flying lead

Notes

- Series will not have leading zeros (e.g. CBL35)
- Stroke must include zeros (e.g. 050)
- Spring must be specified as full return or counter balance, payload and orientation (vertical or horizontal). Mod number will be assigned for non-standard spring specification.

SMAC Moving Coil Actuators

SMAC Actuators' Unique Features

Soft-Land™

A patented capability to apply controlled light force without damaging parts/materials being handled.

Feedback

Built-in sensing that can report if the desired work was accomplished or not. It can be used for Data Acquisition.

Linear Rotary Motion

The precision Z-theta motion within one small compact actuator, providing convenient pick, orient, and place movements.

IP Protection

Optional IP65 and IP67, dustproof and waterproof features.

Graphical User Interface (GUI)

SMAC GUI provides a simple and straightforward way to quickly configure motion parameters of a variety of SMAC actuators and controllers. Application-based GUIs are also available.

VLC Controllers

VLC (Very Low Cost) DC brushed/brushless motor controllers/drivers are designed and manufactured by SMAC. This enables SMAC to offer efficient, competitively-priced solutions with no loss in features or functionality. The product can be adjusted by SMAC to a specific design, or to market or customer needs.

	Part Number	Motor type	Stand-alone	Built-in	Output (Standard)	Digital input	Digital output	Analog input *	Analog output	STO (Safe Torque Off)	Commu-nication interfaces
Single Axis	VLCI-R1	brushed/ brushless		●	3.5 A cont., 6.5 A peak	4 (opto-isolated)	4 (opto-isolated)	1 Diff	1	2 In, 1 Out	RS232
	VLC-M1		●		3.5 A cont., 6.5 A peak	2 (opto-isolated)	2 (opto-isolated)	1 S.E.	n/a	n/a	RS232
	VLCI-X1		●		3.5 A cont., 6.5 A peak	4 (opto-isolated)	4 (opto-isolated)	1 Diff.	1 S.E.	2 In, 1 Out	RS232
	VLC-ETC		●		3.5 A cont., 6.5 A peak	4 (opto-isolated)	4 (opto-isolated)	1 Diff.	1 S.E.	2 In, 1 Out	Serial (UART), EtherCAT (2-ports)
	VLC-1-07		●		6 A cont., 7.8 A peak	8 (opto-isolated)	8 (opto-isolated)	2 Diff., 3 S.E.	3 S.E.	2 In, 1 Out	Serial (UART)
	VLC-1-13		●		10 A cont., 13 A peak	8 (opto-isolated)	8 (opto-isolated)	2 Diff., 3 S.E.	3 S.E.	2 In, 1 Out	Serial (UART)
Dual Axis	VLC-25-07		●		6 A cont., 7.8 A peak	4 (opto-isolated)	4 (opto-isolated)	2 Diff., 3 S.E.	2 S.E.	2 In, 1 Out	RS232
	VLC-25-13		●		10 A cont., 13 A peak	4 (opto-isolated)	4 (opto-isolated)	2 Diff., 3 S.E.	2 S.E.	2 In, 1 Out	RS232

* Diff. = Differential and S.E. = Single-Ended

VLCI-R1

VLC-M1

VLCI-X1

VLC-ETC

VLC-1-07
/ VLC-1-13

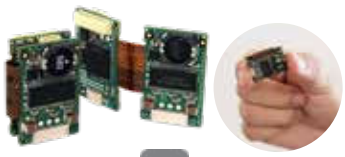
VLC-25-07
/ VLC-25-13

Controllers and Amplifiers

SMAC supplies a range of single and multi-axis controllers as well as stand-alone amplifiers. Complimentary standard programming software is available on the SMAC website, http://www.smac-mca.com/products/controllers. SMAC supports connectivity with ethernet fieldbuses like EtherCAT and Ethernet /IP on certain models. Please contact us for more information.

	Part Number	Motor type	Stand-alone	Built-in	Output (Standard)	Digital input	Digital output	Analog input*	Analog output*	STO (Safe Torque Off)	Commu-nication interfaces
Single Axis	CBC	brushed/ brushless		●	3 A cont., 6 A peak	2 (non-isolate)	2 (non-isolate)	1 S.E.	1 S.E.	n/a	RS232, CANopen
	CBC-I-3/6-C	brushed/ brushless		●	3 A cont., 6 A peak	4 (opto-isolated)	4 (opto-isolated)	1 S.E.	1 S.E.	2 In, 1 Out	RS232, CANopen
	CBC-EIP	brushed/ brushless	●		3 A cont., 6 A peak	4 (opto-isolated)	4 (opto-isolated)	1 S.E.	1 S.E.	2 In, 1 Out	RS232, EtherNet/IP (2-port)
	CBC-ECT	brushed/ brushless	●		3 A cont., 6 A peak	4 (opto-isolated)	4 (opto-isolated)	1 S.E.	1 S.E.	2 In, 1 Out	RS232, EtherCAT (2-port)
	LCC-10 (LCC-11)	brushed/ brushless	●		3 A cont., 6 A peak	2 (non-isolate)	2 (non-isolate)	1 S.E.	1 S.E.	n/a	RS232, CANopen
	LAC-1 / LAC-1C / LAC-1D	brushed	●		2 A cont., 4 A peak	8 (non-isolate)	8 (non-isolate)	4 S.E.	4 S.E.	n/a	RS232
Dual Axis	LAC-25	brushed	●		3 A cont., 6 A peak	4 (opto-isolated)	4 (opto-isolated)	3 S.E.	2 Diff.	n/a	RS232

* Diff. = Differential and S.E. = Single-Ended



CBC GUI

CBC-I-3/6-C GUI

CBC-EIP / CBC-ECT GUI

LCC-10 (LCC-11) GUI

LAC-1/LAC-1D/LAC-1D GUI

LAC-25 GUI

Amplifiers

LAD-1

Smart Driver for single-axis stepper input to servo output
24-48VDC
RS232

LAA-5

Single-axis PWM Amplifier
24-48VDC
3 Arms cont., 6 Arms peak
+/- 10 Volt command input
Single-axis PWM Amplifier

MIOE-8/8

Expansion I/O module for LAC-1, LAC-25 and LAC-45
24-48VDC
8 opto-isolated input/output

Why Use SMAC Cables?

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 technical problems experienced by our customers.

Models	Single Axis Controller				Dual Axis Controller		Amplifier	Smart Driver
Actuator	LAC-1	LCC-10 / LCC-11	CBC-EIP / CBC-ECT	VLC-M1 / VLCI-X1	VLC-25-07 / VLC-25-13	LAC-25	LAA-5	LAD-1
CBL* / CTL*	CAH-4LOD26-03	CAH-6LOD26-03					CAH-LAD26-03	CAH-LSD26-03
2x CBL* / CTL*					CAH-4LTD26-03	CAH-6LTD-03		
LBR					MAH-4RTD026-03			
LCA(S)*/ LCB/ MLA / MSA	CAH-4LOD26-03	CAH-6LOD26-03					CAH-LAD26-03	CAH-LSD26-03
LBL* / LCA (S)* (Multi-pole/brushless)		MAH-6LOD26-03						
2x LCA(S)*/ LCB/ MLA / MSA					CAH-4LTD26-03	CAH-6LTD-03		
2x LBL* / LCA (S)* (Multi-pole/brushless)					MAH-4LTD026-03			
SLA10	CAH-4LOD26-03 (with LAH-PT12-26)	CAH-6LOD26-03 (with LAH-PT12-26)					CAH-LAD26-03 (with LAH-PT12-26)	CAH-LSD26-03 (with LAH-PT12-26)
SLA25*	CAH-4LOD26-03	CAH-6LOD26-03					CAH-LAD26-03	CAH-LSD26-03
LAL35/LAL95	LAH-4LOD26-03	LAH-6LOD26-03					LAH-LAD26-03	LAH-LSD26-03
LAL55/LAL300/LAL500	LAH-4LOD-03	LAH-6LOD-03					LAH-LAD-03	LAH-LSD-03
LAR35	LAH-4RED26-03 (with 2x LAC-1s)	LAH-6RED26-03 (with 2x controllers)			LAH-4RTD26-03	LAH-6RTD26-03	LAH-RAD26-03	LAH-RSD26-03
LAR31-030		MAH-6RED226-03 (with 2x controllers)			MAH-4RTD226-03			
LAR31-050		MAH-6RED026-03 (with 2x controllers)			MAH-4RTD026-03			
LAR55/LAR95/LAR300	LAH-4RED-03 (with 2x LAC-1s)	LAH-6RED-03 (with 2x controllers)			LAH-4RTD-03	LAH-6RTD-03	LAH-RAD-03	LAH-RSD-03
LCR13/LCR16/LCR20 Under 25mm stroke		MAH-6RED226-03 (with 2x controllers)			MAH-4RTD226-03			
LCR13/LCR16/LCR20 35mm stroke and above		MAH-6RED026-03 (with 2x controllers)			MAH-4RTD026-03			
2x LAL35/LAL95					LAH-4LTD26-03	LAH-6LTD26-03		
2x LAL55/LAL300/LAL500					LAH-4LTD-03	LAH-6LTD-03		
MGR	CAH-4RED26-03 (with 2x LAC-1)	CAH-6RED26-03 (with 2x controllers)			LAH-4RTD26-03	LAH-6RTD26-03		
GRP20/GRP35/GRP50***	LAH-4RED26-03	LAH-6RED26-03			LAH-4RTD26-03	LAH-6RTD26-03		
LXY15/LXY25					CAH-4RTDGRP26-03	LAH-6GRP-03		

* No cable required for flying lead option. ** M12 connectors optional for EtherNet/IP. *** Old type of GRP50 requires LAH-GRP26-03 cable.

Options & Modifications (Consult factory for availability)

Cable length ---------- 3m standard, optional 10m length is available. Consult factory for other length.

Superflex ---------- Suitable for robotic applications.

SMAC Moving Coil Actuators

Non-SMAC controller connector ---------- Consult factory for details.

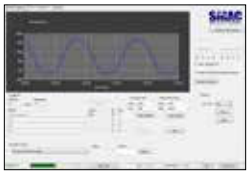
Graphical User Interface (GUI)

SMAC Graphical User Interface provides a simple and straightforward way to quickly configure motion parameters of a variety of SMAC single/dual axis actuators and controllers. Pre-installed, user configurable application-based GUIs are also available.

- Little to no programming experience required
- Menu-driven, Windows based, easy setup
- Pre-programmed with application-specific features
- Real time analysis
- Data and graphical feedback tools
- Built-in tutorial and help features

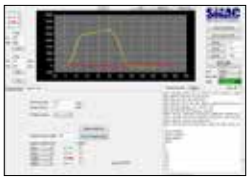
LCC Control Center

Achieve high level programming with no programming experience, monitoring and logging of parameters, fine-tuning of control parameters for LCC and CBC controller.



LAC-X Editor

Easy setup and tuning of control parameters for LAC-1 and LAC-25.



Thread Check Center: TCC

User configurable Thread-Checking applications. Fully automated 100% inspection of internal & external threads. Verification of counter bore height, thread pitch, oversized/ undersized threads, cross thread and shallow thread, etc.

Capping Control Center: CCC

User configurable threaded bottle/container capping applications. Detect and report no/ obstructed cap. 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.

Gauging Control Center: GCC

User configurable gauging applications. Provide real time plot of measured values in relation to limits. The user may save a .csv or image file of the measured values or graph area respectively for data logging.

Ejection Control Center: ECC

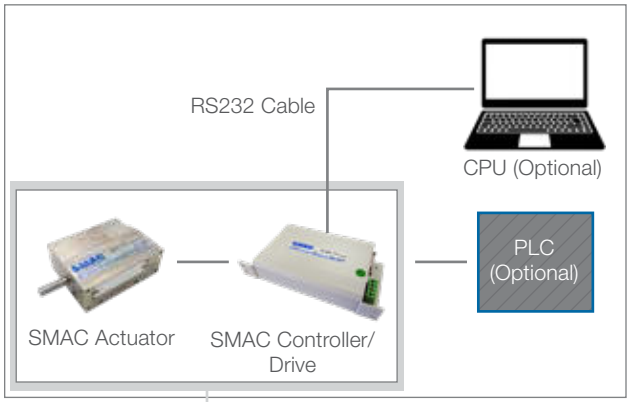
User configurable Ejection applications. Select and program between 4 types of ejection sequence including soft eject, rapid eject etc. Control velocity for ejection based on customer cycle time requirements. Adjust force to eject based on the weight/mass of the object to eject. Manipulate position to park the actuator based on the program sequence.

Leak Test Center: LTC

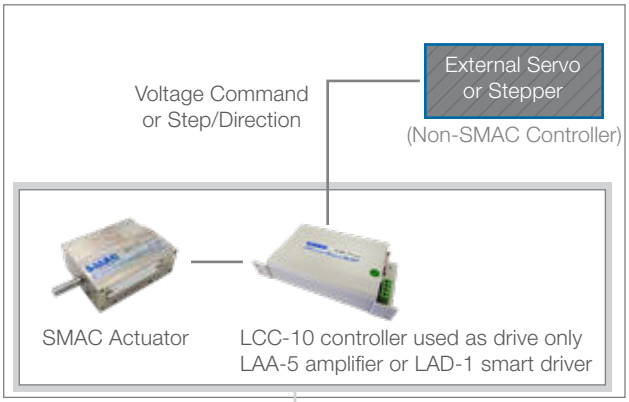
User configurable Leak testing applications: Select and program between two types of leak testing procedure(Velocity and Force). Unique capability of SMAC actuator to soft land on the object and applying force can be programmed using this GUI. Precise monitoring of displacement of the bottle/container/ or any testing sample during leak testing. Adjust the force to be applied on the test object using this software.

SYSTEM CONFIGURATION

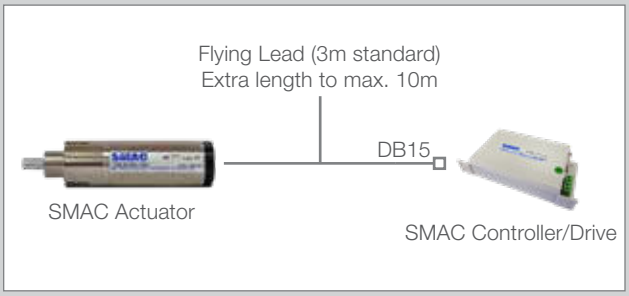
Configuration with SMAC Controllers



Configuration with Non-SMAC Controllers

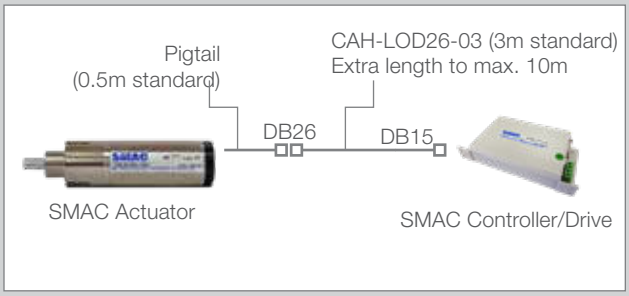


Configuration for Flying Lead Cable

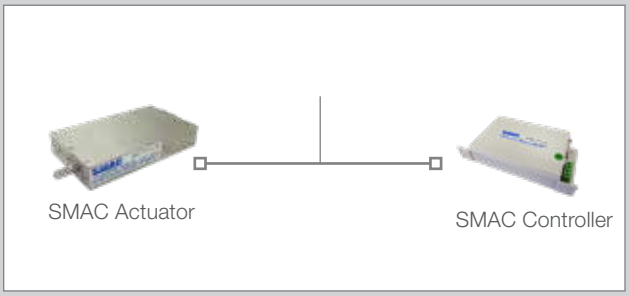


CAL, CBL, CTL, LCA, LCB, LBL, MGR and SLA series

Configuration for Pigtail Cable

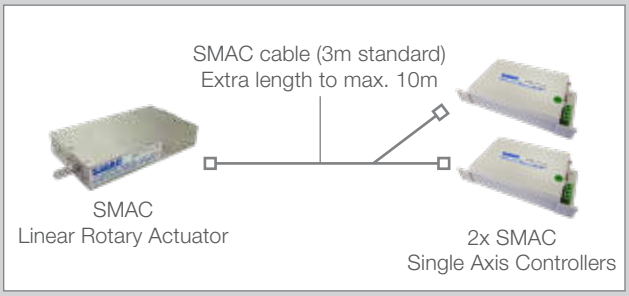


Configuration for SMAC Cable



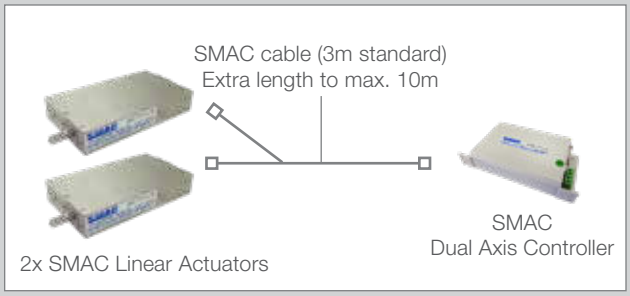
LAL(S), LAR, GRP and LXY series

Configuration with 2 Single Axis Controllers



LAR and LCR series

Configuration with 1 Dual Axis Controller



LAL(S) series

INSTALLATION GUIDE

Duty Cycle
For any SMAC Moving Coil Actuator, the maximum recommended continuous duty current is 600mA supplied to the actuator over a 1 second period. For anything beyond this in terms of current draw or time please consult the factory.

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.

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:

- 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

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 MODIFICATION

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-Bushing
An extended nose bushing 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 and LCA series actuators.

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.

Optical Encoders

SMAC encoders are made using optical components provided by large volume manufacturers of printers, cameras, cell phones and independent manufacturers of standard mixed signal ASIC semiconductor products used in optical encoders around the world.

We use these high reliability optical components that are made in the millions per year to take advantage of the latest manufacturing technologies used in these fields and the latest design features patented by these suppliers. Technologies include using Interlaced Photo Detector Arrays to better balance the light viewed across the photo sensor array and average imperfections in the code pattern of the scale, LED light intensity auto gain to compensate for LED aging and temperature changes and GUI control of the many features selected in the interpolator and signal conditioning ASIC.

SMAC Advantages

- Reflective and diffractive type encoders allow smaller cross-sections with all components on one side of the scale
- Interlaced optical ASIC's allow reader head mounting tolerance rotation of ±0.2 MM and gap settings of 0.5 to 1.0 MM for easier installation.
- Small size ASIC's allow PCB sizes down to 6 MM wide for tighter fits.
- Integrated Optical ASIC interpolators to 16x for 5 Micron linear encoders and 24,000 cpr, 12 MM diameter rotary encoders.
- 20 Micron pitch Diffractive encoder modules with GUI calibrated ASIC interpolation for resolutions down to 50 Nanometers.
- Very compact. Custom packaging available for OEM
- Cost competitive
- Factory calibrated. User programming available for in field optimization.

Custom Encoders

SMAC will work with you to build custom encoders that fits your project specifications. Please contact us if you don't find that any of our standard products will fill your needs.

LL Series Linear Encoder

The LL linear encoder is a miniature non-contacting high resolution incremental linear encoder, which delivers two count channels in quadrature RS422 output signals. This series is available in 1 and 5 micron resolution.

Features

- Light Source: Light Emitting Diode;
- Light Sensor: Optical ASIC
- Resolution after quadrature: 5 and 1 micron
- Output Format: Differential RS422 line driver output. Two count channels A and B in quadrature with an optional ZR output;
- Quadrature spec.: 90° ± 45° at maximum conditions;
- Rise and Fall Time: 1 µs max., with 1000 pF load;
- Travel length: up to 250mm (special lengths available on request)

SLE-LI Series Linear Encoder

The SLE-LI encoder is a miniature non-contacting high resolution Incremental linear encoder, which delivers two count channels in quadrature RS422 output signals. This series is available in 1, 0.5, and 0.1 micron resolution. 150mm scale length standard.

Features

- Light Source: Light Emitting Diode;
- Light Sensor: AEDR Optical Asic;
- Resolution after quadrature:
- Output Format: Differential RS422 line driver output. Two count channels A and B in quadrature with an optional ZR output;
- Quadrature spec.: 90° ± 22° at maximum conditions;
- Rise and Fall Time: 1mµ max. into 1000 pF load;
- Travel length: up to 264 mm.

SLE-35 Series Linear Encoder

The SLE-35, high resolution linear encoder is similar in mounting to other industry standard enclosed linear encoders. This model is a miniature non-contacting high resolution incremental linear encoder, which delivers two count channels in quadrature (called A and B) as output signals. The two output waveforms are 90 degrees out of phase and indicate both the position and the movement direction: when Channel A leads Channel B, for example, then the movement is from left to right of the scale when viewing the pattern side of the scale. Otherwise, if B leads A, then the displacement is in the opposite direction. This encoder is available in 0.1and 0.05 micron resolution.

Features

- Light Source: Light Emitting Diode;
- Light Sensor: AEDR Optical Asic;
- Resolution after quadrature: 0.1um or 0.05um
- Output Format: Differential RS422 line driver output. Two count channels A and B in quadrature with an optional ZR output;
- Quadrature spec.: 90° ±45° at maximum conditions;
- Rise and Fall Time: 1µs max. into 1000 pF load;
- Travel length: up to 150 mm standard. Please contact us for information about longer lengths.

SRE-30 Series Rotary Encoder

The SRE-30 series, high resolution rotary encoder is similar in mounting to other industry standard enclosed rotary encoders. This model is a miniature non-contacting high-resolution incremental rotary encoder, which delivers two count channels in quadrature (called A and B) as output signals. The two output waveforms are 90 degrees out of phase and indicate both the position and the movement direction: when Channel A leads Channel B, for example, then the movement of the disc is clockwise. Otherwise, if B leads A, then the displacement is in the opposite direction. This encoder is available in 1000, 2000, 4000, 8000 and 16000 CPR resolution.

Features

- Light Source: Light Emitting Diode;
- Light Sensor: Optical Asic;
- Resolution: 1000, 2000, 4000, 8000 or 16000 CPR
- Output Format: Differential RS422 line driver output. Two count channels A and B in quadrature with an optional ZR output;
- Quadrature spec.: 90° ± 45° at maximum conditions;
- Rise and Fall Time: 1 µs max. into 1000 pF load;
- 6mm standard shaft size

www.smac-mca.com

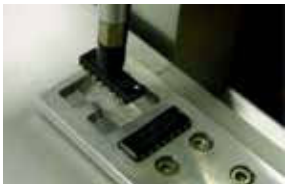
APPLICATIONS

Mechatronic SMAC electronic actuators are used widely in automotive, packaging, electronics, robotics, pharmaceutical, medical assembly, laser cutting, high speed scanning, glass cutting, dispensing, switch testing, spot welding, soldering, and measuring applications to name but a few. SMAC is constantly working on new and diverse applications with both OEMs and end-users across the world.

Automotive | Electronics | Consumer Electronics | Glass | Packaging | Bio/Medical | General Manufacturing

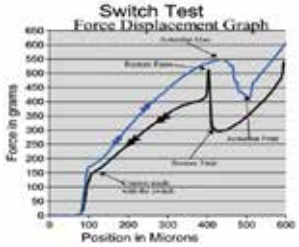
Pick & Place

The precision Z-theta motion within one small actuator, providing a convenient pick, orient and place. The unique Soft-Land function allows the unit to gently land on a delicate component with a controlled force, avoiding damage to the component. These characteristics make SMAC electric actuators ideal for assembling small, fragile components.



Switch Testing

In-line durability test. Measuring click point, force and displacement. Report force vs. position with SPC data collection. Life testing of components as well as measurement and QA reporting functions in one unit.

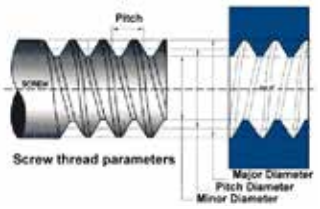


Touch Screen Testing

Quality check for touch screen, including zoom in and out, swiping motion, touch screen fatigue test. SMAC's Soft-Land procedure, programmable force, high speed and detailed feedback are essential in the testing.

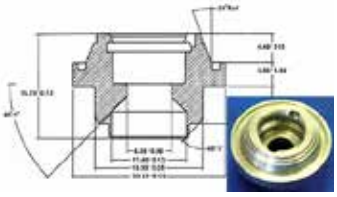
100% Automated Thread Check

Fully automated 100% inspection and test of screw thread check for optimal quality assurance. The unique low-cost SMAC solution enables you to automatically check the following screw thread parameters: Oversize/undersized threads, cross threads, thread depth, no-threads, mis-located threads, thread pitch, and shallow/blocked hole.



Measuring, Bore Gauging and Groove Inspection

100% measure and test inline production of small components for quality control. The SMAC actuator conducts multiple point gauging on parts externally and internally within a few seconds. It can run 24/7 and enables 100% data feedback and verification of each individual test on each individual part.



SMAC Moving Coil Actuators

Tensioning with Precision Force Control

SMAC excels at force control which is key for tensioning materials such as car batteries. Force resolution of 10 grams maintained over the entire force range. Easily replaces low friction pneumatic cylinders that have inconsistent force throughput. Response time 10x better than our closest competitor.

Dispensing / Filling

SMAC actuators' repeatable positioning coupled with high speed allows you to more precisely and repeatedly control the dosing amount. SMAC actuators also allow for easy change over for different dosing requirements based upon the material and container size.

High Speed Pressure/Leak Detecting

SMAC actuator senses the surface of container/package, push with specific force and monitor the movement to determine pressure in container/package. This solution can be used for soft pouch packaging such as contact lens or single-served coffee "pods."

Rejecting, Diverting, and Multi-Lane Sorting

SMAC can reject or divert one container at line speeds over 1200 containers/ minute. Movement of container is smooth, fast, and gentle with unique Soft-Land™ feature. Container will not tip over because of force and velocity control.

Capping

SMAC linear rotary actuator rotates the cap while pushing down. Actuators can press with programmable force and provide torque feedback that informs when the cap has torqued out (or not) to ensure a quality operation. It shows 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.

APPLICATIONS

Assembly

Assembly requires both precise placement and precise low force control. SMAC linear rotary actuators perform pick, orient, and place movements in a single unit. Precise force control and Soft-Land™ capability preventing parts damage delivers a great advantage. Feedback of assembly positioning provides real time quality control information.

Smart Screwdriver

SMAC linear rotary actuators are an all in one solution. Fast approach, then find the surface with Soft-Land™ capability. Turn counter clock-wise, screw moves up, then drops as first thread found, then start rotating clock-wise. First a “snug” torque is applied, when there are a number of screws holding a part on the clamping surface, then a final torque is applied. Monitoring the torque and pitch verification. Good, shallow, cross/no-threads, and the precision of the thread are detected through linear position feedback.

High Speed On-the-Fly Labeling

The label applicator (SMAC actuator) matches the speed of the conveyor as the product comes through. High cycle rate, energy efficient, and adjustable speed and height for the different kind of products. The Soft-Land™ capability allows the actuator to apply labels with controlled low force.

Scanning

A series of precise short movements with repeatability in micron or sub micron ranges used for moving lenses/cameras, wafer scanning, microscopy, cytometry, etc. SMAC actuators eliminate incremental errors that come with the use of open-loop actuators. SMAC’s precision actuators are fully close-looped and provide extremely accurate position data and positioning capability with resolution as to five nanometers. Easy setup, compact, all-in-one package is ideal for integration to existing equipment and new developments.

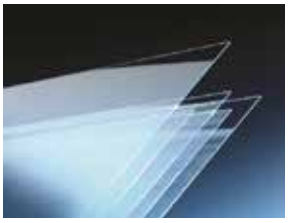
Material Test

SMAC actuators can be programmed to develop a motion profile required. By measuring the force used to stretch/ manipulate the material to the prescribed length, the gradual degradation of the material could be continuously monitored.

Glass Cutting / Scoring

Precision work in grinding, cutting, and polishing processes can be easily done by SMAC programmable actuator. Precise force control and the ability to track a surface with constant force throughout the stroke are important when handling brittle material. SMAC’s unique Soft-Land function, the ability to apply as low force as 0.1N or less, and move with a set force while bevelling or cutting is something SMAC can easily do.

SMAC Moving Coil Actuators



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 catalog are guaranteed for a period of twelve months from the original date of shipment from our factory.

The guarantee conditions are effective when a SMAC actuator is connected via a SMAC or SMAC approved cable/connector and controlled by either a SMAC or SMAC approved controller. If a customer wishes to use a cable/connector or controller which is neither manufactured by, nor qualified/approved by SMAC, SMAC offers a test and qualification service to the customer. Once tested and approved the standard SMAC guarantee applies. Please contact your local SMAC branch for details. 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 labor, 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.

SMAC
Moving Coil Actuators

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2022