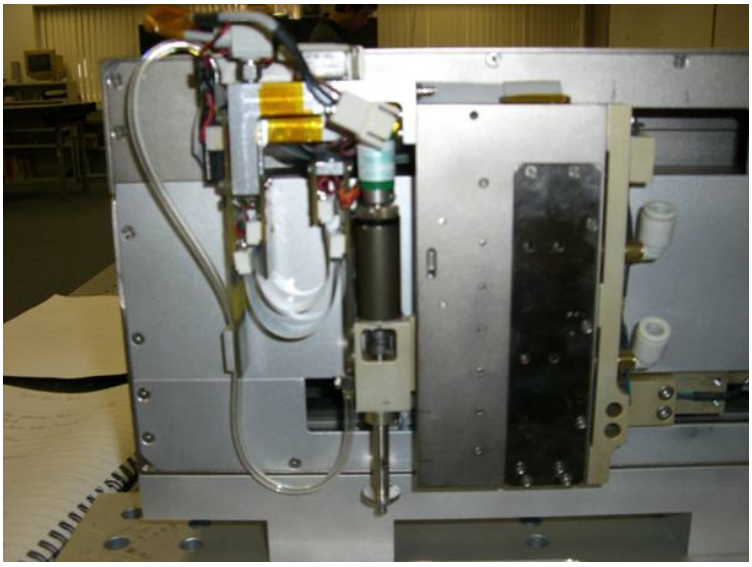
Ultra high speed & precision multi–axis pick & place solution from SMAC Inc

SMAC has developed a unique solution for what is believed to be the fastest & most precise 3 axes pick & place system in the world today…



The solution was developed for a multi-national Japanese manufacturer of luxury goods who were required to both significantly increase product output and improve the flexibility of the manufacturing process.

SMAC is the world leader in Moving Coil Actuator (MCA) technology. Founded in 1990 it began providing customers with unique solutions for factory automation problems. The SMAC actuators are unique due to the fact that the speed, position & force are fully & independently programmable – all at the same time.

The Requirement

The customer required the picking and placing of a number of different sized, high value micro components. The weight of these variable sized components are only a few grams and are extremely delicate, therefore difficult to handle. The X axis of the system has a stroke of 50mm. The Z axis 30mm and the Theta (rotary) axis of 360 degrees. The system is required to use the Z axis actuator to pick up the micro component with vacuum using SMAC's patented 'Softland' function before releasing vacuum and lifting off to ensure no damage to the component occurs during pick up. Then it is required to rotate the component 180 degrees to ensure the component is in the correct position for placing. The X axis then moves 100mm into position and the Z axis then places the component in position – again using the unique 'Softland' function.. Both the start & target positions are reported to guarantee the correct placement of the part.

The system then returns to the start position and repeats. The complete cycle time is <300 milliseconds. This equates to 3 cycles per second or a speed of 15G! The customer's current solution was running at a cycle time of 900 milliseconds – equivalent to only 4G using conventional pneumatic devices & servo systems with external electrical sensors and switches. By integrating force & position sensors into a single direct drive device a major step change in terms of speed and performance has been achieved and new standards in high speed pick & place factory automation has been set by SMAC Inc.

The Specification

Whilst the need for speed was paramount the requirement for precision, accuracy & repeatability was even more demanding. The shaft run out on the Z axis actuator was required to be <10 micron. The overshoot on this axis also less than <10 micron and the settlement (to pick the component) again <10 micron. The same demanding specification was also required on the return cycle. On the Y axis actuator (50mm stroke) overshoot was allowed and an accuracy of +/- 10 micron on the settlement of the actuator. The rotary or Theta axis integrated into the Z axis actuator required accuracy +/- 2 counts on an encoder with a resolution of micron. This was necessary for settlement when 'flipping' the component 180 degrees. No external electrical switches or sensors allowed and a duty cycle of 24 hours a day, 7 days a week was required. On top of this the heat & temperature of the system was not allowed to increase more than 20 degrees Celsius from the ambient at any given time. In all - an extremely demanding set of criteria regarding, speed, precision, accuracy, repeatability & durability.

A Customized Solution

This highly innovative solution was custom designed by SMAC's design engineering team in Carlsbad, California – USA. The customer was supplied with a completely pre-assembled, individual parts handling solution. It was designed to be quickly retro fitted into the existing production system within the customer's factory. One of the key features of the SMAC Moving Coil Actuator solution is that by design it has inherent positioning & feedback capability – a closed loop system that ensures no external sensors or switches are required. This dramatically reduces the amount of external wiring required and facilitates both quick installation and 100% diagnostic feedback & data. The solution was rigorously tested in advance of delivery and ready to install as a turnkey unit. The pick & place system integrated two Multipole Moving Coil Actuators (MCA) one of which was a 2 axis rotary unit. The Y axis unit – part number MLA15-50 had a stroke of 50mm and the Z unit part number MLRA15-30 has a stroke of 30mm and an inbuilt rotary axis of 180 degrees. Due to the exceptionally high speeds and high duty cycle air cooling was used to keep the temperature of the actuators constant. The electronic actuators achieve an exceptionally high degree of speed, accuracy & repeatability by the use of specially designed internal components and SMAC's high performance electronics. 'C' sleeve linear guides deliver exceptionally high life expectancy and a high resolution encoder is integrated into an optimized size footprint. The SMAC system is complemented by 4 high speed Galil electronic controllers which were incorporated into the solution.

The Results

The whole system which is proprietary SMAC technology was taken from concept to delivery of a working system in under 6 months. The SMAC solution not only met the customers requirements it totally surpassed them! The new system enables perfect quality and allows production times to be tripled. Further to this it also enabled the customer to increase manufacturing throughput & flexibility by rapidly switching to new parts for different products quickly. Previously, manual machine change over of parts was required. The SMAC solution reduced existing cycle times from 900 milliseconds to 300 milliseconds whilst being operated 24/7.

from 900 milliseconds to 300 milliseconds whilst being operated 24/7. It is now believed that the SMAC solution sets a new benchmark as the fastest & most accurate pick & place machine automation system in the world. Due to the fact that it is SMAC proprietary technology it can be freely used for other customers and other applications. It is ideally suited for the handling of any micro components where fracturing & damage occurs during the production process when using conventional solutions such as pneumatic devices, ball screw & servo systems. It is particularly suited to SMT & chip placing applications.

This application can be seen on video by visiting the SMAC website on:
http://www.smac-mca.com/pickandplace.htm

SMAC Inc is the world leader in Moving Coil Actuators and associated control systems Headquartered in Carlsbad, California USA with subsidiaries throughout Europe, Asia & Japan. SMAC delivers high tech solutions to industry with linear & rotary Moving Coil Actuators, positioning stages and electronic control solutions.

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