

The Hedgehog: a universal holding fixture for the aircraft industry

NC-controlled vacuum suction devices reduce set-up time by 70 percent

Austrian company, MICADO specializes in fixtures and machines for the production of composite fiber aircraft components. For finishing carbon fiber components for the A350, the new Airbus flagship, the company developed a versatile vacuum suction system called the Hedgehog. The system uses vacuum suction units to secure aircraft components flexibly, without the need for time-consuming changeovers. All control and drive tasks are handled by PC-based control from Beckhoff.



Aircraft panels are made from ever lighter and more resource-friendly materials, based on glass or carbon-fiber-reinforced plastic. The aerodynamically shaped components must be fixed in special devices for further processing. In the past, an exact aluminum negative mould was milled from a block, and the hard tool weighing several tons was transported to a CNC machine with a crane, in order to safely process so-called flap track fairings, for example. There, the aircraft components were inserted, calibrated, and lifted with vacuum suction heads. Only then was it possible to drill the mounting holes and cut and deburr the contours. However, this method is very time-consuming and costly; especially in view of the fact that lot size 1 manufacturing is quite common in the aircraft industry.

Austrian company, MICADO therefore developed a versatile holding system, called the Hedgehog, which can handle more than 20 different components. The device is able to extend its individual vacuum suction units in all directions – similar to how a hedgehog can move its spines – and optimally adjust itself to the contour of respective component. Each vacuum suction head is controlled via a specific NC axis. The different flap track fairing shapes are entered point-by-point only once, and the information is then stored for future operations.

The advantage of this method is that the holding device only has to be mounted and measured once on the machine table. Afterwards, all component types can be mounted and processed in a few minutes. In this way, set-up times are



Mounting an aircraft component on the Hedgehog

reduced by as much as 70 percent. Not surprisingly, demand is high, so further Hedgehog systems have been built for other aircraft, including the Airbus models A330, A340 and A380, as well as the Brazilian Embraer 190.

PC-based control replaces conventional NC controllers

The clamping device has 18 vacuum suction heads, each of which is controlled as an NC axis. Once a component has been placed manually and aligned at the mechanical stops, the Hedgehog positions the required actuators. The system automatically moves to the required position and secures the component. The part is then measured by the processing machine and precisely adjusted via the axes. This sequence is preset and configurable. After milling, the operator releases the component, all actuators move to their idle positions, and the machined part is removed.

The Hedgehog control system is based on an integrated PC-based control solution from Beckhoff. It includes a built-in CP2219 Panel PC, EtherCAT Terminals, as well as drive and safety technology. The axes are controlled via EL7201-0010 servomotor terminals and TwinCAT NC PTP software running on the Panel PC. Point-to-point axis positioning replaces conventional positioning modules and NC controllers, since the high-performance Panel PC can position all NC axes of the vacuum suction units simultaneously and in parallel with the PLC function. All the information is transferred to a database via an XML server.

For implementing the NC axes, MICADO uses compact Beckhoff AM8121 servomotors with One Cable Technology (OCT). Differing from conventional motor cabling systems by combining the power and feedback systems into a single cable, OCT saves valuable installation space. The motors are connected to the EL7201-0010 servomotor terminals, which integrate a complete servo drive into a compact, standard terminal housing. "This system exceeds our expectations for speed and space-saving requirements. With a width of only 12 mm, the devices house a standard EtherCAT slave with a servo drive including servo control, supporting highly dynamic axis positioning with a current control cycle of up to 62.5 μ s. When we were planning the first Hedgehog, Beckhoff was



Andreas Dorians, Technical Director of MICADO AUTOMATION, at the operating panel

the only supplier who could meet our requirements for the drive system with regard to space, speed, and performance," explains Andreas Dorer, Technical Director of MICADO AUTOMATION GmbH.

"Another important aspect when choosing the system was its openness, which allows us to use existing software components from other projects. The controller communicates with the visualization via TwinCAT ADS. The set-up and teach-in procedures, and the range of individual processing parts are stored directly in TwinCAT. Moreover, TwinSAFE safety technology is also an integrated part of the control solution," Dorer continues.

Quick re-fastening and positioning with maximum control quality

"A special challenge was getting a grip on the multitude of axes with drive technology that, at the same time, had to be as compact as possible. Although the holding system is more than 6 m long, the available width was only 50 to 70 cm and the height only 1.50 m. Within this space, we also had to accommodate the control components for 18 NC axes. Additional components included the system technology with operating panel and control units, as well as distributed peripherals and pneumatic components," Andreas Dorer points out. "Our aim was to solve all this with standard products, and in this way, the benefits offered by EtherCAT came in very handy. When it comes to fast, reliable communication, including drive technology, there is no better bus system as far as we are concerned. For fast position sensing, we need a high-performance communication system, and EtherCAT enables significantly enhanced control quality."

Further information:

www.micado.at

www.beckhoff.at