

Case	Delta Industrial Automation Products for Vertical CNC Machining Centers with Automatic Tool Changers (ATC)				
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Applicable to	NC311 Series CNC Controller, ASDA-A2-N Series AC Servo Drive, ASDA-A2R Series AC Servo Drive, Delta AC Servo Motor				
Key words	NC311, ASDA-A2-N, ASDA-A2R				

Delta Industrial Automation offers a Computer Numerical Control (CNC) total solution that provides high rigidity and high precision performance for meeting the demanding requirements of vertical CNC machining centers with ATCs.

[Industry Overview]

CNC machining centers are used in a wide range of manufacturing applications and a wide variety of industries today such as the mechanical parts processing industry, automotive parts industry, architecture and construction products processing industry, dies & molds industry, and more.

With the development of the modern manufacturing and processing industries, there is increased demand for high rigidity, high precision and high accuracy CNC machining centers with Automatic Tool Changers (ATC) controlled by a servo system, which has grown rapidly as an industrial product category. Delta's CNC total solution for CNC machining centers with ATCs increases productivity, saves costs, and earns profits for the relevant industries.

[Introduction of CNC Machining Centers]

Generally, a CNC machining center is composed of a CNC controller that programs and performs a sequence of machine operations, as well as three, four, or more working axes driven by servo systems, a rotating unit with a spindle and another mechanical system such as a rotating work table, a working disk on the worktable for holding a workpiece to be cut, a detecting unit for detecting the clamping and unclamping of a tool, and an automatic tool changer. The most commonly used CNC machining centers include: CNC vertical machining centers, CNC horizontal machining centers, CNC gantry type machining centers, CNC boring & milling machines, and multi-axes CNC turning & milling lathes.

A CNC Vertical Machining Center has its spindle in a vertical orientation. The vertical spindle provides the ability to move vertically. Tools stick straight down from the tool holder and are able to cut across the top of a part. This kind of vertical machining center offers the functions of automatic tool selection, automatic tool change, automatic spindle speed change, and feed rate automatic adjustment that can perform a wide variety of different operations, such as milling, boring, drilling, tapping and reaming. As one of the most commonly used CNC machine tools today for machining various complex workpieces to precise sizes and shapes, it significantly improves machining precision without impacting the speed, providing a cost-efficient alternative to most flat-surface hand-processing work.

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[Tool Magazines and ATC System]

The CNC machining centers comprise a machine tool mechanism and an ATC system, where several tools can be changed automatically and a tool magazine is inserted. The tool magazine can contain a variety of tools for processing the workpieces, and the ATC system used on CNC machining centers is equipped with multiple tools that allow CNC machining centers to rapidly change cutters from one machining operation to the next. With an ATC system, the CNC machining centers can perform multiple tasks and reduce cycle times by automatically changing tools between cuts with no need for manual changes or modification. With CNC technology, the ATC system can help CNC machining centers complete a wide variety of different machining operations, such as milling, boring, drilling, tapping and reaming. The functions of an ATC system can directly affect the processing performance of the CNC machining centers. When processing time is shorter, there is less possibility for errors and troubleshooting. Production efficiency and productivity are higher, and there are savings on production costs and materials consumption.

Tool Magazines

According to storage capacity, shape and tool change procedure, tool magazines can be divided into three types:

A) Drum-type Tool Magazine:

There are 16 to 24 tools in a tool magazine. The drum-type tool magazine easily moves to the spindle axis when changing cutters.

B) Armless-type Carousel Tool Magazine:

This kind of tool magazine is usually used on small-sized vertical CNC machining centers.

C) Chain-type Tool Magazine

A chain-type tool magazine can store large number of cutters. Generally, 20 to 120 tools are expandable as per custom orders.

ATC System

There are three types of ATC system:

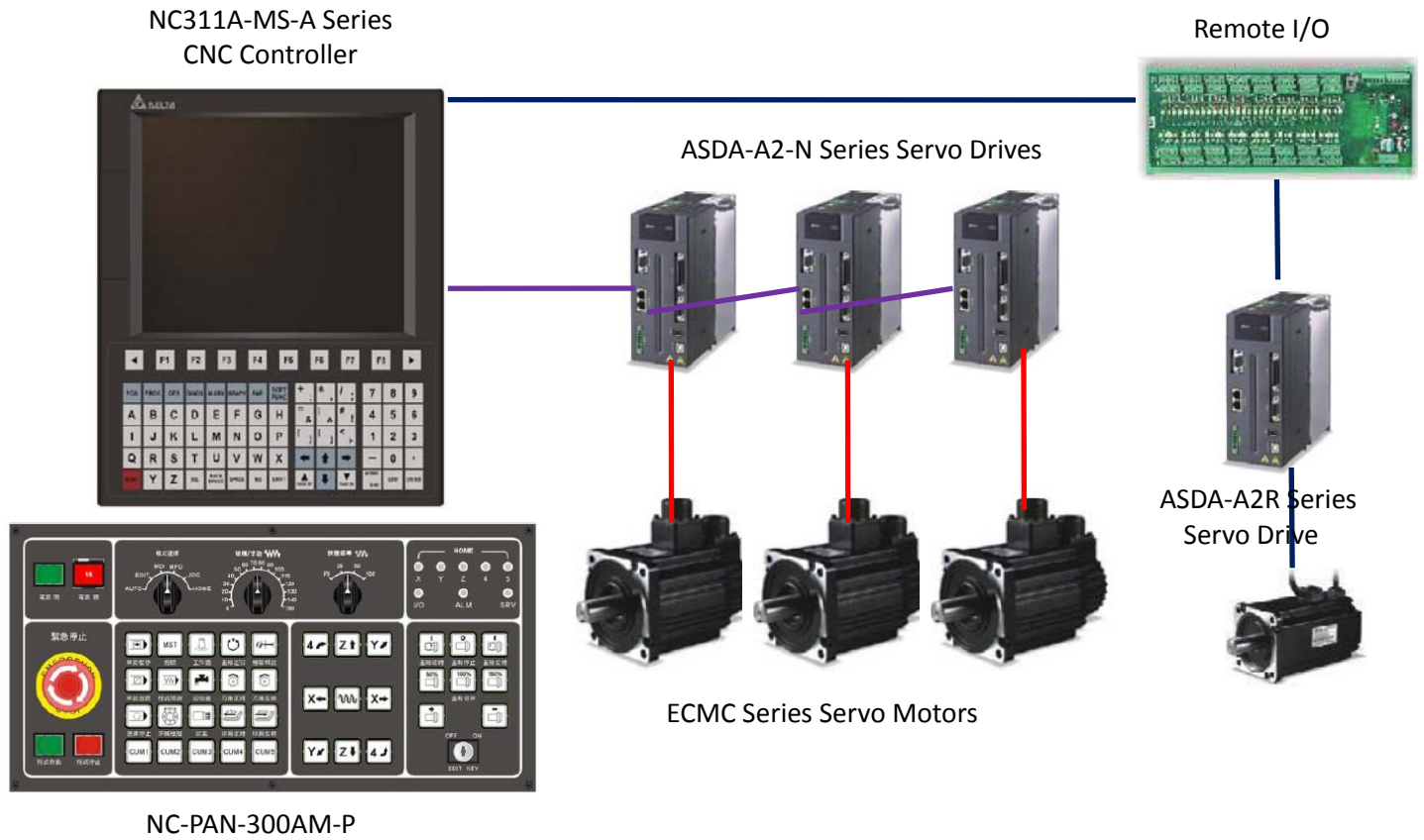
1) Hydraulic control

2) Air pressure control

3) Electronic cam (E-Cam) control

Based on customer demand and market trends for high speed and high reliability, the electronic cam (E-Cam) control ATCs that require no manual intervention are becoming more and more popular and demand has grown rapidly.

[System Structure of Delta's CNC Solution]

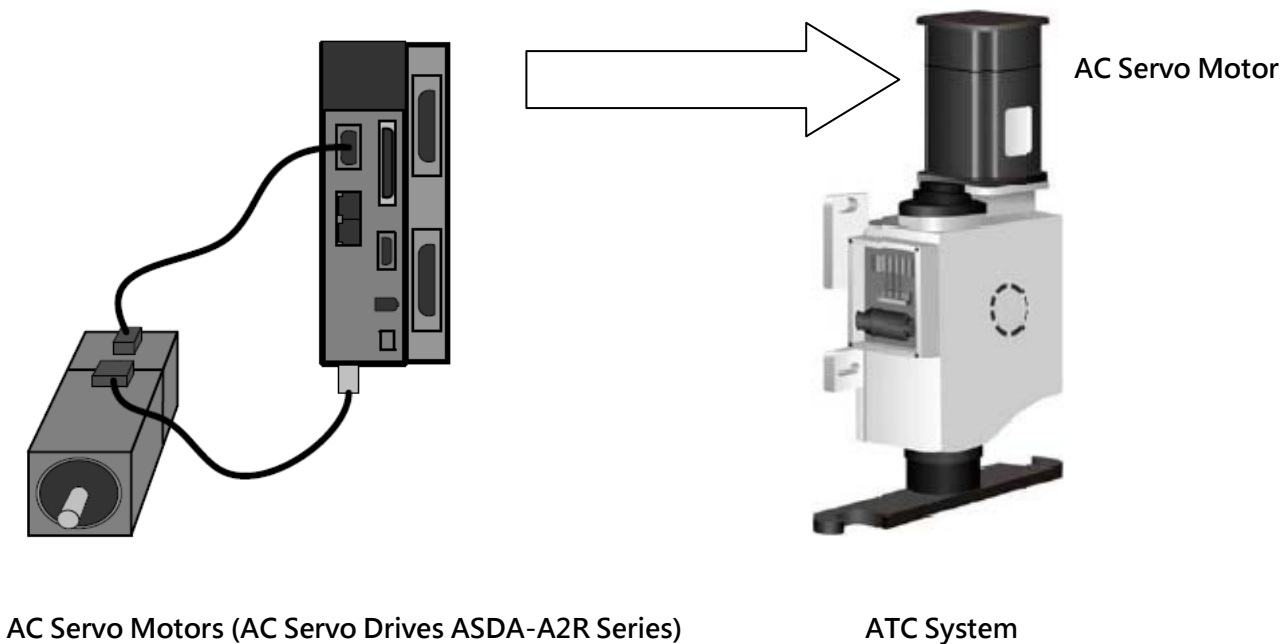


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[Electronic Cam (E-Cam) Control Type ATC]

In a system with electronic cam control type ATCs, electronic cam control is provided by the servo system to achieve complex tool changing during operation, and motion and sequence control is handled by the CNC controller. When the external sensor is triggered, the ATC's cam-driven arm grips the tool holder and brings it toward the machine spindle. With the implementation of a high precision and high frequency response servo system, the electronic cam control type ATC features power, rapid speed, high accuracy positioning, smooth running, low maintenance and is free from problems.

As a result, more and more machine makers adopt high speed, high precision and high accuracy servo systems to drive the ATCs to the optimal level and enhance the reliability and integrity of CNC machining. Using Delta's ASDA series servo system for ATCs reduces equipment wear and tear, improves product precision and quality, and enhances competitiveness.



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[Conclusion]

- Incorporating Delta's key industrial automation products, which include CNC controllers, servo drives and motors, spindle motors, and a self-developed communication system, the Delta CNC Solution is a complete package that provides flexibility and a competitive edge to the CNC machine tools industry. The embedded system with multiple CPUs performs multitasking and improves the operating performance of controllers. Combined with Delta's high speed motion control system, DMCNET, the Delta CNC Solution delivers a high speed, high precision system for exceptional overall performance.
- The Delta CNC Solution features high speed, high precision and superior surface finishing to enhance the speed, quality, and stability of CNC machine tools. It also provides multi-block look-ahead of acceleration/deceleration before interpolation for complete contouring control. The CNC Solution achieves a balance between speed and precision to improve processing efficiency and ensure machining productivity, and is ideal for high-speed, high-precision machining applications.
- Replacing a traditional induction motor with the Delta ASDA-A2R series servo system greatly shortens the tool changing cycle of the ATC system. Using Delta's ASDA series servo system for ATCs saves time, enhances overall stability, simplifies system structure and improves production efficiency, especially when changing tools in high-speed. When a CNC machining center adopts the Delta CNC Solution, the CNC controller needs only to send tool changing commands to the servo drives, and the servo drives will control the ATCs to perform and complete the entire tool changing operation quickly and precisely. The signal exchanging time between the CNC controller and the ATC system is saved to provide fast, stable, and reliable tool exchange action.

Meeting the increasing challenges of the changing global market, the Delta CNC Solution offers the ultimate in performance to assist the machine tools industry excel and stay competitive through continuous innovation and customization.

For more information on Delta's industrial automation products, please visit our website at: www.delta.com.tw/ia