World Class ANCA CNC Grinders
Cut Precisely Using the INtime RTOS
and Windows XP Embedded

Recognizing that software is a vital part of their solution, ANCA Pty Ltd has built their CNC machines around a single PC controller that combines the flexibility and adaptability of embedded Microsoft® Windows® with the hard real-time consistency and reliability of the INtime® RTOS. An emphasis on accuracy, high standards, and innovation has resulted in ANCA leading the CNC industry in the creation of machines that add value to, enhance, and even revolutionize their customers’ existing processes.

An independent Australian manufacturer of CNC machines, ANCA is a world-ranking global company providing leading edge equipment to first-tier companies such as Rolls Royce, General Electric, Samsung, Boeing, Daimler-Chrysler, Caterpillar, and Volvo. During a period when others in the CNC industry are contracting, downsizing, or going out of business, ANCA has grown its market share and product portfolio. ANCA’s sophisticated computer-controlled cutting and grinding machines and CNC software are finding applications in power train applications for the automotive industry, the medical device field, special tool grinding, gear grinding, aerospace, and other industries. An ever-increasing set of customer demands means that ANCA machines, software, automation, and processes continue to change at a rapid pace. Demands ANCA are able to meet because all mechanical, electrical, and

The RX7 CNC tool and cutter grinder is a compact tool manufacturing machine with the power, strength, and working envelope of a much larger machine. Operation and control is managed by a single industrial PC running Windows XP Embedded and the INtime real-time OS.
software design and system manufacturing are done by ANCA. A claim no one else in the industry can make.

Key to their success is the adoption of a single hardware platform to service both machine control and user interface functions. The combination of Windows and INtime has simplified ANCA’s internal development processes and allows them to quickly adapt their system to the needs of their customers. In addition to their own CNC products, the core ANCA CNC platform has been integrated into a variety of OEM applications that rely on Windows as their high-level software platform and utilize INtime for real-time control.

The Performance Challenge

The earliest ANCA systems were built on an embedded computer platform running hand-coded assembly language software, and required a second computer to download complex CNC programs. Performance suffered due to communication bottlenecks and the difficulties associated with coordinating two hardware and software platforms. A decision to move from a dual computer solution to a single hardware platform came in the early 1990s. Their first single hardware platform was built on QNX, an x86 RTOS that included a graphical user interface (GUI).

In the late 1990s ANCA embarked on a change to Windows; prompted by the fact that the QNX OS platform was continually lagging on processor support and was unable to maintain parity with the Microsoft Windows user interface. The accelerating advancements in hardware and software required serious consideration of Windows for ANCA’s CNC machine user interface.

However, Windows alone was unable to meet ANCA’s control demands for their CNC equipment.

“We needed the 3D data presentation and user interface available on Windows but had to maintain the software precision required for numerical control. TenAsys’ INtime RTOS proved to be the right solution, allowing us to keep our single hardware platform strategy and move the user interface to Windows.” — Pat Boland, Director.

Transitioning to a New OS Platform

Rewriting the user interface part of ANCA’s CNC system for Windows was a given, since ANCA was interested in utilizing GUI features of Windows that simply were not available on QNX. However, transferring the heart of the real-time CNC code from QNX to the INtime RTOS was a more delicate matter; given the time and effort that had gone into designing and validating the real-time control elements.

“We ported from QNX to INtime using a ‘shim’ to maximize preservation of existing control code. That code was up and running relatively quickly and continues to work today.”

— Gerard Cullen, CNC Software Developer, ANCA
The unique INtime solution creates two virtual machines on a single CPU, providing isolation between Windows and the INtime RTOS. This virtual machine approach provides bulletproof protection from Windows “blue screen” crashes, which is critical to hard real-time applications. The INtime solution is cost-effective, stable, easy to develop and maintain, and delivers microsecond response times.

ANCA first shipped product based on INtime in 2000. Today, the heart of every piece of CNC equipment built by ANCA uses INtime as the real-time control engine. INtime with Windows has been successfully deployed around the world on two generations of CNC machines.

“The INtime API and RTOS has remained stable, since the initial shipment in 2000 of our Windows based product, allowing us to concentrate on increasing the performance and complexity of our control algorithms without worrying about the stability of the underlying RTOS,” adds Cullen.

“ISA support disappeared from our platforms several years ago,” noted Cullen. “Translating real-time ISA hardware support code to PCI was far easier under INtime than it would have ever been under QNX.”

**The Windows Advantage**

Previous CNC solutions required that ANCA customers purchase a separate QNX desktop box for test, development, and simulation; running on Windows eliminates the need to purchase and maintain a specialized and expensive desktop box. Customers simply use their existing Windows workstations.

The INtime real-time for Windows solution has allowed ANCA to maintain an efficient development process. A unified CNC machine code base runs on two platforms: the INtime real-time platform and the Windows-only desktop simulation platform. This greatly simplifies development and facilitates their customers’ ability to run the system on a desktop for simulation and design purposes.

“The ANCA user interface revolves around highly mathematical concepts, taking advantage of 3D presentation of data. Our 3D simulator runs on a standard Windows platform, allowing for easy transfer between the ANCA CNC equipment and the R&D lab,” explains Lucas Hale, Software Product Specialist.

CIM3D, a Windows program, is ANCA patented software for simulating the grinding motion of their machine tool. Because CIM3D has knowledge of the shapes of the wheels and tools used by the machine it can run through a tool file (cutting program) showing exactly how the part will be produced. Since this is done in software, it can be done at accelerated speed without risk of damage. A task that might take ten minutes to grind can be simulated in five to ten seconds; the simulator can save customers hundreds of dollars on expensive blanks and thousands of dollars in destroyed tool parts by avoiding expensive tool crashes during trial runs.

Utilizing one simulator that runs on both the Windows desktop and the embedded Windows CNC equipment is a significant time saver for operators. By running the simulator directly on the CNC equipment the operator can fine tune cutting programs provided by the R&D lab. Simulation allows the operator to see exactly how the machine will run the tool file. Last minute modifications can be made to better utilize the tool and avoid operations considered either inefficient or risky. And because the simulator runs directly on the CNC machine, operators don’t need to waste time moving between the machine and an office simulator, allowing for faster and more efficient iterations of their work.

As an added benefit, many ANCA customers utilize AutoCAD for their
product design; because the ANCA systems run on Windows their customers’ AutoCAD design data can be imported directly into the INtime driven CNC machine, a feature that would be very difficult to support on any other real-time platform.

Worldwide Support

Internationalization of the CNC equipment is very important to ANCA; because the user interface runs on Windows, ANCA has been able to create machines that support as many as fifteen different languages, including Chinese and several other Asian languages.

Having a worldwide customer base means remote access to the CNC equipment is a necessity, for diagnostics and software updates. ANCA support personnel and their customers can remotely access installed equipment with standard tools such as Microsoft’s NetMeeting and Symantec’s pcAnywhere™. INtime insures that control is smooth and uninterrupted, regardless of how and when the machine is accessed.

“One customer uses a webcam to monitor his CNC machine and remotely control it over the Internet from his home,” remarked David Fisher, OEM Business Development Manager. “This kind of flexibility is uniquely possible because the machine is based on real-time Windows.”

A Multitude of Options

Building their system on the Windows platform gives ANCA access to new and useful I/O devices such as: USB memory sticks for transferring data and programs, touch screens for more complex interaction with the tool, and network interfaces that support connecting the CNC equipment to internal manufacturing networks and company control systems.

Being able to support USB I/O on the real-time side, a feature that TenAsys introduced with INtime 3.0, is an important consideration for future systems, as standard platform hardware sheds traditional I/O interfaces.

For example, ANCA quickly integrated a vision based in-machine measuring system into their equipment, prototyping in just a few days a completely new application and product offering, called iView.

“The INtime plus Windows platform, which is the basis for all our controls, allows for very fast integration of the ANCA CNC platform into unique OEM applications,” explained Fisher. “Writing and installing a device driver with INtime and Windows XP Embedded is so easy that we are confident we can very quickly add any new piece of PC hardware that a customer wants. The options are practically infinite.”

Going Forward

Improve performance and throughput is a common mantra recited by the ANCA customer base. TenAsys’ addition of support for dual-core processors in INtime 3.0 gives ANCA the ability to immediately support even faster hardware platforms.

ANCA’s use of qualified off-the-shelf motherboards keeps their CNC platform on par with advances in computing technology, and translates to faster cycle times for the real-time control element with more complex computations for more accuracy of the tool.

“TenAsys’ ability to keep in-step with current hardware offerings insures that we are able to improve performance and add new features to our product by utilizing new and improved PC platforms,” said Gerard Cullen, CNC Software Developer.

A testament to the ANCA way of building CNC equipment is the fact that other high-end CNC manufacturers are starting to follow their lead: use a single hardware platform to service both the machine control and the user interface for maximum throughput.