

New Era of CNC Maintenance is PC-Based

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When the first-shift supervisor for the strut-machining department arrives at his office each day, one of his first tasks is to check e-mail. Not only does he want to see if anyone in his building has sent something important to him, he wants to see if any of the machines in his department require attention.

He can receive information about his machines in this manner due to the introduction of PC-based CNC technology into factory automation. New CNC controls are able to interact among themselves as well as with other PCs, including the standard PC sitting on the supervisor's desk, to an extent not possible just a few years ago.

CNC software can be configured to send e-mails to specific individuals based on certain events. If a particular machine requires more coolant, for example, or is due for its monthly preventive maintenance, an e-mail can be sent. No action by the machine's operator at that time is required. By connecting the PC-based CNC to the department network (or perhaps the plant network), the CNC can send messages to those users that its Windows account can access. These messages can include a pager, which is useful for bringing attention to urgent problems.

The CNC operator-interface using Web-browser technology lets the maintenance supervisor connect to the CNC and view the interface directly from an office PC. The CNC will have a fault history log so the supervisor (or anyone involved in the machine's maintenance) can view operator and error messages sent in the past few days.

This reading might reveal that too many tool-changer mechanical hang-ups were reported yesterday. Maintenance personnel can then be scheduled for this machine to make the necessary mechanical adjustments.

Additional data such as down time, chip time and part count could also be available to the appropriate personnel. Remote access could even be used by maintenance personnel to view the actual machine input and output conditions at the moment of a reported mechanical problem. The maintenance person might be able to determine the cause of the problem even before arriving at the machine.

PC-based CNC architecture allows a wealth of opportunity for data management in the factory. Part programs and production information can be moved via network (such as Ethernet). If file archival is required, the common USB or built-in (IDE) technologies can be used to write a CD, which requires little time. The PC-based CNC has a large data-storage capacity with its internal hard disk.

Even if a factory has minimal automation overhead (in other words, no network), the PC provides the floppy disk, serial interface (COM port), USB and parallel

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interface (LPT port) to move data.

During machine installation, the CNC OEM can record the initial machine configuration with a network connection or even a dial-up modem connection (factory-to-customer). Some PC-based CNCs can record CNC performance data. A CNC with a software oscilloscope can save its accumulated data for later reference. This multi-channel oscilloscope can be configured to record the benchmark with performance data for certain features, including axis performance or mechanical timing. Later a comparison (with the same benchmark testing configuration) can reveal changes in timing. With that remote connection, the OEM could check the machine for these differences many months or years later, revealing performance issues that might be addressed with preventive maintenance before those issues become problems.

PC-based CNC technology also takes advantage of other aspects of this mature user environment. Most people are familiar with the PC operating systems and their operator interfaces (such as Microsoft Windows). These make CNCs easier for everyone to use. For example, multiple languages can be supported by a single computer. If the operator requires a different language than a part programmer or a maintenance person, the control can switch between those languages.

Most CNCs will typically include other factory automation standards. The interface to the servo drives will be the conventional analog signals (10V analog velocity signal with 5V encoder feedback) or the international SERCOS digital-drive interface (a fiber optic cable between drives and the control).

With most analog drives, the drive supplier provides PC tools for setup and maintenance. These tools can reside on the CNC PC and allow maintenance personnel to review drive errors or even tune-up axes without having to connect an additional PC and cable.

With the SERCOS network, the maintenance person at the CNC display can directly access the respective drive parameters, perhaps including its internal fault history log, during the course of machine maintenance activities (like drive tuning adjustments). The SERCOS parameters in the drives for these activities will be the same regardless of the drive manufacturer, making it that much easier for maintenance to handle a variety of vendors effectively.

The maintenance of the internal hardware with PC-based CNC technology is also convenient. The internal part count is typically very small, with a PC power supply, a standard PC motherboard, perhaps a standard PC VGA card and, finally, the CNC technology board (to access the machine IO and the machine axis/spindle drives). A standard network PC card, standard PC hard-disk drive and perhaps other standard PC hardware (keyboard, mouse, VGA display, etc.) will be used. Replacement of these items is neither difficult nor expensive, given the quantity of installed PCs in the world.

An older CNC having no connection to a network required other mechanisms. For example, alarm conditions in the control often resulted in a blinking beacon,

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perhaps with a buzzer. The only way anyone in maintenance could determine what had gone wrong on a particular control was to physically stand in front of it and check its various displays. Part programs were often distributed by slow serial connections to each control from a central DNC computer. Part-program storage was usually limited on each control so as the machine changed among its parts in production, old programs had to be deleted from the internal storage to make room for the next programs. Also, the opportunity for archival of control information was often limited.

For someone with years of experience in CNC maintenance, the current level of PC-based CNC technology contrasts sharply to that of proprietary CNC technology of just a few years ago. Not only has the initial cost of CNCs been reduced by about 66%, but the total cost of ownership has been reduced and simplified through the growing use of high-volume, reliable, and lower-cost PC components.

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