

CNC Software Savvy

How to get the software you need for the jobs you want to do.

E. Peter Kovar

Question:

When we purchase our first CNC gear hobbing machine, what questions should we ask about the software? What do we need to know to correctly specify the system requirements?

Answer:

Software used in gear manufacturing machines such as hobbers, grinders or other gear finishers is quite different from that used on other kinds of machine tools. Shops that do their own gear blank turning and are familiar with programming their machines themselves may find it difficult to make the transition to gear cutting. New users are advised to look for CNC systems that are easy to use and will automatically calculate some of the more complicated gear geometry entries.

Getting What You Need

Make certain that the features you need will be provided. This may seem simple enough, but far too often users discover after the fact that an important feature they thought was standard equipment is an expensive option.

Begin with a list of features you require. When you begin comparing vendors, start a worksheet of the software features each provides. This is important. Never accept obscure descriptions by vendors of the "standard" software they provide. Get a specific listing, or list your

needs as part of your purchase order; otherwise you may be asking for trouble. See the sample worksheet on page 42 or make up your own.

What Features Should I Get?

Required features depend on the type of work you will be doing. If you are a job shop with many changeovers, or if your operator personnel are not extremely conversant in gear geometry, you should make sure that the software is easy to use and is able to make some of the more complicated geometry calculations automatically. Some of the considerations to take into account with any CNC software purchase follow.

Operator Interface. This is the software that enables your operators to interact with the machine. Again, the type of interface you should specify will depend on what you expect the machine to do and the skill level of the operators. An interface is extremely user-friendly when it does many of the calculations for the operator, offers "conversational input" or a menu and enables the operator to make choices by simply pushing buttons or clicking on specified places on the screen.

Some shops prefer a more basic input approach and wish to make calculations externally of the control. These users are very familiar with gear manufacturing and typically have an engineer prepare

the machinery inputs. This "parametric programming" of the machine is used in low-cost versions of operator interface software.

Some users will wish to limit access to certain data entry screens to qualified personnel. This feature is typical in an automated environment such as in the automotive industry. Access is usually limited by the use of a password or key switch.

All user interface programs should have context-sensitive help screens. It is inefficient for operators to keep referring to hard copy manuals, which are often misplaced or out of date. A well-written operator interface should have a very small operator manual.

Ask the vendors to let you try their software. Is the input simple and easy to use or cumbersome? Are commands simple and intuitive? Is the use of color consistent and helpful? Are you able to load and save often-used setups of parts, tools or processes in the CNC? Also note how fast the screens refresh or the software runs. This is a clue to the efficiency of the software. Ask the vendor if the software has been installed in the field. Talk to other users of the exact version of software you are buying to find out if it is "buggy." Do not be the first user of a new piece of software, or, if you are, request that a software engineer be on site until all features are tested



Gear Technology's newest column will answer your questions about gear machinery controls and electrical systems. Send your questions about CNC, software and machinery electrical systems to Mission: Controls, P. O. Box 1426, Elk Grove, IL 60009 or fax them to 708-437-6618.

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and accepted. (This can be time-consuming and risky, and may cost you money in downtime and wrecked parts.)

Graphical Interface. Many users find a graphical interface is easier to use for data input. This type of interface allows operators to view the gear or tool as they would normally see a blueprint. This preview will reduce scrap costs. A graphical interface is usually supplemental to some type

of menu input. Some manufacturers also offer a *diagnostic* graphical interface, which spotlights certain conditions on screen, typically on a rendering of the machine for easier problem location.

Vendors are offering Microsoft Windows-based front ends on their CNC equipment in order to provide graphical user interfaces (GUIs) on the screens. These Windows- and PC-based front ends add to

Gear Hobbing Software Feature Worksheet

Use this worksheet when comparing the features offered by competing vendors, or make your own. Highlight the critical features for your application.

Software Feature Comparison Worksheet:

Note if Standard (S), optional (O) or not available (NA)

- Number of axes controlled by the CNC ____
- Radial hobbing cycle
- Radial/axial hobbing cycle
- Radial/axial with crowning (symmetrical/asymmetrical, concave/convex)
- Diagonal hobbing cycle
- Equal and alternating hobbing cycles
- Multiple cutting cycles (note number of cycles ____)
- Single index hobbing for helical gears
- Single index hobbing for spur gears
- Taper root spline cutting cycle
- Multiple gear, tool and process setups; note number of gear, tool and process setups that can be input on the CRT and executed in a single cycle (____)
- Automatic hob shifting
- Programmable lubrication control
- Power clamping of workpiece (manual machines)
- Tail center operation (manual machines)
- Automatic parts loading sequence (automated machines)
- Minimum programmable increment of ____mm (or inch) linear, ____rotary axis
- Hour meter and part counter display
- Graphical spindle load display
- Graphical axis position following error, speed, current, input/output status display
- Inch or metric menu input
- Data conversion utilities
- Context-sensitive help screens
- On-machine gear tooth spacing measurement
- Automatic tool/workpiece alignment
- Graphical user interface screens
- Diagnostic graphical interface
- _____
- _____
- _____
- _____

the price of the package. The cost of the PC is *in addition* to the hardware and software normally needed to control the machine, and industrial-quality PC boards are expensive. Furthermore, as you may already know from your experience with Windows applications on your office or home PC, you are subject to faults and additional general errors. Be careful when buying current Windows front ends. You may be better served by waiting until the bugs are worked out or until the next (presumably more bug-free) version of Windows '95 is released.

Gear Size Compensation. Size compensation is a feature that will adjust the machine settings to reflect changes in the machine or part geometry during the manufacturing process. These changes are usually caused by heat generated during cutting or changes in ambient temperature.

Size compensation can be done passively via the use of temperature measuring devices or size correction estimating algorithms stored in the software, or it can be done actively via a probe measuring the current gear size or operator input.

Other Features

Gear Geometry Measurement. Some CNC systems can be equipped with measurement probes or other devices to provide on-machine measurement. This option is especially useful for applications where a large part needs to be moved to a measurement device (gear checker). The part must be mounted and aligned on the measuring machine in the exact position it held when removed from the hobbing machine. On-machine measurement greatly re-

duces the down time when manufacturing large, cumbersome gears.

On-machine measurement is usually not done on smaller, more easily handled parts. Since this measurement takes time, you do not want to do it on a gear hobbing machine in a high-production environment.

Modifications. Can the software you buy easily be modified or edited? Can you or someone on your staff do the modifications, or does it require an investment in programming tools or outside software engineers? You should also find out if process programs can easily be edited for custom specific cycles.

Warranty. Ask your vendor how long the control is under warranty by the original manufacturer and how much an extended warranty costs. Typically, the cost is very low because of the high reliability of modern systems.

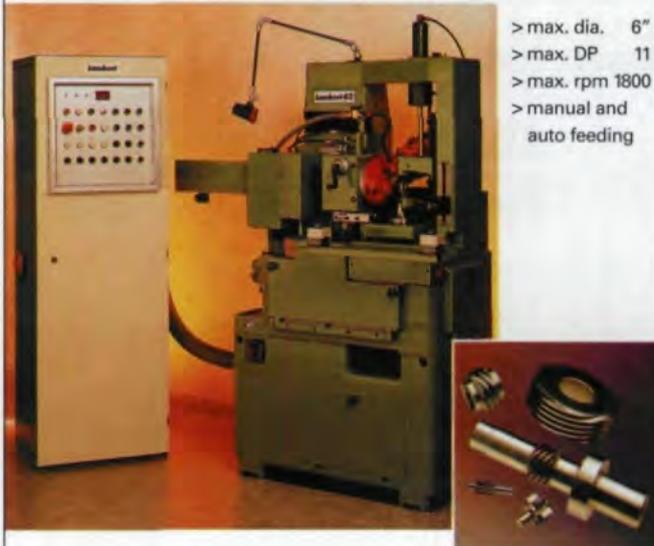
Conclusion

Purchasing a new machine or retrofitting an older one with modern controls is a large investment for any gear cutting firm. The basic strategy for making such a purchase successfully is the same as for any other large capital investment—do your homework. Ask your vendor detailed and informed questions. Know what your quality and production requirements are and convey them clearly to your vendor. Don't buy more machine than you need, but certainly don't settle for less. And remember that the lowest bottom-line figure now does not necessarily mean the lowest long-term costs later. ⚙

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