CNC Computer Numerical Control

Accessory Devices

MIKE LYNCH

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Dedicated to the memory of my father,
Leonard J. Lynch

Preface

Computer numerical control (CNC) machines are currently involved with almost all facets of manufacturing. There is no manufacturing industry not touched in some way by what these very productive and cost-effective machine tools can do.

Machine-tool builders, in order to supply the most efficient and distinctive CNC machine tools, supply a wide spectrum of special accessories designed to enhance or extend what the CNC machine tool is capable of doing. Also, the diversity of CNC equipment has made it possible and even attractive for companies related to CNC to parallel what the machine-tool builders are doing in the way of accessory devices. Just as the machine-tool builders do, many peripheral companies now supply aftermarket devices to enhance the performance and/or capabilities of this sophisticated kind of equipment.

No longer is the CNC machine tool the only factor contributing to the success of the CNC environment. In fact, in many cases, the success of the CNC environment depends heavily on the proper application of accessory devices.

The evolution of aftermarket accessory devices for use with CNC can be easily compared to the recent revolution in personal computers (PCs). The personal computer by itself is of little value without software and certain other accessories. Along with computer manufacturers, a number of software suppliers have been successful in producing a wide range of software products to increase the number of applications for personal computers.

Software is but one of the aftermarket accessories that can be purchased for today's personal computers. Hardware devices like the mouse, hand scanners, full-page scanners, modems, and printers of all varieties are but a few examples of aftermarket devices that can dramatically increase the personal computer's applications and capabilities.

In similar fashion, there are a number of accessories available for CNC equipment. As with the personal computer, some are supplied

and supported completely by the machine-tool builder or control manufacturer. But, by far, a greater number are available from aftermarket suppliers that have little or no relationship with the machine-tool manufacturing companies.

As with the personal computer example, aftermarket suppliers for CNC equipment have a greater motivation to make theirs the products that perform best. Their very existence depends on how well they do in this regard.

The Lack of Emphasis on Accessory Devices

Since CNC machines by themselves do make up such a large portion of the CNC environment, often a CNC beginner is so concerned with becoming proficient with programming or operation of the machine tool itself that certain important factors of the CNC environment are left ignored and unstudied. Granted, the proper application of the machine tool itself plays a major role in the success of the company. However, it is but one facet of the whole CNC picture. Learning CNC without including a study of accessory devices would be like trying to learn about computers without considering software, printers, and other computer accessories. Without a good understanding of those accessories required for use with CNC, the CNC person cannot hope to take full advantage of all that is possible with the equipment.

Often the proper application of accessory devices makes the difference in a CNC machine's success or failure. For example, almost all companies utilizing CNC equipment use some form of program preparation device. This program preparation device may take the form of a simple text editor or a computer-aided manufacturing (CAM) system. To make the most of the entire CNC environment, the user must not only master the usage of the CNC machine tool itself, but must also master the program preparation device as well. Without a good understanding of this accessory device, programs for the CNC machine cannot even be created!

This is but one simple example of how accessory devices impact on the success of the CNC environment. In *all* cases, the CNC user must first be able to recognize that a certain accessory is available, and will help in the particular CNC environment. Once recognized, the user must be able to make the best use of the device.

This is a common scenario in many fields. A race car driver must possess a high level of driving expertise as a primary concern. However, the more the driver knows about internal-combustion engines, fuels, braking systems, suspension systems, tires, and all other facets of the automobile, the better the driver can be. Musicians must be most competent with the instruments they play. But the more they know about other instruments, composition, and playing style, the better they will be. The marksman may be most concerned with aiming and firing a

gun. But the more he or she knows about gun maintenance, load styles, and sight adjustments, the better the marksman can be.

In the same way, a CNC user working with any form of CNC equipment must first possess a firm and complete knowledge of the machine tool itself. But just as importantly, the user must master every accessory device included in the CNC environment.

For example, for working with a machining center, a wide range of accessories may be available. The machining center user may have to master the use of a pallet changer, a probing system, an automatic tool changer, a special work-holding system (like fixtures of all kinds), tooling, and program preparation systems in order to be able to make the most of the machine tool itself. In like manner, a turning center user may have to master the use of a bar feeder, tailstock, steady rest, and live tooling. The list of potential accessory device applications goes on and on.

Unfortunately, there are limited places to which a CNC person can turn to learn about accessory devices for CNC. While most machine-tool builders offer training for the machine tool itself, most assume the user will independently figure out any accessory device equipped with the machine. While they may be able to answer specific questions about any one device, no formal training is usually scheduled for accessories. Worse, if the accessory device is supplied by an aftermarket manufacturer, the machine-tool builder may refuse to help at all.

The supplier of each accessory device may be able to help with the specific usage of its particular device, but unwilling or unable to discuss how the device is interfaced with the machine tool itself.

In both situations (machine-tool builder and aftermarket supplier), if training is available, it would not even begin until *after* an accessory device is purchased. Most programmers exposed to this kind of learning environment would agree that it is a baptism-by-fire approach to learning.

Most technical schools offer CNC training, but like machine-tool builders, their primary concern will be to present the usage of the CNC machine tool itself. Very few curriculums offer any presentations related to accessory devices.

How This Book Can Help

This book is unique in the sense that its *only* goal is to present information about accessory devices related to CNC. There are several ways in which it can help anyone attemping to learn more about CNC.

Exposure to a multitude of different devices

There is a saying that applies to all forms of learning: "Before you can begin to apply any technique or feature, you have to know that the

technique or feature is available!" For example, if your telephone has an automatic redial feature, you have to know what the feature is *and* that it is equipped on your phone *before* you can even attempt to learn how to use the feature.

The field of CNC is filled with special accessories aimed at making a CNC machine perform better. But before a CNC user can begin to take advantage of these accessories, he or she must know what they are and what they can do to improve the CNC environment.

This book will acquaint the reader with countless accessories and techniques available for CNC. While not every type of accessory will be of immediate concern, at least you will have been exposed to the accessory for the time when the need arises.

Learn about CNC accessory devices without pressure

Nothing is worse than having to learn something new while under a great deal of pressure. If you wait until the day that you have to actually work with one accessory or another to begin learning about the accessory, you will be under a great deal of pressure. Possibly, *you* will be the bottleneck that keeps production from being run. It is very difficult to learn anything new while you have production people breathing down your neck, wondering why you cannot make the CNC machine and/or accessory device function.

By using this book with which to become familiar with potential future needs, you will be much better prepared to work with the accessory device when the need arises. While there are numerous variations in the way certain accessory devices function, at the very least you will have been exposed to the most basic and common possibilities.

Learn specific application and programming techniques

Most machine-tool related accessory devices discussed in this book require programming considerations. While machine-tool and accessory-device manufacturers do vary somewhat with regard to how certain devices are applied and programmed, this book will show the most common methods. In most cases, specific programming examples will be shown, to stress the points being made. Armed with the reasoning behind how a particular device functions *and* with the specific programming techniques related to one specific device, you should be well prepared for any variations that come along.

Learn to match your requirements with your company's budget

As with almost any facet of manufacturing, CNC and related accessory devices sometimes require compromises to be made. Just as a company may not be able to justify the purchase of an expensive single-purpose CNC machine tool and compromises must be made by using general-purpose machines, sometimes compromises have to be made with the purchase of accessory devices.

When applicable, we will show possible alternatives and list the compromises and limitations that the CNC user can expect. While our presentations may get a little opinionated during these discussions, at least you'll know what you will be in for if compromises need to be made.

Organization

We think you'll find that this book can easily be used in two different ways. The first is as a tutorial. A relative newcomer to CNC should be able to read the book from cover to cover and find that the presentations are made in a logical and easy to follow manner. By reading the book in this manner, you can gain a wealth of new information related to CNC.

However, there will be those readers who have a specific and imperative need to learn about only one particular accessory device. Such readers can use the table of contents and index to find the information they seek. Once the reader has been directed to the proper section, the presentation will be self-contained and will provide the necessary background required to understand the information presented.

This book is presented in three rather lengthy chapters. Chapter 1 presents CNC-related devices used in the preparation, transfer, storage, and verification of CNC programs. As you will see, there are numerous devices available for use in this area. This chapter will explore the application and usage for these important CNC devices.

Chapter 2 presents machining-center accessory devices. We start with simple devices and work toward more complex ones. Numerous devices, as well as specific programming techniques required for each, will be presented.

Chapter 3 switches the focus to turning-center accessory devices. While certain devices are common to both turning and machining centers, most are applied quite differently from one style of machine to the other. In most cases, presentations made in this chapter will be complete unto themselves, discussing only how the device is applied to turning centers.

Author's Note

Admittedly, no text can thoroughly cover every minute detail of how each CNC accessory is justified, applied, and programmed. The variations within each device category make such a goal impossible. Truly, there are certain accessories (like probing devices and automation systems) that could fill a volume by themselves. Our intention is *not* to become bogged down trying to present every little detail and restriction related to CNC accessories. Instead, our intention is to acquaint you with each accessory, giving you a working knowledge of how it is applied and programmed.

The author welcomes comments and suggestions related to the current text, as well as ideas for devices which the reader feels should be added for future editions.

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