数控技术专业

教育部高等职业教育
示范专业规划教材 数控技术专业

# 数控技术应用英语

黄星 主编

SHUKONG JISHU YINGYONG YINGYU

机械工业出版社
CHINA MACHINE PRESS

教育部高等职业教育示范专业规划教材
数控技术专业

# 数 控 技 术 应 用 英 语

## Practical English for Computer Numerical Control Technology

主　编　黄　星
副主编　蒋耀熠
参　编　赵九九

机 械 工 业 出 版 社

本书为教育部高等职业教育示范专业规划教材，是专业阶段的英语教材，旨在提高高职高专院校数控技术专业学生和数控技术从业人员的专业英语水平，以及涉外业务人员的交际能力。

本书是依照高职高专教育培养目标及教学实际，遵循“边学边用，学用结合”的原则编写的，内容全面、实用、先进、通俗易懂，难点、重点突出，贴近企业，贴近实际。

全书包括10个单元，每个单元都有与企业紧密结合的实用例题，还安排有数控实用英语对话等。

本书既可作为高职高专、成人高校数控技术、机电一体化等专业的专业英语教材，也可用作企业培训教材，或供相关技术人员学习参考。


**图书在版编目（CIP）数据**

数控技术应用英语/黄星主编．—北京：机械工业出版社，2009.1
教育部高等职业教育示范专业规划教材．数控技术专业
ISBN 978-7-111-25725-7

Ⅰ．数…　Ⅱ．黄…　Ⅲ．数控机床—英语—高等学校：技术学校—教材
Ⅳ．H31

中国版本图书馆CIP数据核字（2008）第192917号

机械工业出版社（北京市百万庄大街22号　邮政编码100037）
责任编辑：郑　丹　版式设计：霍永明　责任校对：熊　贞
封面设计：鞠　杨　责任印制：杨　曦
北京瑞德印刷有限公司印刷（三河市胜利装订厂装订）
2009年1月第1版第1次印刷
184mm×260mm·14.75印张·365千字
0001-4000册
标准书号：ISBN 978-7-111-25725-7
定价：24.00元

凡购本书，如有缺页、倒页、脱页，由本社发行部调换
销售服务热线电话：（010）68326294
购书热线电话：（010）88379639　88379641　88379643
编辑热线电话：（010）88379171

# 前　言

《数控技术应用英语》是专业英语阶段的教材，旨在提高数控类专业学生专业英语水平及满足其一般交际的需要。

本书是依照《高职高专教育英语课程教学基本要求（试行）》的标准，从培养高级应用型人才的总体目标以及高职教育教学实际出发，结合学生毕业后的工作实际，力求为学生提供未来工作岗位所必需的专业英语知识，培养学生在实际工作岗位应用专业英语的能力而组织编写的。

全书共设10个单元，每个单元都由阅读与翻译、模拟套写与实际训练等几部分内容组成，以与企业紧密结合的英语实用性文章或具体实例来编写，同时配有与数控知识相关的实用英语对话。

本书是以就业为导向，以提高学生的职业能力和职业素质为目的，结合专业英语的特点而编写的数控技术专业英语，突出数控专业的词语和用法，以典型数控系统的操作、维修、诊断和编程英文说明书为主要参考，以英文阅读理解、翻译和资料查询为重点，使学生获得阅读和查阅数控机床、数控系统操作与编程说明书等的能力。

本书共设10个单元，供一个学期使用。每个单元主要包括四部分内容：

第一部分为“专业阅读”（Technical and Practical Reading），旨在培养学生数控专业英语的阅读能力，包括两篇文章，展示当今高、新数控机床及加工工艺等，同时附有一些真实场景的数控实践方面的照片等，每篇字数控制在500～650字。

第二部分为“了解控制面板”（Glance at a Control Panel），它可以帮助学生了解数控机床操作面板中各键的功能及应用，是应用性很强的必学内容。

第三部分为“模拟套写”（Simulated Writing），包括两部分内容：Section A为“常见数控故障诊断”（Common Failure Diagnostics）；Section B为“试试您的动手能力”（Have a Try），为小零件数控程序设计。同时还配有相应的套写、拟写，翻译简单的产品广告、机床说明书、数控系统操作与编程说明书等应用文。

第四部分为“交际会话”（Communicative Speaking），选用贴近实际、贴近企业、贴近生产的常用专业英语会话，以便进行口头交际能力的训练等。

本书构思力求实用为先，特色鲜明，贴近企业，贴近专业，重点突出和针对性强。尤其是对课文以外部分的“练习”内容的编排，着重突出专业英语的特色，设计独创，采取一种全新的方式，让学生通过“练习”，既能学到英语，又能学到数控专业的各类小知识，可谓一举两得。

长春汽车工业高等专科学校黄星任本书主编，北京林业大学外语学院蒋耀熠任副主编。黄星编写了第1、2、3单元，蒋耀熠编写了第4、5、6单元，长春汽车工业高等专科学校赵九九编写了第7、8、9、10单元。

本书由中国一汽集团公司机动处（蓝迪公司）机器人部部长黄晶高级工程师主审，他在机床设计及制造方面有很高的造诣，为本书提供了部分专业素材，并在编写过程中提出了许多专业方面的建议，对全书进行了审核。

本书在编写过程中还得到了刘万菊教授、刘永久、王伟罡等专业老师的大力支持，他们提出了许多宝贵意见和建议，还提供了大量的数控技术方面的最新资料，使得本书能够顺利完成。在此，编者对他们的热情帮助以及无私奉献深表谢意。

为满足广大专业读者的需求，本书在兼顾英语习惯的通用性和特殊性的基础上突出体现了数控技术的专业性，但由于时间仓促，加之编者水平有限，书中不当之处在所难免，恳请广大专家、读者批评指正，在此深表感谢。

本教材配有电子课件，凡使用本书作为教材的教师可登录机械工业出版社教材服务网 www. cmpedu. com 注册后下载。咨询邮箱：cmpgaozhi@ sina. com。咨询电话：010-88379375。

编　者

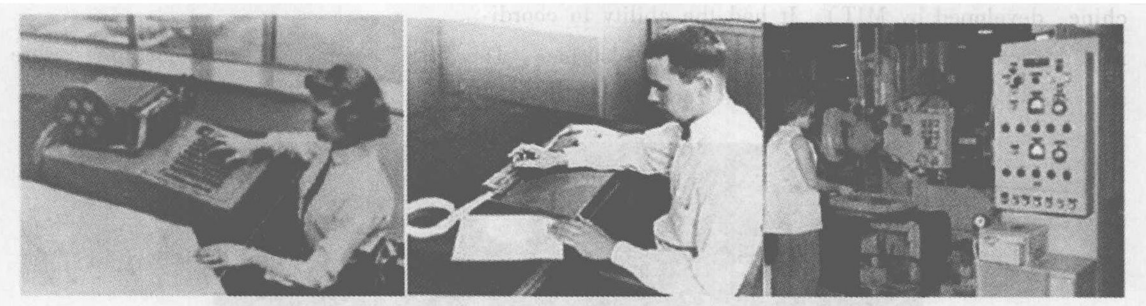
# Contents

# *Unit 1　History of NC and CNC*

## Part Ⅰ　Technical and Practical Reading

### • Passage A

**History of Numerical Control**



**Time Line (Milestones) for Numerical Control (NC)**

Knitting machines in England controlled by punched cards—1725.

M. Fourneaux—made the first automatic player piano operating with forced air through perforated rolls of paper—1863.

Eli Whitney (Figure 1-1) developed jigs and fixtures—American system of interchangeable parts manufacture—1870 ~ 1890.


Figure 1-1

John Parsons, Parsons Corporation, Michigan, Whitney's developed a control system that directed a spindle to many points in spindle succession—1947.

Servomechanism Laboratory of Massachusetts Institute of Technology (MIT), added computer to Parsons system—1951.

Cincinnati Milicron Hydro-Tel Vertical Spindle Milling Machine, the first three-axis numerically controlled, tape-fed machine tool—1952.

NC was announced to public—1954.

First production NC machines were delivered and installed—1957.

NC and CNC machine tools commonly available—1960 up to today.

**Where did NC come from?**

NC's roots may go back to the 1720s when the jacquard loom was devised that used holes in punched cards to control the decorative patterns woven into the cloth. Perhaps a more familiar ancestor of numerical control is the player piano (Figure 1-2. An ancestor of NC). Originating in the 1860s, player pianos use a roll of punched paper to control the actuation of the keys and notes.

Numerical control, as we know it today, started out before the advent of the microprocessor used in contemporary computers. The U. S. Air Force is generally credited with being the prime force in the development of NC. The introduction of the turbojet engine permitted a considerable increase in the speed of combat aircraft, which resulted in increased stresses on aircraft structural members.

Figure 1-2

The first successful NC machine, funded by the Air Force, was demonstrated by the Massachusetts Institute of Technology in 1952. It was a "retrofitted" Cincinnati milling machine (Figure 1-3. The first successful NC machine, developed by MIT). It had the ability to coordinate the axis motions to machine a complex surface. The first "commercial" NC machines were shown at the 1955 National Machine Tool Show.


Figure 1-3

The first generation of NC machines used large vacuum-tube-based controllers that consumed a great deal of electrical power, generated a lot of heat, occupied a large area of floor space, and left much to be desired with respect to reliability. Second-generation models replaced the vacuum tubes with transistors for increased reliability, decreased power consumption, and to occupy less space. Third-generation models featuring integrated circuitry and modular circuit design reduced costs and increased reliability still further.

These first and second generation controllers had no memory. The controller had to be "fed" its instructions, one at a time, from an external source, a tape reader (Figure 1-4. A pre-CNC electromechanical tape reader and NC tape). The controller would accept a single instruction, execute that command, accept the next command, execute it, accept another command, etc.

The commands were encoded on a paper tape. As the tape passed through the tape reader, a single block of information—the command—would be read and passed on to the controller for execution (Figure 1-5. The finger-like contact passes through tape holes, touching electrical contacts in the drum). After execution, the controller would signal the tape reader that it was ready for another command. The tape reader would then read the next block, and so on, until the entire tape was read, passed on to the controller, and executed. The last command on the tape was a code to cause the reader to rewind the tape. The first command on the tape was a code to tell the tape reader when to stop rewinding to prevent the front end of the tape from coming off the supply reel. Although NC machines like this are no longer being made, a number of these machines are still in use.

Figure 1-4

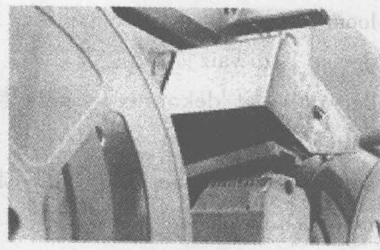


Figure 1-5

Numerical Control is a technique involving coded, numerical instructions for the automatic control and performance of a machine tool. It is a method of controlling machine tool movements with the aid of a number language. This system was soon universally adopted by industry and has made it possible to produce large quantities of identical parts.

## Notes

1. NC's roots go back to the 1720s when the jacquard loom was devised that used holes in punched cards to control the decorative patterns woven into the cloth.

句中由 when the jacquard loom... 引导出定语从句，修饰 the 1720s；而 that used holes... 所引导出的从句，则为分割定语从句，修饰 the jacquard loom。

2. The first generation of NC machines used large vacuum-tube-based controllers that consumed a great deal of electrical power, generated a lot of heat, occupied a large area of floor space, and left much to be desired with respect to reliability.

由 that consumed a... 引导的部分为定语从句；consumed..., generated a..., occupied a... 和 left much... 为并列结构。

## New Words

milestone [ˈmailstəun] *n.* 里程碑
punch [pʌntʃ] *v.* 穿孔
automatic [ˌɔːtəˈmætik] *a.* 自动的
player [ˈpleiə] *n.* 播放器
perforate [ˈpəːfəreit] *v.* 透孔
jig [dʒig] *n.* 夹具

fixture [ˈfikstʃə] n. 固定器
interchangeable [intəˈtʃeindʒəb(ə)l] a. 交互的
part [pɑːt] n. 零件
manufacture [ˌmænjuˈfæktʃə] n. 制造业；v. 制造，加工
spindle [ˈspindl] n. 主轴
servomechanism [ˈsəːvəuˈmekənizəm] n. 伺服机构
hydro-tel [ˈhaidrəuˈtel] a. 液电的
vertical [ˈvəːtikəl] a. 垂直的
feed [fiːd] v. 进给
install [inˈstɔːl] v. 安装
loom [luːm] n. 织布机
devise [diˈvaiz] v. 设计
decorative [ˈdekərətiv] a. 装饰的
pattern [ˈpætən] n. 样式，模式
actuation [ˈæktjueiʃən] n. 起动
note [nəut] n. 符号
microprocessor [ˌmaikrəuˈprəusesə(r)] n. 微处理器
advent [ˈædvənt] n. 产生
contemporary [kənˈtempərəri] a. 同时期的
turbojet [ˈtəbəudʒet] n. 涡轮喷射机
considerable [kənˈsidərəbl] a. 相当多的，相当大的
aircraft [ˈɛəkrɑːft] n. 飞行器
stress [stres] n. 应力
demonstrate [ˈdemənstreit] v. 演示
retrofit [ˈretrəˌfit] v. 翻新
coordinate [kəuˈɔːdinit] v. 协调
axis [ˈæksis] n. 轴
complex [ˈkɔmpleks] a. 复杂的
commercial [kəˈməːʃəl] a. 商业性的
vacuum [ˈvækjuəm] n. 真空
controller [kənˈtrəulə] n. 控制器
consume [kənˈsjuːm] v. 消耗
reliability [riˌlaiəˈbiliti] n. 可靠性
transistor [trænˈzistə] n. 晶体管
consumption [kənˈsʌmpʃən] n. 消耗
feature [ˈfiːtʃə] n. 特征；v. 以……为特征
modular [ˈmɔdjulə] a. 模块的
circuit [ˈsəːkit] n. 电路
memory [ˈmeməri] n. 存储器

instruction [inˈstrʌkʃən] *n.* 指令
execute [ˈeksikjuːt] *v.* 执行
external [eksˈtəːnl] *a.* 外部的
encode [inˈkəud] *v.* 编码
block [blɔk] *n.* 程序块，部件
rewind [riːˈwaind] *v.* 转回
performance [pəˈfɔːməns] *n.* 执行
adopt [əˈdɔpt] *v.* 采用
identical [aiˈdentikəl] *a.* 完全相同的

## Phrases and Expressions

Numerical Control (NC) 数控
knitting machine 织布机
jacquard loom 提花织机
punched card 穿孔卡
decorative pattern 装饰图案
Massachusetts Institute of Technology (MIT) 麻省理工学院
milling machine 铣床
go back to 追溯到
air force 空军
result in 导致
electrical power 电量
with respect to 关于
replace... with... 用……取代……
integrated circuitry 集成电路
one at a time 同一时间一次
external source 外部源
tape reader 纸带阅读机
pass on to 传递到……
come off 脱离
supply reel 供带盘
be in use 在使用中
with the aid of 在……的帮助下
be applied to 存在于，应用于
in the form of 以……的形式

**EXERCISE 1**

*Mark the following statements with T(True) or F(False) according to the passage.*

1. In 1957, first production NC machines were put into production.
2. According to the passage, NC's roots go back to the 1820s.

3. The first NC machine funded by the Air Force was demonstrated by the Cincinnati Milicron Company in 1952.

4. Third-generation models featuring vacuum tubes with transistors reduced costs and increased reliability.

5. Numerical control is a technique, and it is a way of controlling machine tool movements with the aid of a number language.

**EXERCISE 2**

*Translate the following phrases into Chinese or English.*

| | |
|---|---|
| 1. numerical control | ______________ |
| 2. ______________ | 织布机 |
| 3. punched card | ______________ |
| 4. ______________ | 铣床 |
| 5. integrated circuitry | ______________ |
| 6. ______________ | 外部源 |
| 7. decorative pattern | ______________ |
| 8. ______________ | 供带盘 |
| 9. air force | ______________ |
| 10. ______________ | 纸带阅读机 |

**EXERCISE 3**

*Fill in the blanks with the suitable words or phrases given below, changing the form where necessary.*

> manufacturing, numerical control, a microcomputer, punch cards, instructions, a controller, machine tools, a tape reader, perform, advanced technologies

1. __________ machines are machines that are automatically operated by commands.

2. These early machines were often fed instructions that were punched onto __________.

3. NC machines are used in __________ tasks, such as milling, turning, punching and drilling.

4. In modern NC technology, the machine control unit (MCU) consists of __________ and related control hardware.

5. Programmed __________ are changed into output signals that in turn control machine operations.

6. Prior to the advent of NC, all __________ were manually operated and controlled.

7. An industrial robot is actually a form of an NC machine, and its motion is controlled by __________.

8. An NC machine can be programmed to __________ a series of operations and run itself.

9. __________ was used to interpret the instructions written on the tape for a machine.

10. Like so many __________, NC was born in the labs of the Massachusetts Institute of Technology.

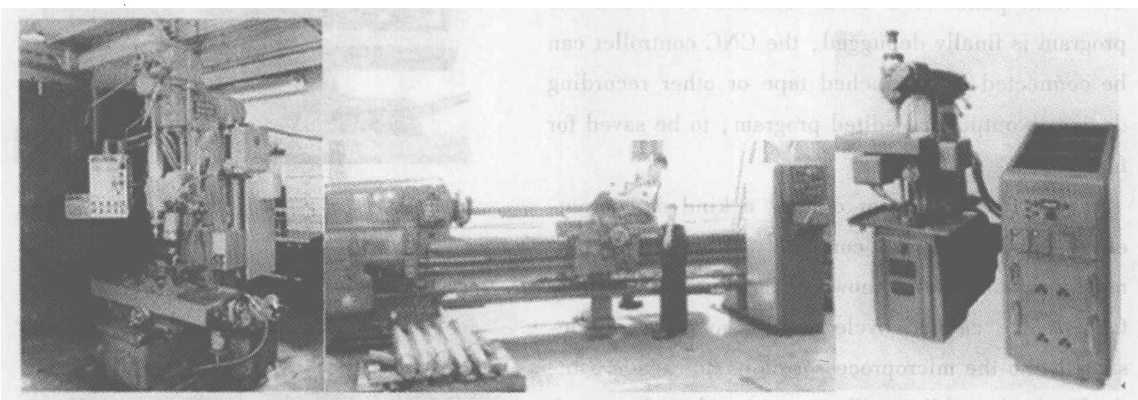
**EXERCISE 4**

*Translate the Chinese parts given in the brackets into English.*

1. The manufacturers have never stopped ________ (对新型数控机床的研究).
2. These NC components ________ (都由手工制造的).
3. We must try our best to surpass advanced world levels in ________ (现代数控设计与制造).
4. With the common efforts from both sides, ________ (我们的新一代数控机床现在正式开始投产了).
5. To develop the machine tool industry of our country, we must introduce not only foreign funds, ________ (还应引进国外的先进科技).

## • Passage B

### History of Computer Numerical Control



CNC or "Computer Numerical Controlled" machines are sophisticated metalworking tools that can create complicated parts required by modern technology. Growing rapidly with the advances in computers, CNCs can be found performing work as lathes, milling machines, laser cutters, abrasive jet cutters, punch presses, press brakes, and other industrial tools. The CNC term refers to a large group of these machines that utilize computer logic to control movements and perform the metalworking (Figure 1-6. The early CNC machine tool).

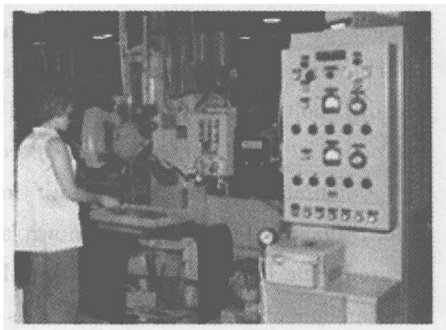


Figure 1-6

With the advent of the microprocessor chip, it became practicable to provide the controller with its own memory. This permitted the tape of program instructions to be read by the controller's tape reader only once and then stored in the controller's memory. Magnetic tape recorders and floppy disk drives were also being used for program recording and storage. The tape or disk could then be taken out and stored for future use. Alternatively, the controller could be connected directly to the computer to receive its instructions without the use of any intermediate medium. In addition, the controller could be fitted with its own keyboard for directly entering the program, called Manual Data Input (MDI). Whatever the method for instructing the controller, the controller could then execute the program by reading from its own memory.

Debugging an NC program before the advent of CNC required making a new tape, trying out the new tape, finding the next error, making another tape, and so on. The process of debugging a new program could require making a dozen or more punched tapes until an error free program was achieved. Engineering changes required a new tape to be made and debugged.

The introduction of CNC, with the NC program stored in the controller's memory, made it possible to access the program directly in the controller's memory, making all the needed changes by keying in from the controller's keyboard (Figure 1-7. The front panel of a CNC controller). When the program is finally debugged, the CNC controller can be connected to a punched tape or other recording device to output the edited program, to be saved for future use.

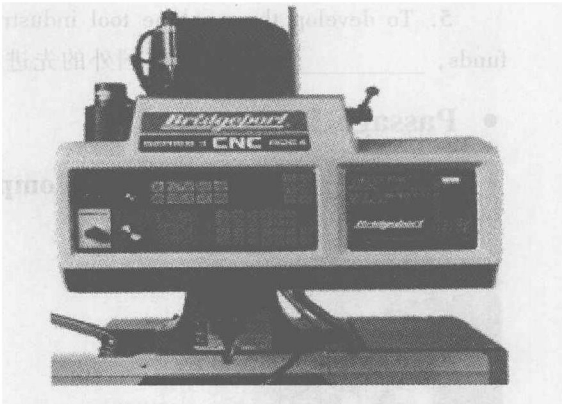



Figure 1-7

The microprocessor chip is a kind of computer—a special-purpose computer. Hence such NC machines came to be known as computerized NCs-or CNCs. The canned cycle circuit boards were designed into the microprocessor chips and made a little fancier by adding still more canned cycles, such as peck drilling for deep holes, rectangular and circular pocket milling, and even routines to calculate and drill bolt circle patterns (Figure 1-8. The small microcircuit in the center contain more functions).

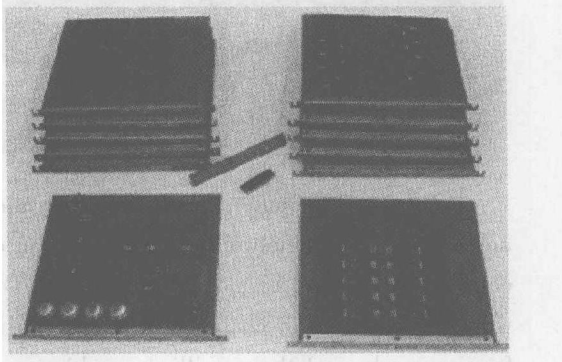


Figure 1-8

Calculator routines were built into CNC controllers that could scale up or down all axis moves for producing families of parts. Other built-in calculator routines yield the ability to take into account the diameter of the cutter in case it is undersize or oversize. All of these capabilities and more are being "built in" to the modern CNC controllers. Some controllers will even ask you predetermined questions on a screen display and build the program from your answers.

Automated equipment is not always NC controlled. Automation is the process of controlling manufacturing systems to perform repetitive operations with a minimum of human intervention. Automation may or may not be computerized. Computerization of manufacturing processes enhances flexibility. To change the method of operation one needs only to change the computer program with perhaps minor changes to hardware such as tooling. NC and manipulative robots are examples of computerized automation equipment.

These machines are grouped together in the factory and connected by a conveyer mechanism to transfer the engine blocks from one machine (or station) to the next. Each machine may have a mechanism to automatically load and unload the workpiece, and automatically measure critical dimensions and shunt defective parts off to the side. Collectively, these machines are called a transfer line (Figure 1-9. A multi-station non-numerical control high-volume production machine tool transfer line). They are still the most efficient and cost-effective means to achieve high-volume production such as in the automotive and many other industries. They may require little, if any, human intervention, and hence are a form of automation.

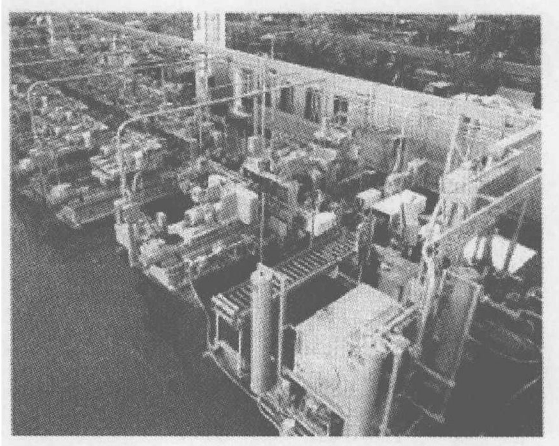


Figure 1-9

## New Words

sophisticated [səˈfistikeitid] *a.* 复杂的，尖端的
metalworking [ˈmetəlˌwəːkiŋ] *a.* 金属加工的
complicated [ˈkɔmplikeitid] *a.* 复杂的
lathe [leið] *n.* 车床
abrasive [əˈbreisiv] *a.* 有研磨作用的
utilize [ˈjuːtilaiz] *v.* 运用
logic [ˈlɔdʒik] *n.* 逻辑
chip [tʃip] *n.* 芯片
practicable [ˈpræktikəbl] *a.* 可行的
recorder [riˈkɔːdə] *n.* 记录器
drive [draiv] *n.* 驱动器
alternatively [ɔːlˈtəːnətivli] *adv.* 可以选择的是
medium [ˈmiːdjəm] *n.* 媒介
keyboard [ˈkiːbɔːd] *n.* 键盘
debug [diːˈbʌg] *v.* 调试
achieve [əˈtʃiːv] *v.* 获得
engineering [ˌendʒiˈniəriŋ] *n.* 工程
access [ˈækses] *v.* 访问
edit [ˈedit] *v.* 编辑
save [seiv] *v.* 存储
fancy [ˈfænsi] *a.* 特别的

peck [pek] *n.* 穿孔
rectangular [rek'tæŋgjulə] *a.* 长方形的
circular ['səːkjulə] *a.* 圆形的
pocket ['pɔkit] *n.* 槽
mill [mil] *v.* 铣
routine [ruː'tiːn] *n.* 程序
calculate ['kælkjuleit] *v.* 计算
bolt [bəult] *n.* 螺栓
calculator ['kælkjuleitə] *n.* 计算器
built-in ['bilt'in] *a.* 内置的
diameter [dai'æmitə] *n.* 直径
cutter ['kʌtə] *n.* 切刀
undersize ['ʌndəsaiz] *a.* 尺寸不足的
oversize ['əuvə'saiz] *a.* 尺寸过大的
capability [ˌkeipə'biliti] *n.* 性能
predetermined ['priːdi'təːmind] *a.* 预先决定的
screen [skriːn] *n.* 屏幕
display [di'splei] *n.* 显示，展示
automated ['ɔːtəmeitid] *a.* 自动化的
repetitive [ri'petitiv] *a.* 可重复的
minimum ['minimәm] *n.* 最少
computerization [kəmˌpjuːtərai'zeiʃən] *n.* 计算机化
hardware ['hɑːdwεə] *n.* 硬件
tooling ['tuːliŋ] *n.* 更换刀具
manipulative [mə'nipjulətiv] *a.* 可操纵的
robot ['rəubɔt] *n.* 机器人
monitor ['mɔnitə] *v.* 监视
overall ['əuvərɔːl] *a.* 整个的
direct [di'rekt, dai'rekt] *v.* 指示
individual [ˌindi'vidjuəl] *a.* 单个的
conveyer [kən'veiə] *n.* 传动装置
mechanism ['mekənizəm] *n.* 机构
load [ləud] *v.* 装载
unload ['ʌn'ləud] *v.* 卸载
dimension [di'menʃən] *n.* 尺寸
shunt [ʃʌnt] *v.* 分路
defective [di'fektiv] *a.* 有缺陷的
cost-effective [kɔsti'fektiv] *a.* 有成本效益的
automotive [ɔːtə'məutiv] *a.* 汽车的