

## APPENDIX B

### NC-CNC GLOSSARY

#### COMMON WORDS AS THEY RELATE TO PROGRAMMING BRIDGEPORT NUMERICALLY CONTROLLED SYSTEMS.

ABSOLUTE DIMENSION. A dimension expressed with respect to a fixed point of zero origin. (See INCREMENTAL DIMENSION on page B-8).

ACC/DEC. The ability of the control system to provide smooth changes in velocity when starting and stopping, and when changing from one feed rate value to another.

ACTIVE STORAGE. Data registers which hold the data which is actively being processed. In the Bridgeport Control, this consists of the interpolation registers (and the N, F, S, T, M function registers).

ADAPT. A computer-aided NC programming language and processor. It is a sub set of APT and is essentially limited to two axis contouring and three axis point-to-point work.

ADDRESS. An identification for a control storage register. In the Bridgeport Control, the various registers are addressed by a letter, e.g. N, F, X, Y, Z, etc.

ALGORITHM. A prescribed set of well-defined rules or processes for the solution of a problem. Algorithms are implemented on a computer by a programmed sequence of instructions.

ALPHANUMERIC CODE. A code whose set consists of letters, numbers and associated special characters. (see EIA or ASCII CODE).

ANALOG. In N/C, a system which utilizes electrical voltage magnitudes or ratios to represent physical axis positions.

ANSI. American National Standards Institute

APT. (Automatically Programmed Tools). An NC computer-aided programming language developed on a pooled fund basis by an organization of private companies and government agencies. It consists essentially of: (a) the APT processor, (b) a Bridgeport APT postprocessor, and (c) a computer of sufficient size to run the APT program. The APT system is capable of 3, 4 and 5 axis contouring and point-to-point work. the Bridgeport APT post-processor has been implemented on the following series of computer systems: IBM 360/370, GE/HONEYWELL 635, UNIVAC 1110, CDC 6600.

ARGUMENT. The independent variable of a function. Arguments can be passed as part of a subroutine call where they would be used in that subroutine.

ASCII CODE. The acronym for American Standard Code for Information Interchange. This standardized code is used extensively in data transmission. The code includes 128 upper and lower case letters, numerals, and special purpose symbols each encoded by a unique 7-bit binary number.

ASYNCHRONOUS. Operation of a data transfer network whereby each character transferred is preceded by a start bit and followed by a stop bit. The time interval between characters may vary.

AUXILIARY FUNCTION. see MISCELLANEOUS FUNCTION.

AXIS. (1) A reference line of a coordinate system; for example, the X, Y and Z axis of the Cartesian coordinate system.  
(2) A direction along which a movement of the workpiece occurs.

AXIS REVERSAL. The reversal of the sign (plus or minus) of the X and Y input values, on a selective basis, to permit machining "left-handed" parts from "right-handed" part programs.

BACKLASH. A relative movement between interacting mechanical parts, resulting from looseness.

BASIC. A conversational programming language developed at Dartmouth College which permits the use of simple English words, abbreviations, and familiar mathematical symbols to perform logical and arithmetic operations. This language is generally used in conjunction with an inter-active terminal.

BATCH PROCESSING. Pertaining to the technique of executing a set of computer programs such that each is completed before the next program of the set is started. (see also TIME-SHARING).

BAUD RATE. Synonymous with signal events (bits) -per-second and used as a measure of serial data flow between a computer and/or communications devices.

BCD. (Binary Coded Decimal). A notation system in which the individual decimal digits expressing a number in decimal notation are each represented by a four bit binary number. For example, the decimal number 92 is represented by 10010010 in BCD notation.

BINARY. A numbering system utilizing a base of two. Binary Code is notated by 0 and 1's. For example, the number 92 is represented by 1011100. Control systems utilize binary logic because the switching components within them have two states: "on" and "off". In general, X, Y, Z, I, J and K dimensions which are input to the control in BCD notation are converted internally to binary values so that the arithmetic functions may be more conveniently implemented.

BIT. A binary digit. A bit is the smallest unit of data in a digital computer.

BLOCK. A group of words, on punched tape, that collectively provides a complete operating instruction to the control. The block of information is terminated by an End of Block character.

BOOTSTRAP. A short sequence of instructions which when entered into the computer's programmable memory will operate a device to load the programmable memory with a larger, more sophisticated program.

BUFFER STORAGE. Storage registers for X, Y, Z, I, J, K, F and M data which act as an intermediate storage area between the tape reader and active storage. This data is available for rapid transfer to active storage. Buffer storage is provided to prevent delays in the transfer of data due to tape reader speed.

BUS. A group of circuits providing a communication path between two or more devices.

BYTE. A set of adjacent binary bits, usually eight, which are operated on as a unit. A byte can also be a subset of a computer word.

CAD. Computer Aided Design

CANNED CYCLE. A preset sequence of events initiated by a single command. For example, the Z axis canned drill cycle, initiated by a "G81" command moves the Z axis toward the workpiece a stored distance at a stored feedrate and then away at rapid traverse at the end of each XY axis programmed move.

CAM. Computer Aided Manufacturing

CARTESIAN COORDINATES. A dimensioning system whereby the position of a point can be defined with reference to a set of axes at right angles to each other.

CENTRAL PROCESSOR UNIT (CPU). That unit of a computing system which fetches, decodes and executes programmed instructions and maintains the status of results as the program is executed. The subunits of a CPU typically include Accumulator and Operand registers, instruction logic, arithmetic/logic unit, I/O (Input/Output) control logic.

CHANNEL. (track level). A path parallel to the edge of a tape along which information may be defined by the presence or absence of holes.

CHARACTER. One of a set of symbols which may be combined to express information in a program. The characters used are special letters N, G, XYZ etc. The decimal digits 0 to 9, and the special characters "-", "tab", "end of block" and "rewind stop". All for the purposes of addressing specific registers.

- CIRCULAR INTERPOLATION. A mode of contouring control which uses the information contained in a single block to produce an arc of a circle.
- CHIP. An integrated circuit.
- CLDATA. (Cutter Location Data. CLFILE, CLTAPE). CLDATA is the output of the generalized numerical control programming processor (such as APT) and is the input to the postprocessor.
- CLOCK. A pulse generator which generates basic timing signals to which all system operations are synchronized.
- CLOSED LOOP SYSTEM. A system in which a position command signal is compared with the actual position of the moving element. The difference between these two signals is the resultant error which is amplified and compared with a velocity (tachometer) signal and output to the power amplifier. The power amplifier accepts the rate loop error signal and supplies the necessary output for the servo drive which then attempts to reduce the error to zero. Note: Zero error is also zero torque output in an analog type drive (Servo Motor, Hydraulic Motor, etc.). The continuous path error while in motion is approximately 0.0001" per ipm of feedrate on each axis drive. (See OPEN LOOP SYSTEM on page 10).
- CODE. A system of characters in a predetermined fixed pattern representing information in a language which can be understood and handled by the control.
- COMMAND. A signal, or group of signals, initiating one step in the execution of a program.
- COMPILER. A computer program that will convert a higher level language into machine language.
- COMPUTER. A device capable of accepting information, operating on the information according to pre-programmed instructions and supplying the results of these operations. A typical computer consists of a CPU (central processing unit - control, arithmetic and logic, and register elements), main memory and I/O (input/output) devices.
- COMPUTER LANGUAGE. The computer understands instructions coded as binary numbers. Since programming in binary codes is very demanding, symbolic translator programs have been written which enable the programmer to express the problem not directly in the "MACHINE LANGUAGE" of the computer, but rather in a more powerful language, which will be translated into the basic language and encoded into the binary format automatically. The symbolic translator is itself a computer program that operates on the format of the input (SOURCE) program and outputs it as machine language (OBJECT) code, ready to be executed.

ASSEMBLY language is one of many such translators. It enables using mnemonic code sets rather than binary numbers to program a set of instructions. For example, a program could be written:

START	CLA	CLEAR ACC
A,	IAC	INCREMENT ACC
	SKA	SKIP NEXT INSTRUCTION
		IF ACC = 0
	JUMP, A	JUMP BACK TO INSTRUCTIONS
		LABELED A
	HLT	STOP THE COMPUTER

FORTRAN is a still more powerful symbolic translator. It lets the user express the problem he is trying to solve in a mixture of English words and mathematical statements. Additionally, an attempt was made to make FORTRAN computer independent so that a program coded in FORTRAN does not have to run on a specific computer. The above program coded in FORTRAN would be written:

```
      A = 0
2     A = A + 1
      IF (A.NE.0) GOTO 2
      STOP
```

CONSOLE. That part of the Bridgeport Control used for communication between the operator and the machine tool controller. The console can be used to control the machine manually, determine the status of the various registers, and modify the contents of buffer storage.

CONTINUOUS PATH. The controlling of the motion of machine members so that the slides travel through the designated path at the specified rate. For example, a continuous path controller would be used to mill intricate shapes.

CORE MEMORY. A read-write random access memory which uses small ferrite torroids (doughnut-shaped cores) as the memory bit storage. Core memory is nonvolatile; data remains in storage after removal of power.

CRT. Cathode Ray Tube - An electronic vacuum tube containing a screen on which alphanumeric or graphic information may be displayed.

CURRENT LOOP. A communication line on which the presence or absence of electrical current is used to represent transmitted data.

CURSOR. Visual moveable pointer used on a CRT.

CUTTER DIAMETER COMPENSATION. The capability of a control to accept differences between a programmed tool diameter and the actual tool diameter. This compensation generates an entirely new milling path parallel with the old and equidistant from it by the compensation amount at all times.

CUTTER PATH. The path described by the cutter in order to generate the desired part configuration.

CYCLE. A predetermined sequence of operations that is repeated regularly. In the Standard RS-274 Word Address format, the "G81" command sets the drill cycle.

CNC. Computer Numerical Control - A numerical control system wherein a dedicated, stored program computer is used to perform some or all of the basic numerical control functions.

DATA. A representation of facts or instructions in a formalized manner, particularly as they are input, acted upon, and/or output by a controller used for handling such information.

DIAGNOSTIC PROGRAM. A troubleshooting aid for locating hardware malfunctions in a system or a program to aid in locating coding errors in newly developed programs.

DIGIT. A symbol that is used to represent one of the integers of a numbering system. For example, in the decimal system, the integers 0 to 9 are digits; in the binary system, 0 and 1 are digits.

DISK STORAGE. A method of high-speed bulk storage of programs and data. The medium is a rotating circular plate coated with a magnetic material, such as iron oxide. Data is written (stored) and read (retrieved) by fixed or movable read/write heads positioned over data tracks on the surface of the disk. Addressable portions can be selected for read or write operations.

DUPLEX. A communications circuit that permits two-way simultaneous transmission.

EDITOR. A program which permits a user to create new files in symbolic form or modify existing files.

EIA STANDARD CODE. The two EIA Standards for N/C character coding are:

- |          |   |
|----------|---|
| RS-244-A | Character code for Numerical Machine Control Perforated Tape. (Commonly called EIA code)  |
| RS-358   | Subset of the USA Standard Code for Information Interchange for Numerical Machine Control Perforated Tape. (Commonly called ASCII Code) |

NOTE: The Bridgeport Control conforms to both code character sets.

- ENABLE. A signal condition which permits a specific data processing event to occur.
- END OF BLOCK CHARACTER. (EOB). A character that represents the end of a line or block of information contained in a machine control tape. (see EIA STANDARD CODE).
- END OF PROGRAM. An "M02" code indicating completion of the work-piece. Stops spindle, coolant, and feed after completion of all commands in the block. The tape is rewound back to the rewind stopcode at the beginning of the program.
- ERROR SIGNAL. Difference between the output and input signals in a Servo system.
- EXECUTE. To perform a specified computer instruction. To run a program.
- EXECUTIVE. Software which controls the execution of programs in the computer.
- FEEDRATE. Generally a three digit code (2 before the decimal, one after) which determines the machine slide rate of feed. This number is coded directly in inches/minute in most controls.
- FETCH. The action of obtaining an instruction from a stored program and decoding that instruction. Also refers to that portion of a computer's instruction cycle when that action is performed.
- FILE. A collection of related record treated as a unit. In a computer system, a file can exist on magnetic tape, disk, punched paper tape, punched cards, or as an accumulation of information in system memory. A file can contain data, programs, or both.
- FIRMWARE. A computer program (software) that is implemented in hardware, such as read-only memory.
- FLAG. An indicator, whose state is used to inform a later section of a program that a condition, identified with the flag and designated by the state of the flag, had occurred.
- FLOATING ZERO. A characteristic of a machine tool controller permitting the zero reference point on any axis to be easily established at any point in the travel. (Ref. G92)
- FORMAT. A formalized arrangement of data. As applied to tape, the rules defining the character configuration. As applied to programs, the rules defining the structure of the information.
- FORMAT CLASSIFICATION. A EIA shorthand system used to classify NC systems. Refer to EIA RS-274C.

For example: D59.524.35

- FORTTRAN. FORMula TRANSlator. A science-oriented language (see COMPUTER LANGUAGE on Page 4).
- FULL DUPLEX. Refers to a communication channel which can simultaneously and independently transmit and receive data.
- GENERAL NC LANGUAGE PROCESSOR. A computer program developed to operate on symbolic input data generated by a parts programmer in developing the mathematical representation of a geometric form.
- HALF DUPLEX. Refers to a communication channel which can receive and transmit, but not simultaneously.
- HANDSHAKING. Refers to the required sequence of signals for communication between system functions. The I/O bus protocol for a system defines its handshaking requirements. (This is especially true for asynchronous I/O systems in which each signal requires a response [reply] to complete and I/O operation).
- HARD COPY. A printed output.
- HARD-WIRED LOGIC. A group of logic circuits permanently interconnected to perform a specific function.
- HIGH LEVEL LANGUAGE. Computer language which uses readily understood symbols and command statements. Each statement typically represents a series of computer instructions. Examples of high-level languages are BASIC, FORTRAN and APT.
- INCREMENTAL DIMENSION. The dimension from one point of departure to the next. In an NC program, if the entire job is incrementally dimensioned and the tool programmed to return to its start point, the algebraic sum of all the intervening plus and minus motion is zero.
- INPUT RESOLUTION. The smallest increment of dimension that can be programmed as input to the system.
- INTEGRATED CIRCUIT (IC). A solid state microcircuit consisting of interconnected active and passive semiconductor devices diffused into a single silicon chip.
- INHIBIT. An external signal which interrupts data processing until a peripheral auxiliary function has been completed.
- INITIALIZE. To set the system logic at the beginning values.
- INSTRUCTION. A command that specifies an operation. For example, a BLOCK of DATA.



INTERFACE. That portion of the machine tool controller that connects the control system to the "outside" world. This can include a data link to a remote computer or connection to peripheral machine tool equipment. Special consideration has to be given in the interface design so that the control system is effectively isolated from externally generated electrical "noise" transients.

INTERPOLATION. Development of a path by means of determining the many intermediate discrete points which produce the desired smooth curve or straight line. The Bridgeport Controller is capable of 2 axis circular and 3 axis linear interpolation.

INTERRUPT. Suspension of normal program execution to execute a higher priority service routine, as requested by a peripheral device. After completing service routine execution, the interrupted program execution is restored at the point where it was interrupted.

LARGE-SCALE INTEGRATION (LSI). High-density integrated circuits for complex logic functions. LSI circuits can range up to the equivalent of several thousand transistors on a one-tenth of a square inch silicon chip.

LIBRARY. A collection of standard or frequently used routines and subroutines.

LINEARIZATION. A mathematical procedure whereby a path defining a curve is subdivided into many small linear segments that closely approximate the desired path, such that tool motion resulting from the consecutive subdivisions will machine the shape to a specified tolerance.

LOOP. A sequence of instructions that is executed repeatedly until a terminal condition exists.

MACHINE LANGUAGE. The binary equivalent of a computer's instruction repertoire. An object program is an executable machine language program coded in binary form, as opposed to a source program coded in symbolic form. (see COMPUTER LANGUAGE).

MACRO. A subroutine consisting of a group of instructions which can be stored and then recalled as a group to avoid reprogramming the subroutine in a new location. The macro call statement must assign values to the variables (if any) in the macro.

MANUAL DATA INPUT (MDI). A mode of control that enables an operator to insert data into the control system. This data is identical to information that could be inserted by means of a tape.

MANUAL FEEDRATE OVERRIDE. A control that enables the operator to increase or to reduce the feedrate if the tape programmed rate is not optimum for the material being machined.

MANUSCRIPT. A listing which details manual or computer part programming instructions.

MICROCOMPUTER. A class of computer having all major central processor functions contained on a single printed circuit board constituting a stand-alone module. Microcomputers are typically implemented by a small number of LSI circuits and are characterized by a word size not exceeding 16 bits.

MICROPROCESSOR. A single LSI circuit which performs the functions of a CPU. Some characteristics of a microprocessor include small size, inclusion in a single integrated circuit or a set of integrated circuits, and low cost.

MISCELLANEOUS FUNCTION. A two-digit "M" code which sets a particular auxiliary machine function such as spindle/on-off, coolant/on-off, etc.

MODAL. Remains in effect until changed.

NESTING. A programming technique in which a segment of a larger program is executed iteratively (looping) until a specific data condition is detected, or until a predetermined number of interactions has been performed. The nesting technique allows a program segment to be nested within a larger segment and that segment to be nested within an even larger segment.

NONVOLATILE MEMORY. A type of computer system memory offering preservation of data storage during power loss or system shutdown. Magnetic core read/write memory systems are typically nonvolatile and, therefore, do not require reloading to restore programs and data when system power is applied.

NUMERICAL CONTROL (NC). A method of controlling machine members and auxiliary equipment using an input media which consists of coded alpha numeric characters.

OCTAL. A number system of base eight. For convenience, binary numbers are usually read in octal. For example, decimal 92 = binary 1 011 100. This is equivalent to 134 in octal.

OPEN LOOP SYSTEM. The output motion is directly generated by input data. A digital system will generally utilize the logic as a variable rate high speed switching system to control current in the forward and reverse direction in several coils of a special motor. The motor has discrete shaft positions controlled by the active current coils. Though an open loop system is designed as a compromise between torque and speed, it has the advantages of fewer parts, no adjustments, high stability, high accuracy and maximum holding torque at commanded position as compared with the CLOSED LOOP POSITION (q. v.).

ORTHOGONAL. Mutually perpendicular.

PARALLEL TRANSMISSION. The simultaneous transfer and processing of all bits in a unit of information.

PART PROGRAM. A specific and complete set of data and instructions written in one of the part programming languages for the purpose of machining a part on an NC machine. For example, a manual part program or a computer assisted part program in the APT language.

PERIPHERAL EQUIPMENT. Auxiliary equipment used with a computer's central processing unit, off line or on line. For example, card readers, paper tape punches, magnetic tape readers, disc storage units, high speed printers.

POINT-TO-POINT CONTROL. (Positioning system). An NC machine which provides control only of discrete positions at which a machine operation is performed. The path and rate of movement between points is not under continuous control in every system. The most common application of point-to-point control is drilling.

POLAR COORDINATES. A mathematical system for locating a point in a plane by the length of its radius vector and the angle this vector makes with a fixed line.

POSTPROCESSOR. A computer program (software) which is the interface between an NC processor language and the specific machine tool controller. The postprocessor describes the features of the machine tool controller such as geometry, dynamics, peripheral equipment. It transforms the general output from the processor, such as APT, to the unique format required by the machine tool/controller. The Bridgeport postprocessor is written entirely in FORTRAN IV (See COMPUTER LANGUAGE).

PRECISION. All numbers in a computer are in binary. The largest number that can be represented is dependent on the size (number of bits) of a computer logic word.

PROGRAM. The complete plan for the processing of a series of manufacturing operations; more specifically, the complete sequence of machine instructions and routines necessary to effect these operations.

PROGRAMMING. Preparing a detailed sequence of operating instructions for a particular program. This involves the analysis of the problem, preparation of a general scheme or flow diagram, preparing details, developing subroutines, specifying formats, etc.

PROGRAM STOP. Miscellaneous function command that stops the feed after completion of other commands in the block. It may also electro-magnetically disconnect line power from other machine tool auxiliary functions.

PROGRAMMABLE READ-ONLY MEMORY (PROM). A read-only memory which can be programmed after manufacture by external equipment. PROMs are generally integrated circuits, with each memory cell connected to assert a logic 1. The fusible link connecting a cell can be disconnected (burned open) to produce a logic 0. (see READ ONLY MEMORY on Page 14).

PROTOCOL. A formal agreement between two communicating devices. It defines how data is formatted, what the control signals mean, how error checking is performed and the order and priority of various types of messages.

PULSE. A short duration change in the level of a variable.

PUNCHED TAPE. A tape with holes produced in such a manner so as to represent a particular set of data. The standard geometry is specified in EIA RS-227.

QUADRANT. One of the four quarters of the rectangular coordinate dimensioning system.

RANDOM-ACCESS MEMORY (RAM). A computer memory structured so that the time required to access any data item stored in the memory is the same as for any other item.

READ ONLY MEMORY (ROM). In its virgin state the ROM consists of a mosaic of undifferentiated cells. One type of ROM is programmed by mask pattern as part of the last manufacturing stage. Another more popular type, better known as P/ROM, is programmable in the field with the aid of programmer equipment. Program data stored in ROMs are often called firmware because they cannot be altered. However, another type of P/ROM is now on the market called EPROM which is erasable by ultra violet irradiation and electrically reprogrammable.

RE-BOOT. Sets all control registers to zero.

REMOTE JOB ENTRY (RJE). The ability to access a system from a station distant from that system. The usual connotation is with APT programming on a Time Sharing basis.

RESOLUTION. A measure of the smallest programmable value that a control system can execute. In the Bridgeport Control, the input resolution is .0001", the arithmetic logic resolution is generally on order of magnitude less.

ROW. A path perpendicular to the edge of a tape along which information may be stored by the presence or absence of holes. The content of a row defines a character.

SEQUENCE NUMBER. A multidigit "N" number identifying the block or group of blocks on the NC tape. This sequence number is displayed on the operator's console.

SERIAL OPERATION. A controller operating mode in which all the bits of data word are handled sequentially bit by bit.

SERVICE BUREAU. A company which offers software support service to owners of NC equipment. This support can range from simply supplying program tapes to a complete counselling and computer part programming service.

SETPOINT. The position established by a programmer or operator as the starting point for the program from which the first programmed move is made.

SLOWDOWN SPAN. A length necessary to allow the machine slide to decelerate from its present feedrate to a stop without losing position. Control, see data under ACCELERATION OVERRIDE.

SOFTWARE. Programs and related documentation, as compared to the computer or machine tool controller, which is hardware. Software can be modified by changing instruction sets, hardware must be modified by changing wiring and/or components.

SOURCE LANGUAGE. The original symbolic language in which a program is prepared for processing by a computer. It is translated into object language (see COMPUTER LANGUAGE) by an assembler or compiler.

STATEMENT. A meaningful complete expression.

STEPPING MOTOR. A bi-directional permanent magnet motor which turns in finite steps.

STORAGE. A device into which information can be introduced, held, and then retrieved at a later date. For example, the paper tape used in NC is a storage device. Random Access Memory (RAM) is a form of storage.

STRING. A group of characters. e.g., N30, or X5, or F30.

SUBROUTINE. A series of computer instructions to perform a specific task for other routines. It is distinguishable from a main routine in that it requires a location specifying when to return to the calling program after its function has been accomplished.

SURFACE. A geometric shape used for controlling the location of a tool in space. As a cutter is directed along a path, it is guided by two surfaces from the programmer's viewpoint. One called the PART SURFACE. Generally, the bottom of the cutter moves along the part surface while the side of the cutter is guided by the drive surface. A third surface, the CHECK SURFACE, is used to check or halt the movement of the tool in its progress along the DS-PS pair.

SYNCHRONOUS COMMUNICATION. A method of transferring serial binary data, transmitted at a fixed rate, with the transmitter and receiver synchronized by characters located at the beginning of each block of data.

SYNTAX. A format check.

TAB SEQUENTIAL FORMAT. Means of identifying a word by a tab character preceding each word in a block. The tab characters address each register sequentially. Words must be presented in a specific order so that they enter the proper registers.

TERMINAL. A point in a system or communication network at which data can either enter or leave.

TIME SHARING. The use of a device for multipurposes during the same overall time period, accomplished by interspersing component actions in time. In commercial NC timesharing, the computer's processing capability is shared on a real time basis with many other users. Normal access to a time share computer is by a data terminal in the user's plant connected via telecommunication link to the remote computer.

TOOL ASSEMBLY. A complete assembly usually consisting of the tool holder with collet, etc. where necessary, the cutter, and if applicable, the tool insert. The tool holder fits directly into the spindle nose of the machine.

TOOL LENGTH OFFSET. An input, either manually or programmed, which eliminates the need for preset tooling and allows the programmer to program all tools as if they were the same length. Storage is provided for several values of offset, each defined by a Tool Number.

TRANSISTOR/TRANSISTOR LOGIC (TTL or T<sup>2</sup>L). A family of integrated circuit logic in which the multiple inputs on gates are provided multiple emitter transistors. TTL logic is characterized by high speed, low power dissipation, and low cost, and is widely used in modern computers.

VECTOR VELOCITY. The resulting speed of a particular combination of axes motion. The individual axes move slower than the programmed rate, but the resultant rate, or vector, is equal to the programmed rate.

VOLATILE MEMORY. Refers to a read/write memory whose content is irretrievably lost when operating power is removed. Virtually all types of read/write semiconductor memories are volatile.

WORD. An ordered set of coded characters used to cause a specification of a machine tool. A word is made up of a group of characters. A word or a group of words will make up a block of data.

WRITE. The process of storing data in a memory.

XTABL. The APT vocabulary table containing the code numbers which are used to represent the vocabulary words of the APT language, as used internally by APT, and passed along to the postprocessor.

ZERO SHIFT. A characteristic of a machine tool controller permitting the zero point on an axis to be shifted readily over a specified range.

ZERO SUPPRESSION. The elimination of non-significant zeroes to the left of the decimal point or non-significant zeroes to the right of the first digit after the decimal point. The Bridgeport control permits both modes provided that the decimal point appears in the word.