

Experiment No.-13

Aim: Study the constructional detail and working of CNC lathes Trainer.

Computer Numerical Control (CNC)

CNC may be defined as an NC System in which a dedicated stored program computer is used to perform store or all of the basic NC functions in accordance with control programs stored in the read-write memory of the computer. CNC is also called soft-wired NC. In contrast, in the hard-wired controls, the logic functions are wired together in a fixed, pre-engineered arrangement. CNC is quite different than direct numerical control (DNC). Computers supporting DNC are used to disseminate manufacturing data to, and collect product information from, several machine controllers. CNC generally supports only one machine.

The microprocessor of CNC is accordingly in close proximity of the machine, but the computer of DNC is remote from the machine tools. The software supporting DNC is usually written to support overall manufacturing activity, i.e. machine loading, productivity and efficiency trends. Software for CNC is written specifically, for a particular machine device.

The various units are discussed below:

Input Unit. It receives all the commands from operator interface (operation station containing all the switches, push buttons displays, etc, required to operate and monitor machine activities) and feedback or status of machine in the form of a.c., d.c., and analog signals. All input signals are made compatible (by input unit) to be understood by control unit (like conversion of signal to digital form by A/D converter, etc.), Software (system operating program, part programs and diagnostics) are input by means of paper tape, or magnetic devices stored in memory until needed by control unit. When the number of inputs is many, multiplexing technique is used in which the state of all inputs is monitored sequentially at desired interval, over a single channel.

Control Unit. It takes instructions from the memory unit and interprets them one at a time. It processes information received from the operator and machine interface. This information is interpreted and manipulated with hardware logic and computer programs. It then sends appropriate instructions to other units to cause instruction execution. It turns on and off machine outputs and controls machine motion via machine interface.

Memory Unit. It stores instructions and data received from the input. It also stores the results of arithmetic operations and supplies information to the output unit. The size of the programs and space required to manipulate data determine the amount of memory required. Part programs and usually stored in Random Access Memory (RAM) which provide immediate access to any storage location point in memory. Fixed programs (such as the system operating program and diagnostics) are stored on Read Only Memory (ROM) which stores information permanently. Information on ROM can be read but can't be altered

Arithmetic Unit-It performs calculations and makes decisions. Its results are stored in the memory unit.

Output Unit-It receives data from memory at the command of control unit. The signals are made compatible with output devices so that commands issued by output unit can be obeyed by them. Digital signals are first converted to analogue form to control axis drive servomotors. Output signals are used to turn on and off devices, display information, position axes, etc.

Operator Interface. Various units which comprise operator interface are as follows.

Punched tape is the most commonly used input system for NC System

Typewriters having a tape-punch attachment are frequently used to prepare NC punched-tape programs. The instructions for a given operation are contained in several rows of information called a block. By means of the hole patterns punched in the tape, all the letters of the alphabet as well as digits 0 to 9 can be coded to form words within a block. Various other symbols useful for controlling machine functions can also be coded. Tape readers may be either electromechanical type (using fingers or other devices to make electrical contact through holes of the tape, usually slow type) or photoelectric type (detecting light or reflected light type-faster than electromechanical type). Some tape-readers are capable of reading an entire block of holes simultaneously. Such tape-readers are used on simple positioning machines.

A **servomechanism** is a group of elements which convert the NC output into precision mechanical displacements. These elements include motors (hydraulic or electric), gear trains and transducers (velocity or position). The drive to spindle and slides in NC tools, is usually provided by either hydraulic or electric motors. Servomechanisms may be either open or closed loop. Fig. shows the mechanical elements of a CNC system.

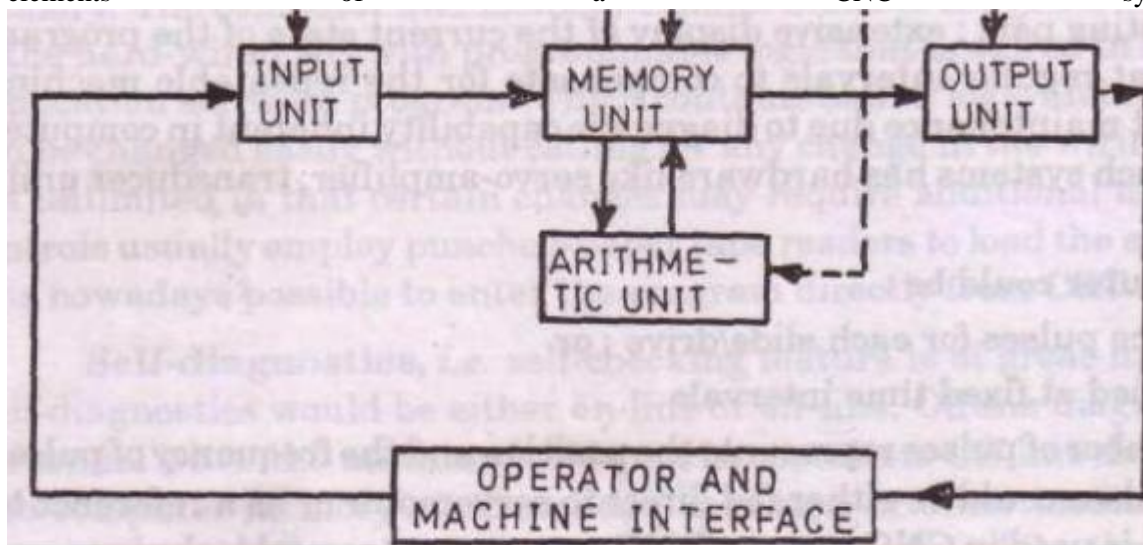


Figure: Various parts of CNC Trainer

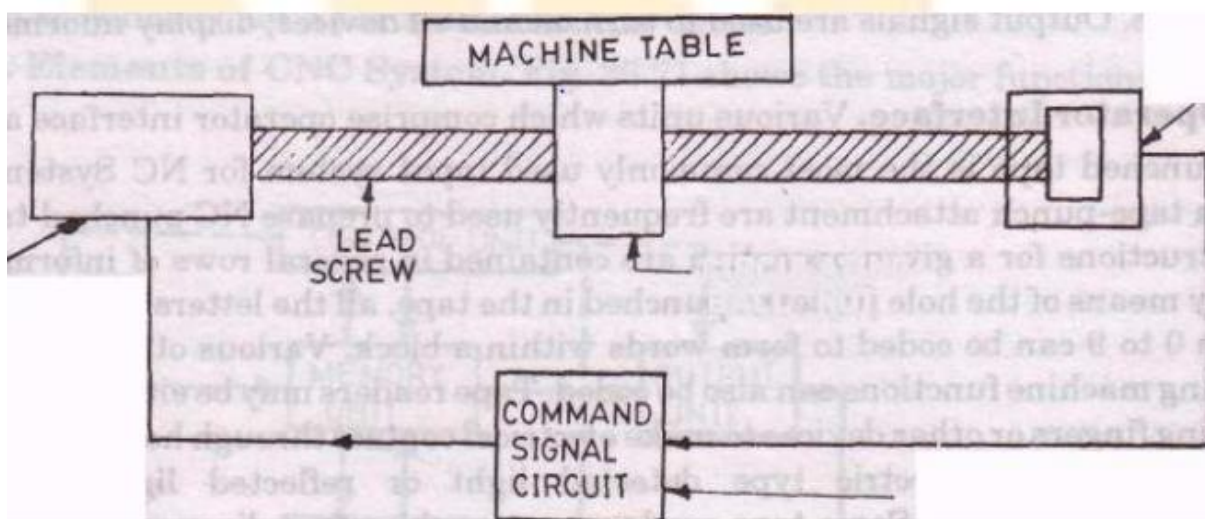


Figure: Machine table