

Numerical Control

G-Code and M-Code :-

- * G Stands for geometry, and it's the alphanumeric format of the system uses to tell the parts of a m/c what to do.
- * It indicates where to start, how to move and when to stop.
- * A G-Code controls the movements of a m/c dictating how and where a m/c should move to fabricate a part.
- * An M-Code controls miscellaneous m/c function including starting and stopping specific actions of programs.
- * M represents miscellaneous codes.

Functions of most common G and M codes :-

G - Code

a) G00

b) G01

c) G02

d) G03

e) G40

f) G41

g) G42

h) G71

Functions

a) Rapid linear motion.

b) Linear motion at preset feedrate F

c) Circular feed motion - CW

d) Circular feed motion - CCW

e) Cutter compensation off

f) Cutter compensation left

g) Cutter compensation right

h) units in mm

2) M-Code

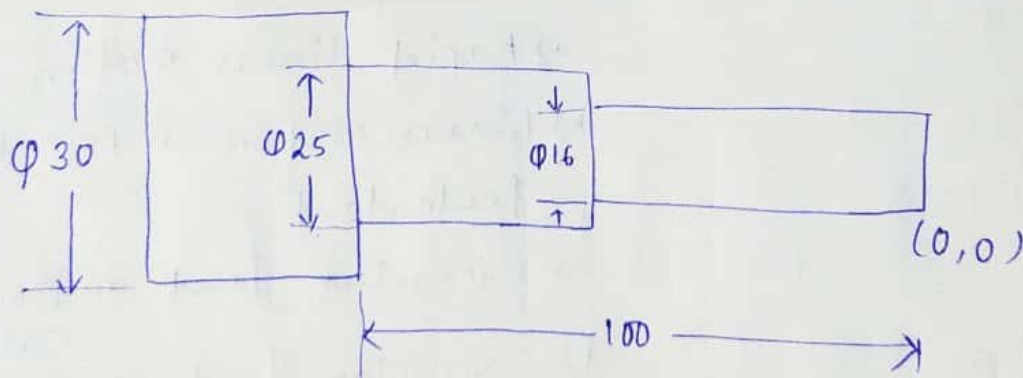
- a) M00
- b) M02
- c) M03
- d) M04
- e) M05
- f) M06
- g) M08
- h) M09
- i) M13

Functions

- a) Program stop
- b) End program
- c) Spindle on (CW)
- d) Spindle on (CCW)
- e) Spindle off
- f) Change tool
- g) Coolant on
- h) Coolant off
- i) Coolant and Spindle on

Simple part Programme for Lathe :-

O1 (All dimensions are in mm)



(Turning operation)

%1000;

(main programme)

N01 G54 G90 G71 G94 M03 S800; (parameter setting)

N05 G01 X-12.5 Z0F2; (Facing the job)

N10 G00 Z1 ;	(Retrieval of tool)
N15 G00 X00 ;	(Tool clearance)
N20 G01 Z-100 ;	(Starting cut)
N25 G00 X1 Z1 ;	(Clearance position)
N30 G00 X-2 ;	(Position of cut)
N35 G01 Z-60 ;	(Cutting length)
N40 G00 X1 Z-1 ;	(Retrieval of tool)
N45 G00 X-3 ;	(Position of cut)
N55 G00 X-2 Z1 ;	(Retrieval of tool)
N60 G00 X-4 ;	(Position of cut)
N65 G01 Z-60 ;	(Cutting length)
N85 G0	
N70 G00 X-3 Z1 ;	(Retrieval of tool)
N75 G00 X-4.5 ;	(Position of cut)
N80 G01 Z-60 ;	(Cutting length)
N85 G00 X5 Z5 ;	(Final position of tool)
N90 M02 ;	(End of programme)

Direct Numerical Control (DNC)

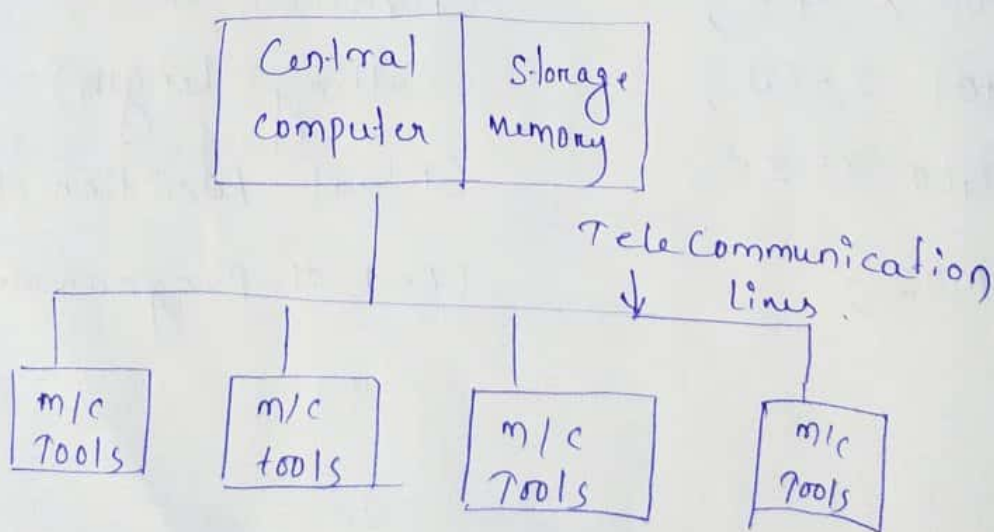
* DNC is a manufacturing system in which a number of machines are controlled by a computer through direct connection and in real time.

* DNC is a system connecting a set of NC machines to a common memory for program or m/c program storage with provision for on demand distribution of data to m/c's.

Components :-

- 1) Central Computer
- 2) Bulk memory storage
- 3) Telecommunication lines
- 4) m/c tools.

Principle :-



* A Central Computer connected to a number of m/c tools and control them.

* Part Program of all m/c tools are stored in the memory of the Central Computer and transmitted on direct transmission lines on demand.

* There is no limitation for the ~~no~~ number or size of Programs stored.

* There are various advantages provided by DNC System such as easy and effective programming, high level of decision making, convenient storage of NC part Program.

2) Computer Numerical Control (CNC)

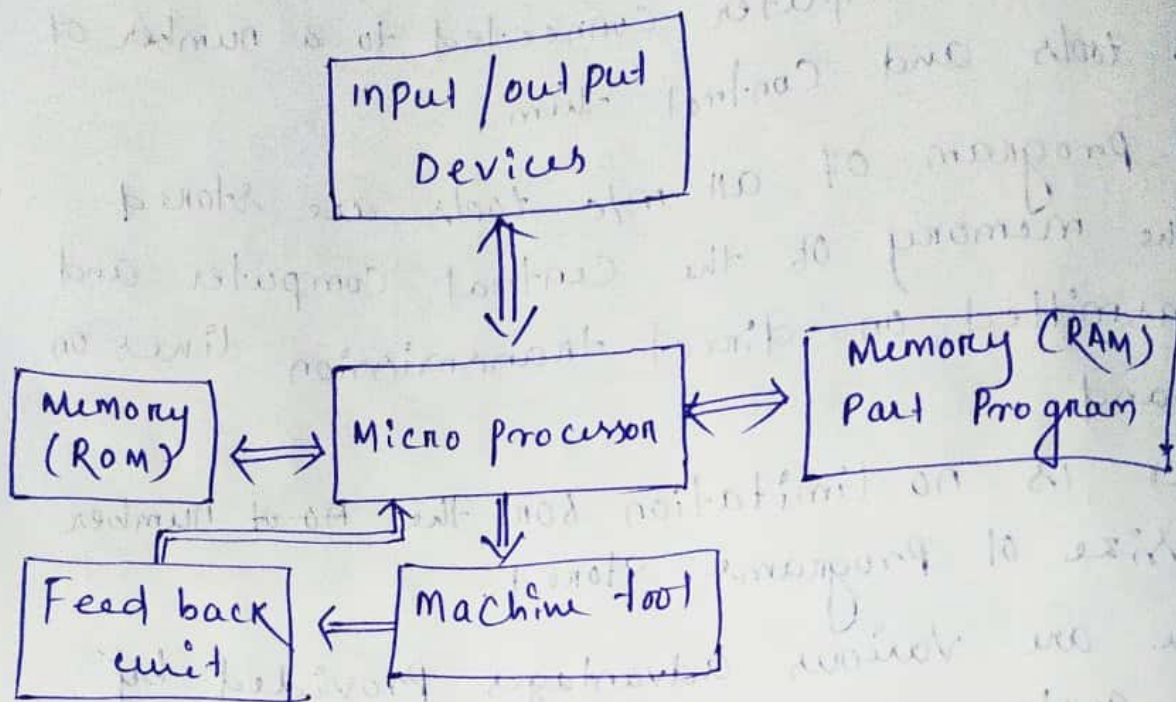
* In CNC m/c, a dedicated computer is used to perform the most of basic NC m/c functions.

* CNC m/c is a NC m/c which uses a Computer as the m/c control unit.

* The entire Program is entered and stored in computer memory.

Components of CNC m/c:

- a) Input/output Console
- b) microprocessor based control unit
- c) Memory
- d) Feedback unit
- e) m/c tool
- f) interface.



- * Input/output Console is the unit through which Part Program is fed to the CNC m/c tool system and required output is taken out.
- * Microprocessor takes input/output device, feedback from feedback unit and actuates the drives as well as the tool of the m/c tool.
- * Memory consists of RAM and ROM. RAM stores Part Program where ROM stores the Programs for m/c control.
- * The feedback unit takes input from m/c tool and transfer it to control unit.
- * m/c tool is operated by the control unit.

3) Adaptive Control :- (AC)

- * Adaptive control system is a logical extension of the CNC mechanism.
- * For a machining operation the term adaptive control denotes control systems that measure certain output variables and uses to control speed or feed.
- * The AC is basically a feedback system that treats the CNC as an internal unit.
- * In adaptive control the cutting speed and feed automatically adapt themselves to the actual condition of the process.
- * AC is not suitable for every machining operation.

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