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## CNC-CMM

The main features of **CNC-CMM** are shown in figure has stationary granite measuring table, Length measuring system. Air bearings; control unit and software are the important parts of CNC &CMM.

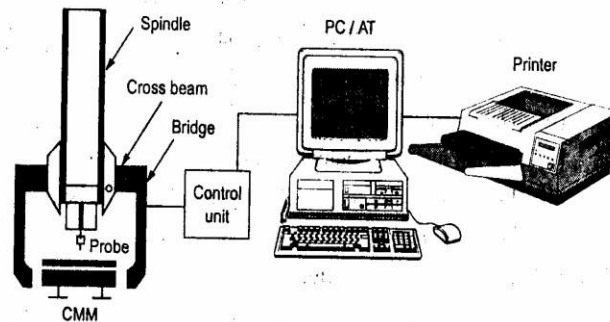


Fig 4.19 CNC - CMM

- **Stationary granite measuringtable**

Granite table provides a stable reference plane for locating parts to be measured. It is provided with a grid of threaded holes defining clamping locations and facilitating part mounting. As the table has a high load carrying capacity and is accessible from three sides. It can be easily integrated into the material flow system ofCIM.

- **Length measuringsystem**

A 3- axis CMM is provided with digital incremental length measuring system for each axis.

- **AirBearing**

The Bridge cross beam and spindle of the CMM are supported on air bearings.

- **Controlunit**

The control unit allows manual measurement and programme. It is a microprocessor control.

- **Software**

The CMM, the computer and the software represent one system; the efficiency and cost effectiveness depend on the software.

### **Features of CMM Software**

- (i) Measurement of diameter, center distance, length.
- (ii) Measurement of plane and spatial carvers.
- (iii) Minimum CNC programme.
- (iv) Data communications.
- (v) Digital input and output command.
- (vi) Programme for the measurement of spur, helical, bevel and hypoid gears.
- (vii) Interface to CAD software.

A new software for reverse engineering complex shaped objects. The component is digitized using CNC CMM. The digitized data is converted into a computer model which is the true surface of the component. Recent advances include the automatic work part alignment and to orient the coordinate system. Savings in inspection time by using CMM is 5 to 10% compared to manual inspection method.

### **COMPUTER AIDED INSPECTION USING ROBOTS**

Robots can be used to carry out inspection or testing operation for mechanical dimension physical characteristics and product performance. Checking robot, programmable robot, and co-ordinate robot are some of the types given to a multi axis measuring machines. These machines automatically perform all the basic routines of a CNC co ordinate measuring machine but at a faster rate than that of CMM. They are not as accurate as p as CMM but they can check up to accuracies of 5 micrometers. The co-ordinate robot can take successive readings at high speed and evaluate the results using a computer graphics based real time statistical analysis system.

## Integration of CAD/CAM with InspectionSystem

A product is designed, manufactured and inspected in one automatic process. One of the critical factors is in manufacturing equality assurance. The co-ordinate measuring machine assists in the equality assurance function. The productivity can be improved by interfacing with CAD/CAM system. This eliminates the labour, reduces preparation time and increases availability of CMM for inspection. Generally the CAD/CAM-CMM interface consists of a number of modules as given

### (1) CMMinterface

This interface allows to interact with the CAD/CAM database to generate a source file that can be converted to a CMM control data file. During source file creation, CMM probe path motions are simulated and displayed on the CAD/CAM workstation for visual verification. A set of CMM command allow the CMM interface to take advantage of most of the CMM functional capabilities. These command statement include set up, part datum

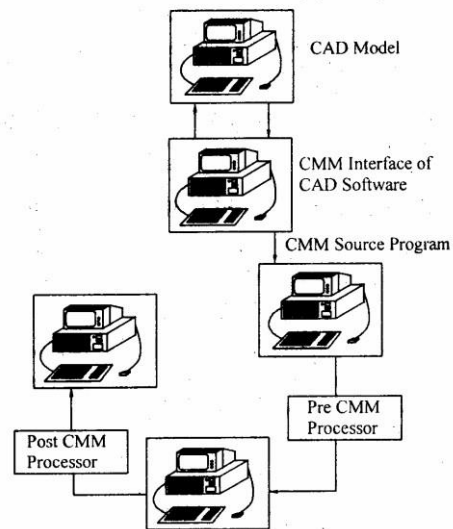


Fig 4.20 CMM Interface

control, feature construction, geometric relations, tolerance, output control and feature measurements like measurements of lines, points, arcs, circles, splines, conics, planes, analytic surfaces.

### (2) Pre-processor

The pre-CMM processor converts the language source file generated by CMM interface into the language of the specified coordinate measuring machine.

### (3) Post-CMMprocessor

This creates wire frame surface model from the CMM-ASCII output file commands are inserted into the ASCII-CMM output file to control the creation of CAD/CAM which include points, lines, arcs, circles, conics, splines and analytic surfaces.

## Flexible InspectionSystem

The block diagram of flexible inspection system is shown in figure. This system has been developed and the inspection done at several places in industry. This system helps product performance to improve inspection and increase productivity. FIS is the Real time processor to handle part dimensional data and as a multi programming system to perform manufacturing process control. The input devices used with this system are CMM's;

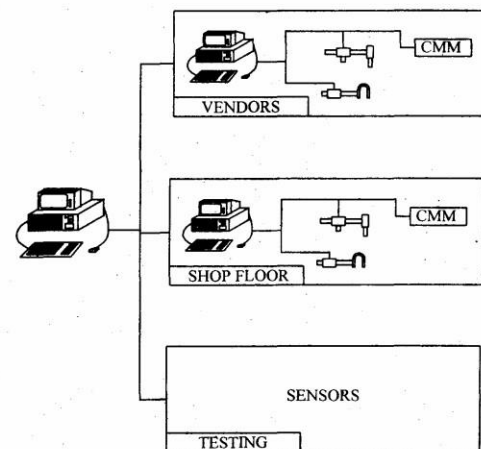


Fig 4.21 Flexible Inspection System

Microprocessor based gauges and other inspection devices. The terminal provides interactive communication with personal computers where the programmes are stored. The data from CMMs and other terminals are fed into the main computer for analysis and feedback control. The equality control data and inspection data from each station are fed through the terminals to the main computer. The data will be communicated through telephone lines. Flexible inspection system involves more than one inspection station. The objective of the flexible inspection system is to have off time multi station automated dimensional verification system to increase the production rate and less inspection time and to maintain the inspection accuracy and data processing integrity.

