CH-04 MACHINE TOOL & AUTOMATION

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3. Elements of control system, Limit switches, Proximity switches,Block diagram for feedback and servo control system,

4. Introduction to PLC, Block diagram of PLC.

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1.INTRODUCTION :

Automation is the technology by which a process or procedure is performed with minimal human assistance. Automation or automatic control, is the use of various contro system for operating equipment such as machinery. Every industry is working hard to improve the quality of the finished product.. At the same time Its aim is to manufacture the product in most economical way. This led to use of two words mechanisation and automation.

2.Mechanisation:-

Mechanization is the process of changing from working largely by doing that work with machinery. But the process is controlled and monitored by human only. Mechanisation refers to semi automatic machines. It is primary stage of automation.

3.Automation:- The term automation means higher degree of Mechanisation.It represents a process like material handling, material processing or inspection are performed automatically. In this Operator only have to inspect the machine and can operate several machines at a time.

Automation in industry

3.1 NEED OF AUTOMATION:-

1.Increase labour productivity.

2. Reduce production cost.

3. Improve labour safety.

4.Improve product quality.

5. Reduce manufacturing lead time.

6. Producing complex products.

7. Reduce labour cost.

3.2 BENIFITS OF AUTOMATION:-

1.Increase in productivity.

2. Human fatigue is greatly minimized.

3. Good quality of product is obtained.

4.One Operator can operate more that one machine simultaneously.

5. The components produced are uniform. 6.Less floor space is required.

3.3 CLASSIFICATION OF AUTOMATIC MACHINE:

Automatic machines are classified as follows:-

1) Magazine loaded automatic machines:-

These are used to machine the work pieces in the form of blanks which have been properly machined to appropriate dimensions prior to feeding them to the automatics.

2) Automatic bar machines:-

These are used for machining work pieces from bar or pipe stock. It can be further classified:-

a) single Spindle automatics. b) Multi spindle automatics.

3) Automatic transfer machine: On this machines a number of Operations are carried out on the workpiece. Hence number of machine heads are arranged and workpiece is machined in sequence from first to last station.

4.SINGLE SPINDLE AUTOMATS:-

Machine used for operating single component bata a time are known as single Spindle automats. Single Spindle automats can be said to be the development of Capstan and turret lathe. They can be further classified as:

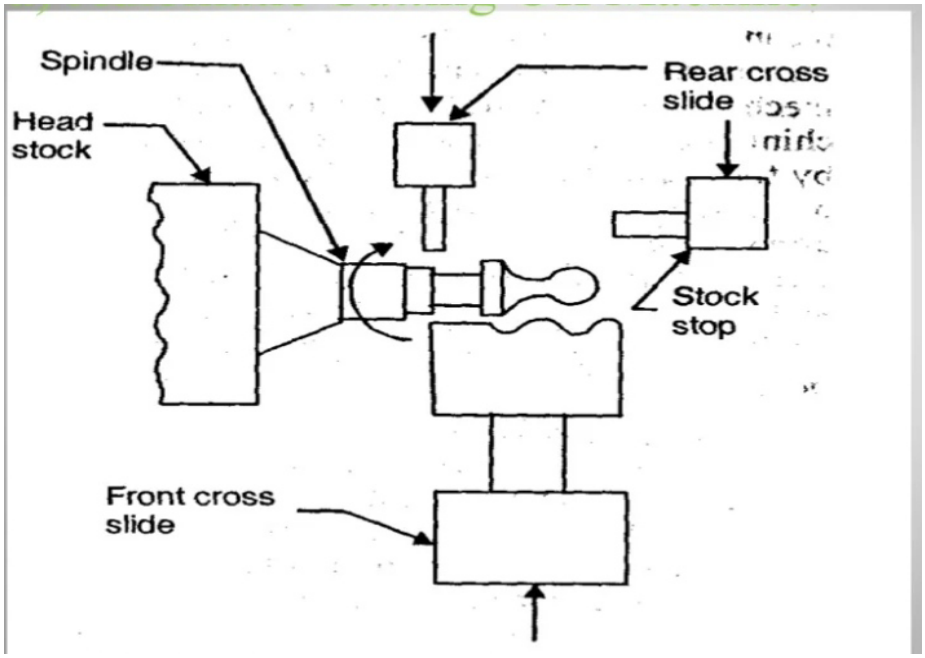
1) Automatic cutting of machines.

2) Swiss type automatic screw machine.

3) Turret type automatic screw machine.

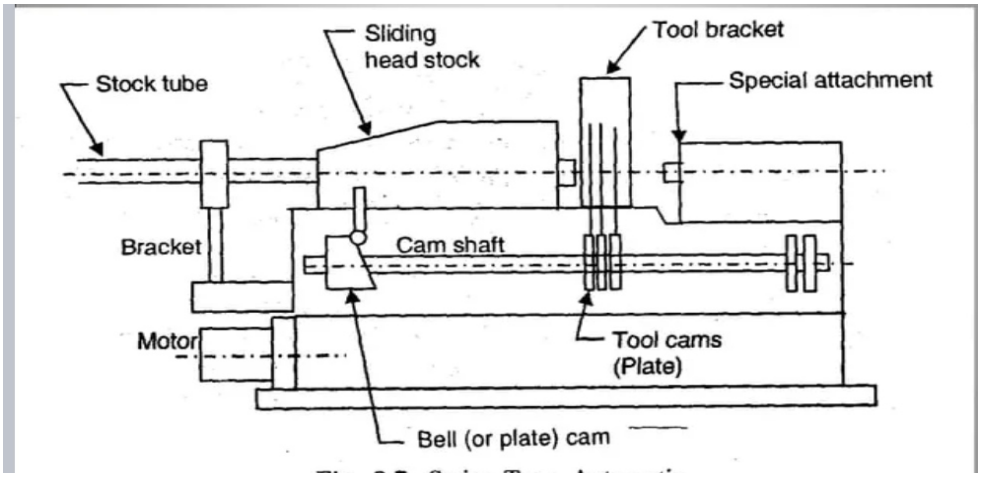
4.1) AUTOMATIC CUTTING OF MACHINE:-

These machines are used to produce small workpiece which are simple in design of.They are primarily used for turning, facing, cutting of Operations. These are capable machining of workpiece of small length.



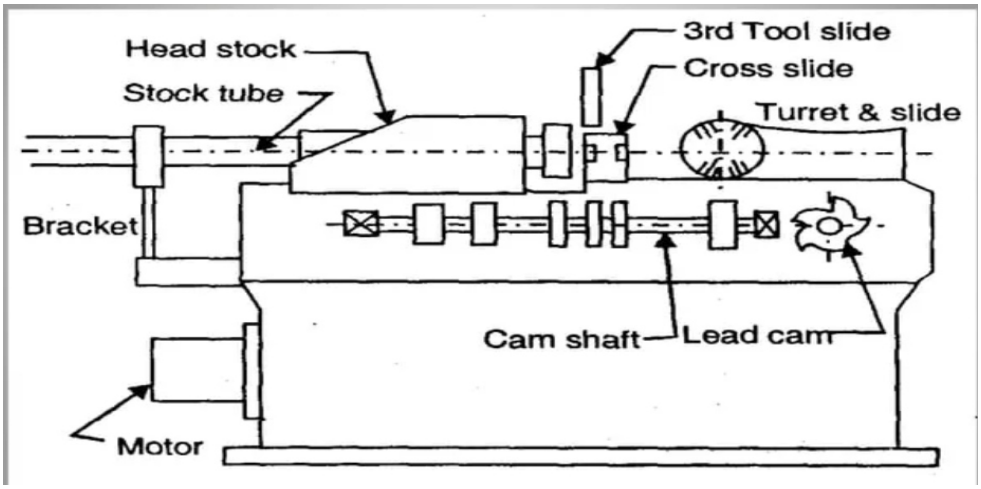
4.2) SWISS TYPE AUTOMATIC SCREW MACHINES:-

In this machine the tool are fixed and headstock is movable. The bar stock are fed forward by moving head stock against the turning tool. This machine is used for precision turning of small parts.



4.3) TURRET TYPE AUTOMATIC SCREW MACHINES:-

In this machine the tool is fixed and the head stock is movable. This machine is used for machining complex internal and external surfaces. At a time several tools can perform a set of Operation.



5. TRANSFER LINE:-

An automated flow line or transfer line consists of several machines/work-stations linked by work handling devices to transfer lines parts automatically. The raw work parts enter from one end and are processed sequentially at various stations and finished part comes out of other end of automated flow line. In every cycle of transfer machine One complete part is produced.

For example:- Automobile assembly, aircraft Industry.

5.1 ADVANTAGES OF TRANSFER MACHINES:-

1. Material handling is fast and Automatic.

2. Less floor space is required as machines are arranged in sequence.

3. Less number of operator is required

4. Greater accuracy of parts is obtained.

5.2 DISADVANTAGES OF TRANSFER MACHINE:-

1. A very high initial investment is required.

2. Whole setup is to be changed if the components design changes.

3. Breakdown Of one machine will temporary stop the production

4. The system is un economical for small quantity of production.

5.3 TYPES OF TRANSFER MACHINES:-

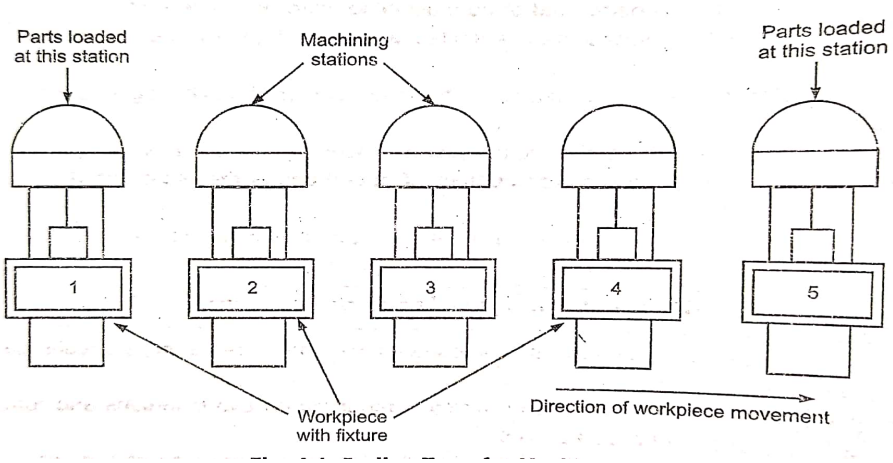
1. In-line transfer machines.

2. Rotary transfer machines.

3. Drum type transfer machine.

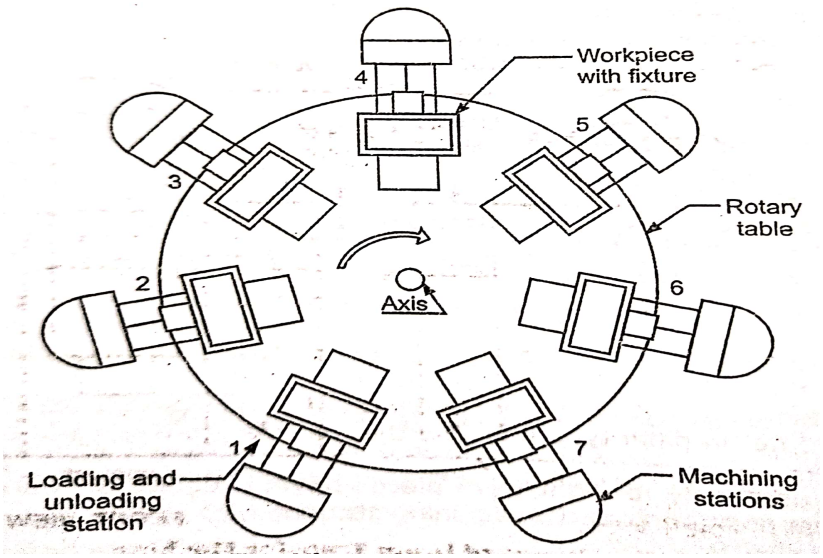
1.IN LINE TRANSFER MACHINE:-

In this type of transfer lines, the machine tools are arranged in a straight line. But if the floor space is less, then various geometric arrangements like L type,C type,U type, square or rectangular are used to arrange the machine heads. The parts to be machined are conveyed along a track on the bed either with or without use of holding fixture called as pallet. It uses chain or conveyor belt to transfer the workpiece. The work may be loaded manually or automatically on the machine.



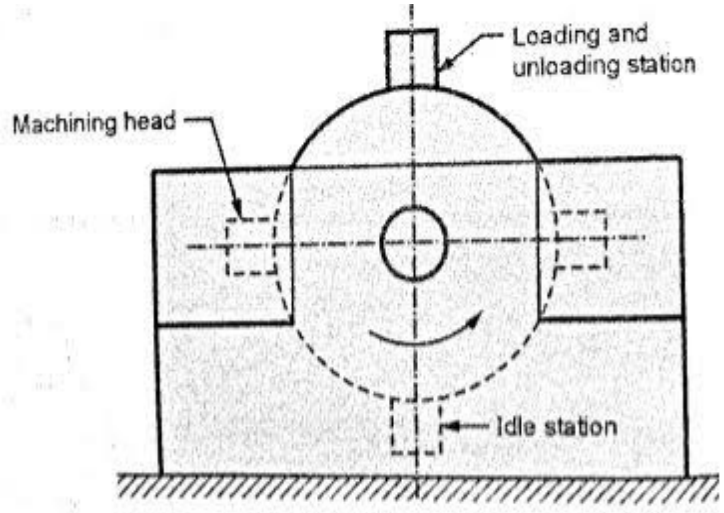
2. ROTARY TRANSFER MACHINE:-

In a rotary transfer machine the workpiece is transferred along a circular path. This type machine carries a round table, Which rotates about a vertical axis. An automatic indexing mechanism under the table indexes the table at equal interval. The machine heads are arranged at equal interval around the table. The workpiece is loaded or unloaded from same station in which simple or no machining Operations takes place. It is used where limited floor space is available and the number of required machining station is few around 8 to 10.



3.DRUM TYPE TRANSFER MACHINES:-

In drum type transfer machine the components are transferred along a circular path similar to a rotary transfer machine, instead it Carries a drum mounted on two trunnions and rotates about a horizontal axis. The workpiece is loaded and unloaded at a same station. The fixtures which holds the workpiece are arranged on the drum. The station on the bottom of the drum is known as ideal station because it is not possible to operate a tool due to lack of space there. An automatic indexing mechanism is provided to index the drum at equal intervals. It is used when less floor space is available and machining Operations to be performed is few.



6. CONTROL SYSTEM:-

A System is a combination or arrangement of different physical components those acts together to achieve certain objectives. A control system manages, commands, directs, or regulates the behavior of other devices or systems using control loops.

Examples of control system:-

Control system is used everywhere. some basic examples are given below.

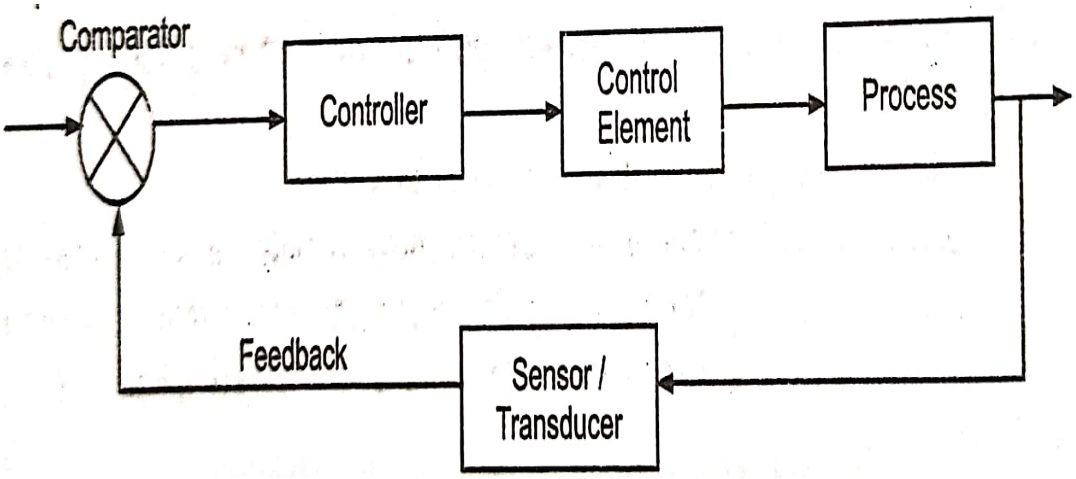
1.Automatic packaging machines.

2. Traffic light control system.

3. Refrigerators.

4. Automatic washing machines.

6.1 ELEMENTS OF CONTROL SYSTEM:-



The basic elements of any control system is given below:-

1.Process or system

2. Measurement.

3 Error detector.

4.controller.

5. Control element.

1) Process or system:- It is a simple or complex assembly of various physical components. Many variables may be involved in process and It may be required to control all the variables at same time.

2) Measurements:- In order to control these variables,we must have information about the variables itself. Such information can be found by measurement of the variables. Various measuring sensors perform these measurements.

3) Error detector:- The difference between actual value and set point value is known as error. A comparator or error detector is used to compare these two values.

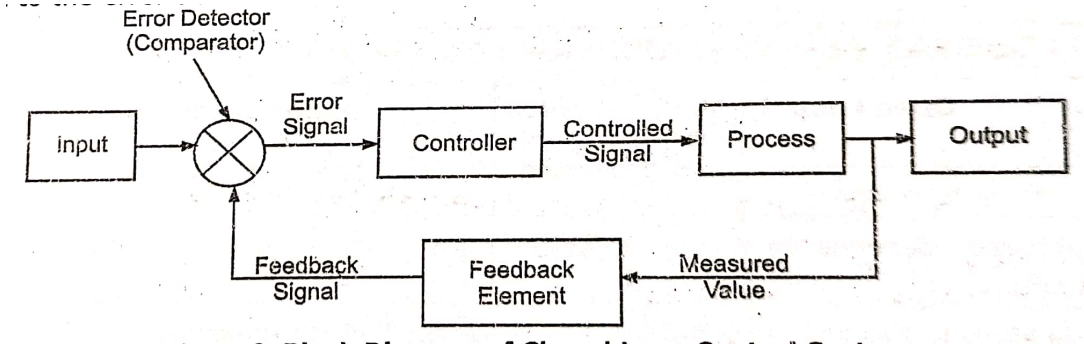
4) Controller:-The controller is called brain of control system. It receive measured value from the error detector and compare it with actual value. If it finds any difference between the two values then it's sends signal to the bring Set point value.

5) Control Element:- They are also called as final control element. They are used to take action for implementing the decision taken by the controller.

6.2 TYPES OF CONTROL SYSTEM:-

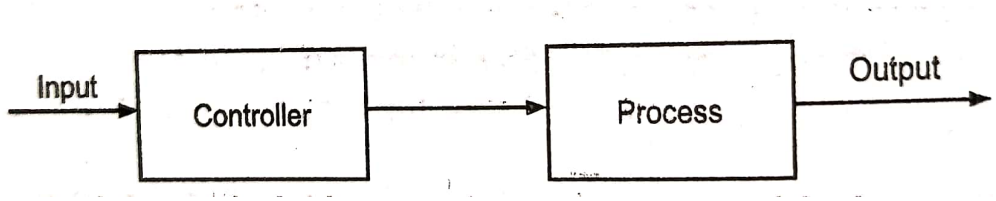
1) Closed loop control system:-

The closed loop system has a feedback system to monitor the output of the motors. Closed systems are also able to correct errors in position, velocity, and acceleration, and also fault the system if the error is too large.



2)Open loop system:-

Open loop refers to a system where the communication between the controller system and the motor is one way.



7. LIMIT SWITCH:-

A limit switch is a mechanical device that requires the physical contact of an object with the switch's actuator to make the contact change state (open/closed).

The function of limit switches are:-

1. To control the movement of a mechanical part.

2.To indicate an end of travel or to prevent travelling to far.

3.To provide a function of breaking electrical circuit.

Types of limit switches:-

1)Momentory or spring return switch:- This switches return to the normal state as soon as the actuator passes it's release point.

2) Maintained contact switch:- This switches remain in the trigger position after the actuator is released and needed to reset.

8. PROXIMITY SWITCHES:-

The proximity switches allow the user to detect the presence of material without having any physical contact. Proximity switches open or close electrical circuit when they come with in the certain distance of an object.

Functions of proximity switches:-

1. To measure the position of the machine components.

2. To function in security system application.

Types of Proximity switches:-

1)Infrared proximity Switches:-

It includes a light source, and a sensor that detects the light.These sensors detect objects directly in front of them by the detecting the sensor's own transmitted light reflected back from an object's surface.

2) Acoustic proximity switches:-

It uses a transducer to transmit in audible sound waves at various frequency at a preset sequence. Then they measure the time the sound takes to hit the near by object and return to the second transducer of the switch.

3) Capacitive proximity switches:-

It can detect both metallic and non-metallic targets in powder, granulate, liquid, and solid form. The capacitive proximity sensors use the variance in the capacitance of the sensor to

concluded that an object has been detected.

4) Inductive proximity switches:-

It is useful to detect the metallic object which is present next to their active side. This sensor operate under the electrical principal of inductance; where a fluctuating current induces an electromotive force (EMF) in a target object.

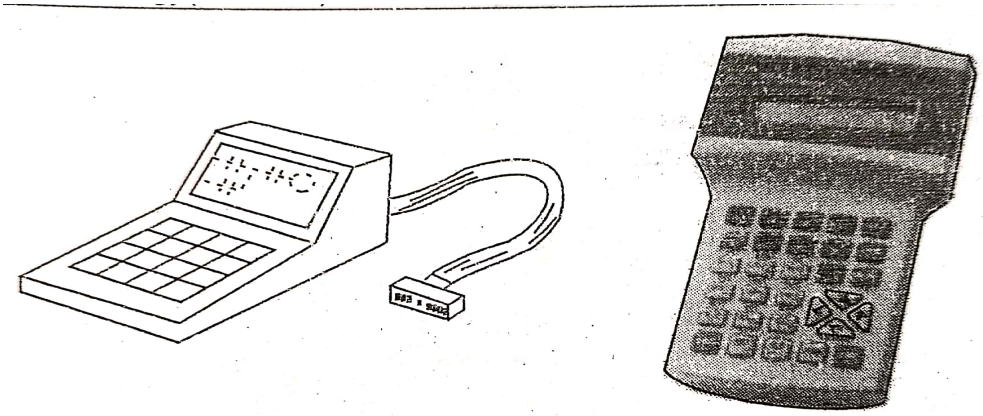
9.Difference between limit and proximity switches:-

LIMIT SWITCH	PROXIMITY SWITCH
1. This requires physical contact between the target object and switch activator.	1. Proximity switch allow the user to detect any material without having any physical contact.
2. They are comparatively slow in Operation.	2. They are fast in Operation.
3. It is electro mechanical device.	3. It is either infrared or magnetic device.
4. The limit switch changes its state when the object reaches the end of its range.	4. The proximity switch changes its state when any object gets within a specific distance of its range.
5. Since it has mechanical part,it wear over a period of time.	5. It do not have any Mechanical parts it is good for dirty and wet conditions.

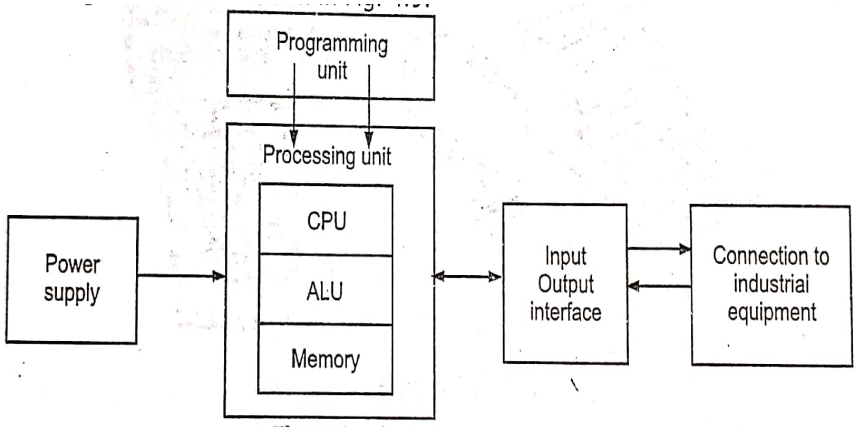
10.INTRODUCTION TO PLC:-

A programmable logic controller or programmable controller is an industrial digital computer that has been designed for harsh conditions and adapted for the control of manufacturing processes, such as assembly lines, robotic devices, or any activity that requires high reliability,

ease of programming, and process fault diagnosis. Unlike general purpose computers PLC is designed for multiple input and output arrangements, extended temperature, Immunity to electrical noise and vibration. A PLC is an example of real time system since output result must be response to input c



10.1 BLOCK DIAGRAM OF PLC:-



The basic elements of PLC are:-

1. Power supply unit.

2. Programming unit.

3. Processor.

4. Inlut output section.

5. Housing.

1) Power supply unit:- The power supply unit provide necessary voltage to operate the circuit. The power supply may also contain battery backup for memory device to retain data if an AC power failure occurs.

2) Programming unit:- The programming unit is an external electronic device that is connected to the PLC when programming Occurs.It allows the user to enter data, to edit and monitor program Stored in the processor unit. The programming unit communicates with the processor unit by using a data communication link.

3) Processor: A processor is a Computer that executes a program to perform a specific Operation. It control the operation of the entire system. The processor is composed of main three units :

a) CPU:- It is the brain of PLC.It is composed of micro processor,which is integrated circuit with tremendous computing and controlling capacity.

b)ALU:- This unit performs mathematical calculation and make logical decision.

c) Memory:- The program and other data required by the CPU are Stored in the memory.

4) Input and output interface:- The PLC is designed to be connected to industrial equipment. This connection is accomplished by means of input and output interface. The input input interface is designed to receive process or machine signal and convert them into acceptable form for the PLC.The output interface converts PLC control signals into a form which can be used by process equipment.

5) Housing:-The equipments of PLC are installed in a suitable housing to withstand the shop environment. They are easily inserted into the channels provided in the housing.

ADVANTAGES OF PLC:-

1.PLC increases the reliability, flexibility, and accuracy of the automation system.

2.PLC has a lower cost associated with it as compared to the other automation technology.

3.PLC software has good capabilities and flexibility for programming. Even, you can easily make the modification in the existing program at any time.

4.PLC does not take much space. It occurs smaller in size, especially compact PLC

5.Fast operation (no booting time) are the most important advantages as compared to alternative technologies

6.PLC has low maintenance associated with it.

7.In the PLC system, we require less and simple wiring as compare to te other systems.