

COMPONENTS OF A FLEXIBLE MANUFACTURING SYSTEM (FMS)

A **Flexible Manufacturing System (FMS)** consists of several key components that work together to achieve high automation and flexibility in production.

1. Workstations

- These include **CNC machines, robotic arms, and assembly stations** that perform manufacturing operations such as machining, welding, and assembling.
- **Types:**
 - **CNC Machining Centers** – Drilling, milling, turning, grinding.
 - **Robotic Stations** – Material handling, welding, painting.
 - **Inspection Stations** – Quality control using vision systems and sensors.

2. Material Handling System

- Ensures efficient movement of raw materials, workpieces, and finished products between workstations.
- **Types of material handling systems:**
 - **Automated Guided Vehicles (AGVs)** – Self-navigating transport vehicles.
 - **Conveyor Systems** – Used in assembly lines.
 - **Robotic Arms** – For precise material handling.
 - **Automated Storage and Retrieval Systems (AS/RS)** – For inventory management.

3. Computer Control System

- Acts as the **brain of FMS**, managing the entire manufacturing process.
- **Functions:**
 - **Scheduling and Routing** – Directs products to appropriate workstations.
 - **Monitoring and Diagnostics** – Tracks machine status and detects faults.
 - **Data Collection and Analysis** – Optimizes production efficiency.

4. Loading and Unloading Stations

- Where raw materials enter and finished products exit the system.
- **Manual or Automated** systems can be used, depending on the level of automation.

5. Tooling and Fixture System

- Includes **tool changers, fixture systems, and automated tool magazines** to adapt to different products.

- **Examples:**
 - Automatic tool changers (ATC) in CNC machines.
 - Reconfigurable fixtures for holding different parts.

6. Human-Machine Interface (HMI)

- Operators use HMIs to interact with the system, monitor processes, and intervene if necessary.
- Includes **touchscreen panels, software dashboards, and diagnostic systems.**

7. Sensors and Feedback Systems

- Used for **real-time monitoring of operations, quality control, and predictive maintenance.**
- **Examples:**
 - Temperature sensors, pressure sensors, laser scanners, and vision systems.