

DISTRIBUTED CONTROL SYSTEM (DCS)

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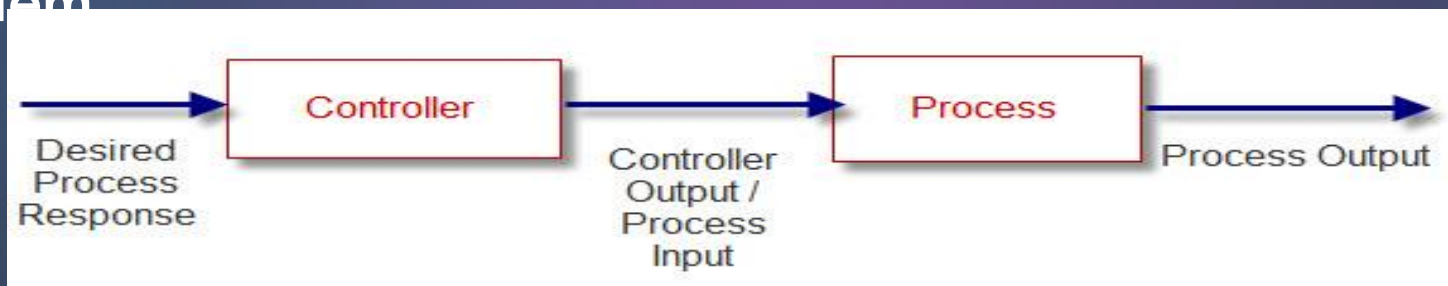
INTRODUCTION

➤ CONTROL SYSTEM

A **control system** manages, commands, directs or regulates the behaviour of other devices or **systems**, a system that senses, switches, or regulates another system

➤ OPEN LOOP SYSTEM

One type of **control system** in which the output has no influence or effect on the **control** action of the input signal is called an **Open-loop system**

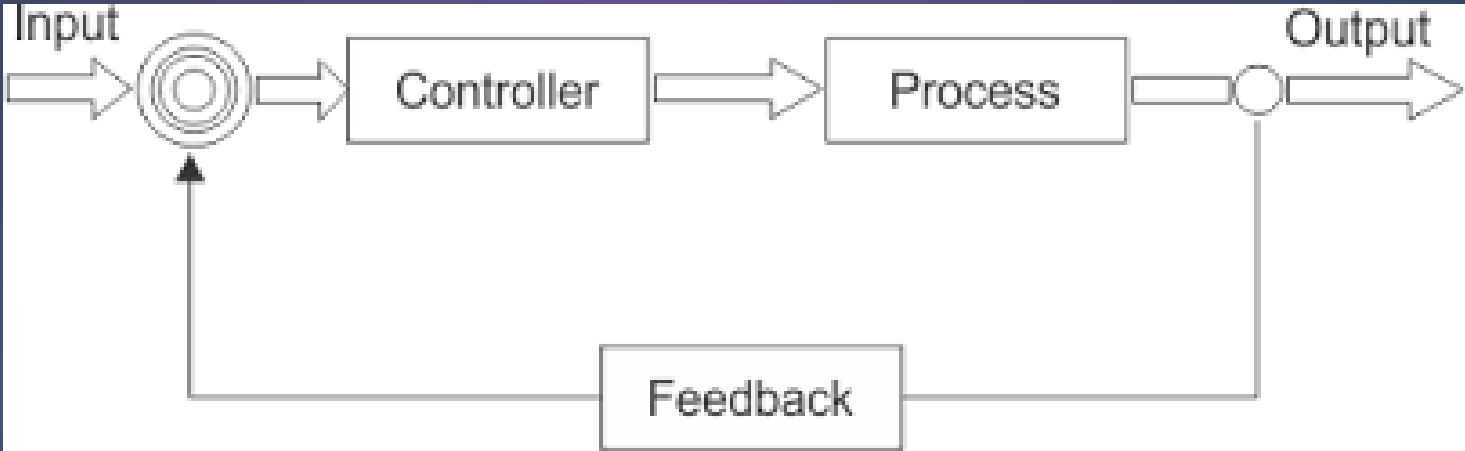


➤ Examples-Traffic Light Controller, Electric Washing Machine ,clothes dryer etc.



➤ CLOSE LOOP CONTROL SYSTEM

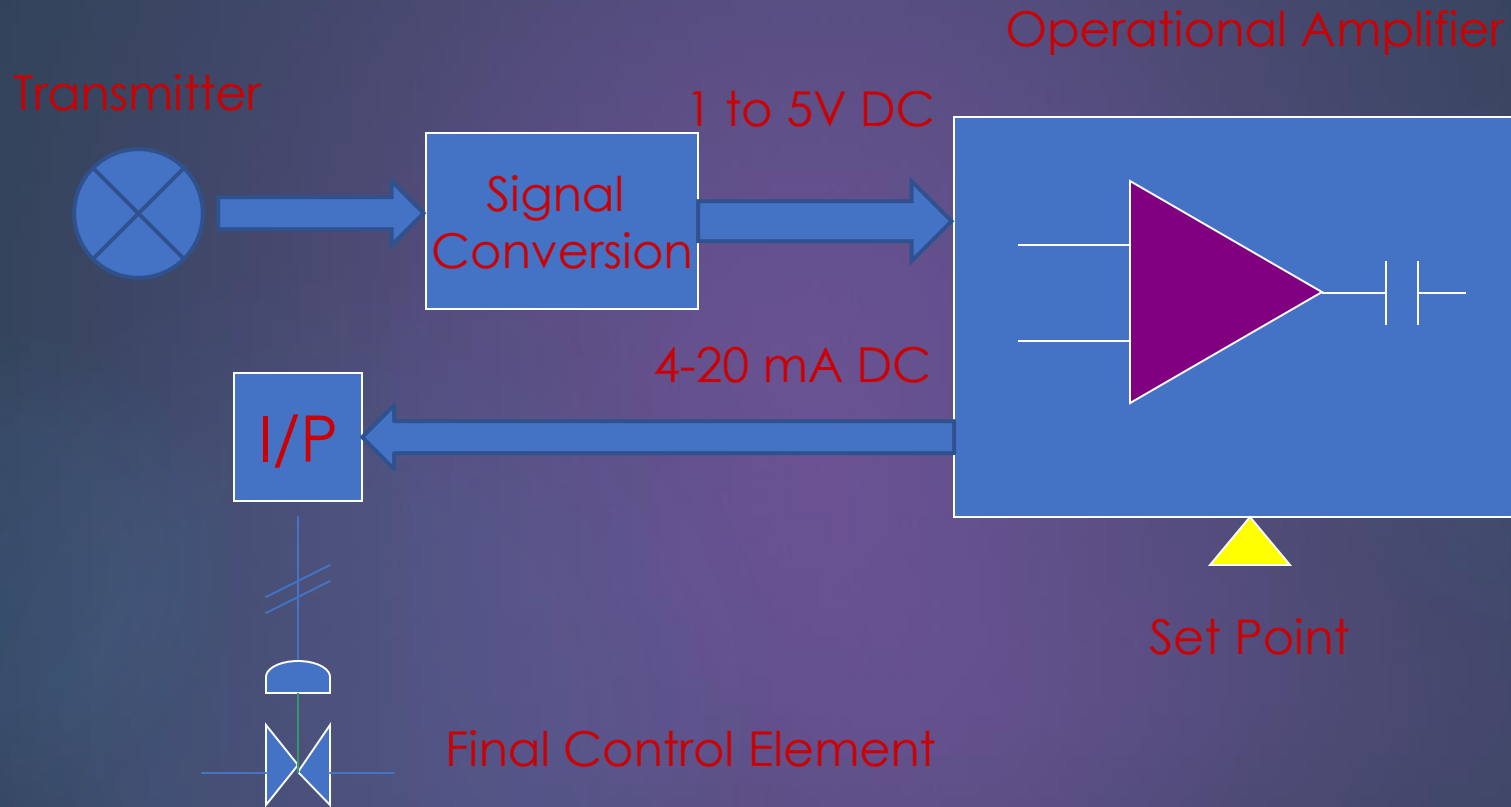
an automatic control system in which an operation, process, or mechanism is regulated by feedback



➤ Example-Missile Launching System, Human Respiratory System, Autopilot System etc.

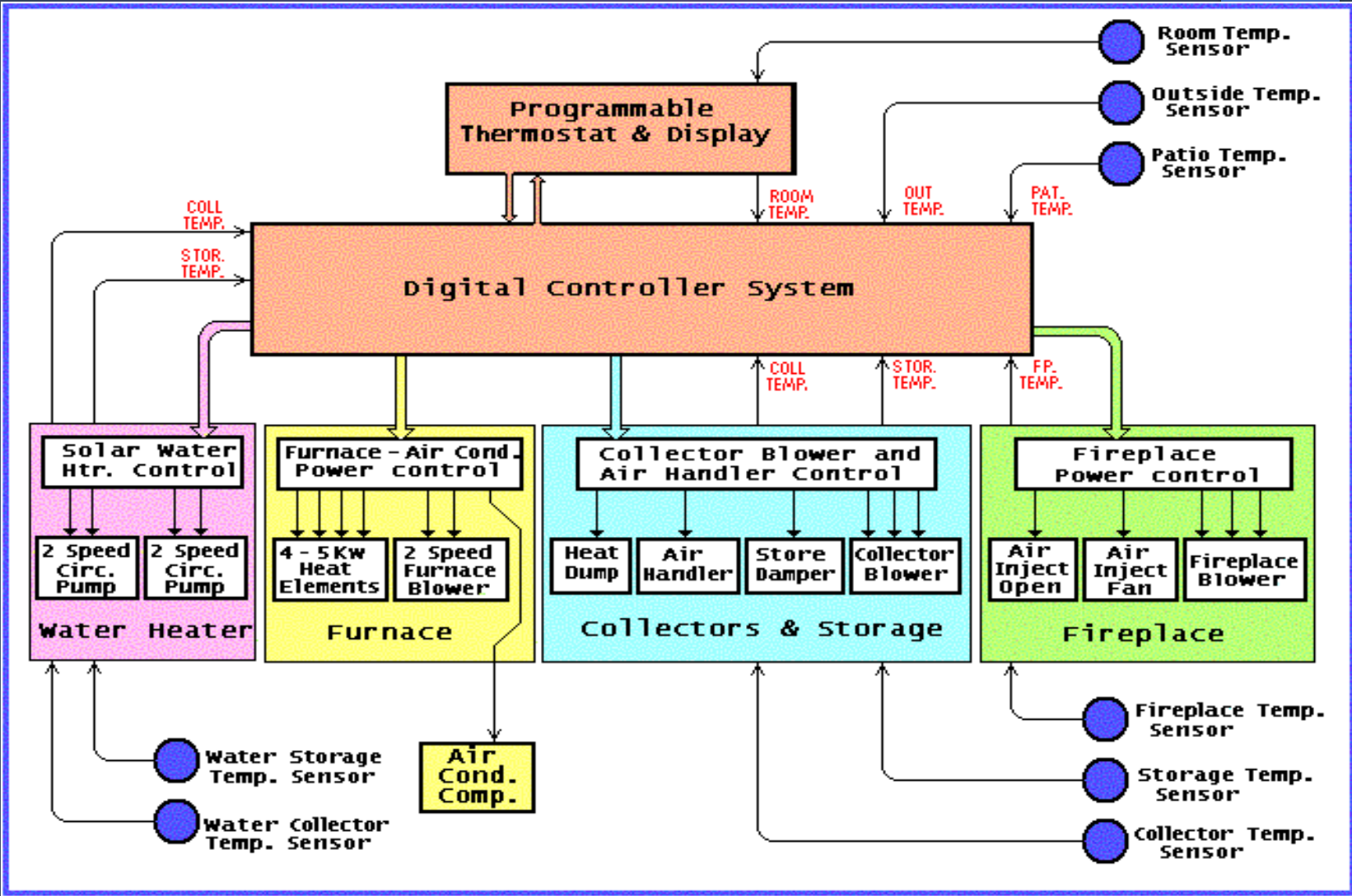
TYPES OF CONTROL

➤ ANALOG CONTROL SYSTEM



➤ Examples- Volume Control of Radio, Room Temperature Control With Thermostat etc.

➤ DIGITAL CONTROL SYSTEM

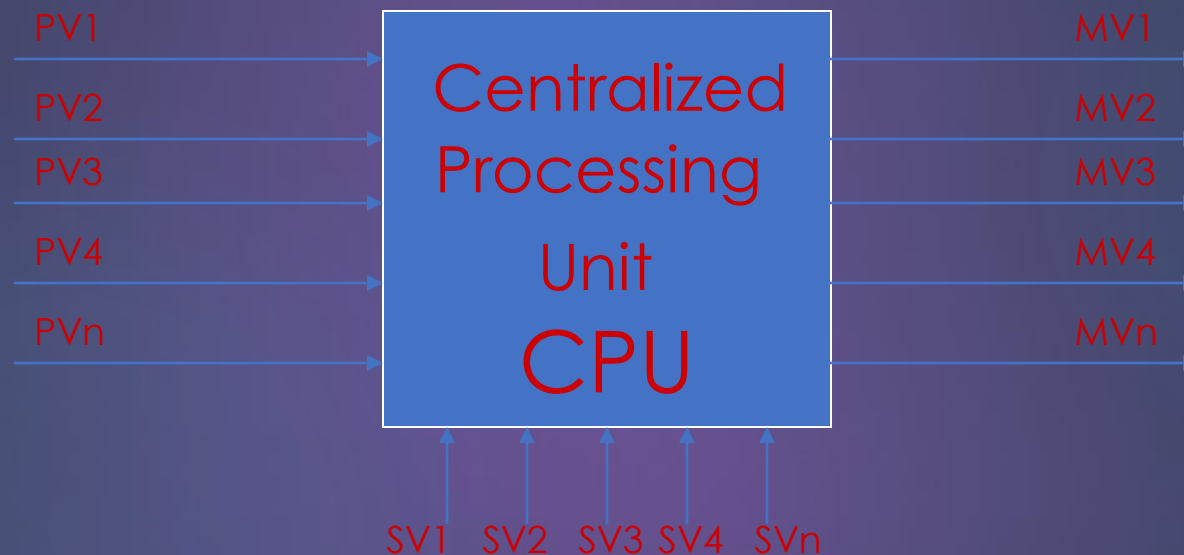


➤ Examples-PLC, DCS, SCADA, Embedded System etc.

TYPES OF DIGITAL CONTROL

Centralized Control System

Distributed Control System



Drawbacks of CCS:

- If the CPU fails the entire plant gets affected.
- Redundancy concept is not available.



DISTRIBUTED CONTROL SYSTEM(DCS)

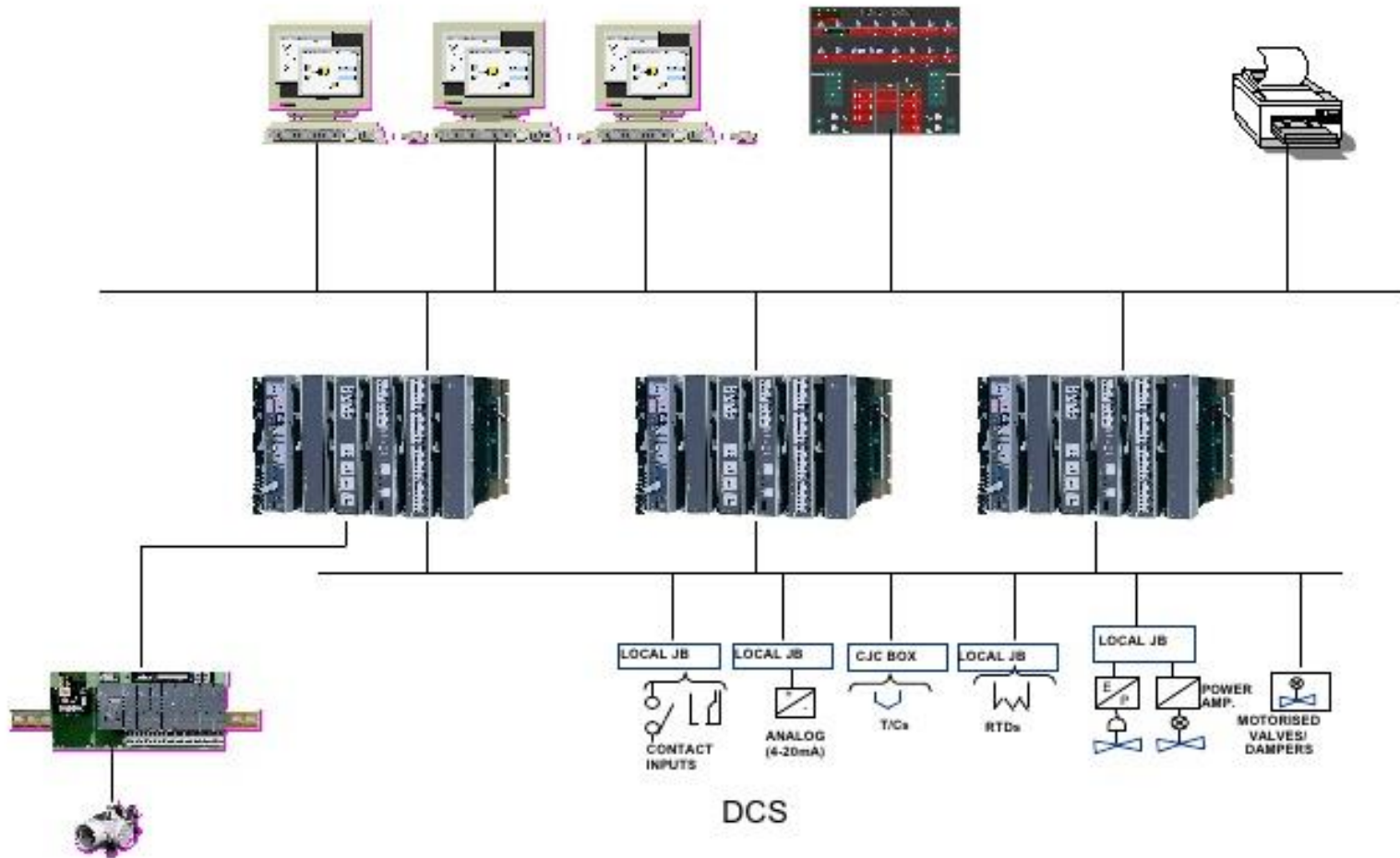
➤ A **Distributed Control System (DCS)** is a control system for a process or plant, wherein control elements are distributed throughout the system. Each process element or machine or group of machines is controlled by a dedicated controller.

DCS consists of a large number of local controllers in various sections of plant control area and are connected via a high speed communication.

➤ Example scenarios where a DCS might be used include:

- Chemical Plants
- Petrochemical (Oil) And Refineries
- Papermaking
- Cement production
- Boiler Controls And Power Plant Systems
- Nuclear Power Plants
- Environmental Control Systems
- Water Management Systems

DCS Architecture



BASIC COMPONENTS OF DCS



Engineering Station (ES)

Operating station (OS)

Automation Station (AS)

Plant Bus/Terminal Bus

Field devices

Engineering Station (ES)

- It is the supervisory controller over the entire distributed control system. It can be a PC or any other computer that has dedicated engineering software.
- This engineering station offers powerful configuration tools that allow the user to perform engineering functions such as creating new projects, creating various input and output logics, modifying sequential and continuous control logic, configuring various distributed devices, preparing documentation for each input/output device, etc.

Operating Station (OS)

- Operating station is used to operate, monitor and control plant parameters. It can be a PC, HMI or any other monitoring device that has a separate software tool on it. An operator can view process parameter values and accordingly take control actions.
- Operating stations can be a single unit or multiple units where a single unit performs functions like parameter value display, trend display, alarming etc.

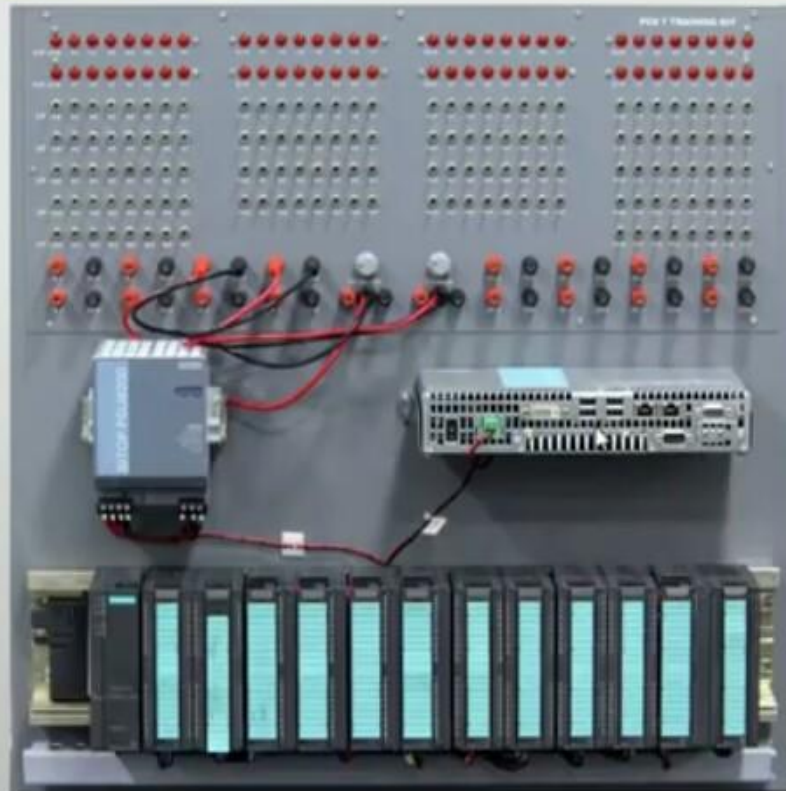
- **OS –Operator Station**



Automation Station (AS)

- The automation station is a controller or hardware for performing the logical tasks of a PLC but here it will work as master control.
- It registers and processes process variables from the connected central and distributed I/O and outputs control information and set points to the process.
- It supplies the operator station with the data for visualization.
- It registers actions on the operator station and forwards them to the process.

- **AS- Automation Station**

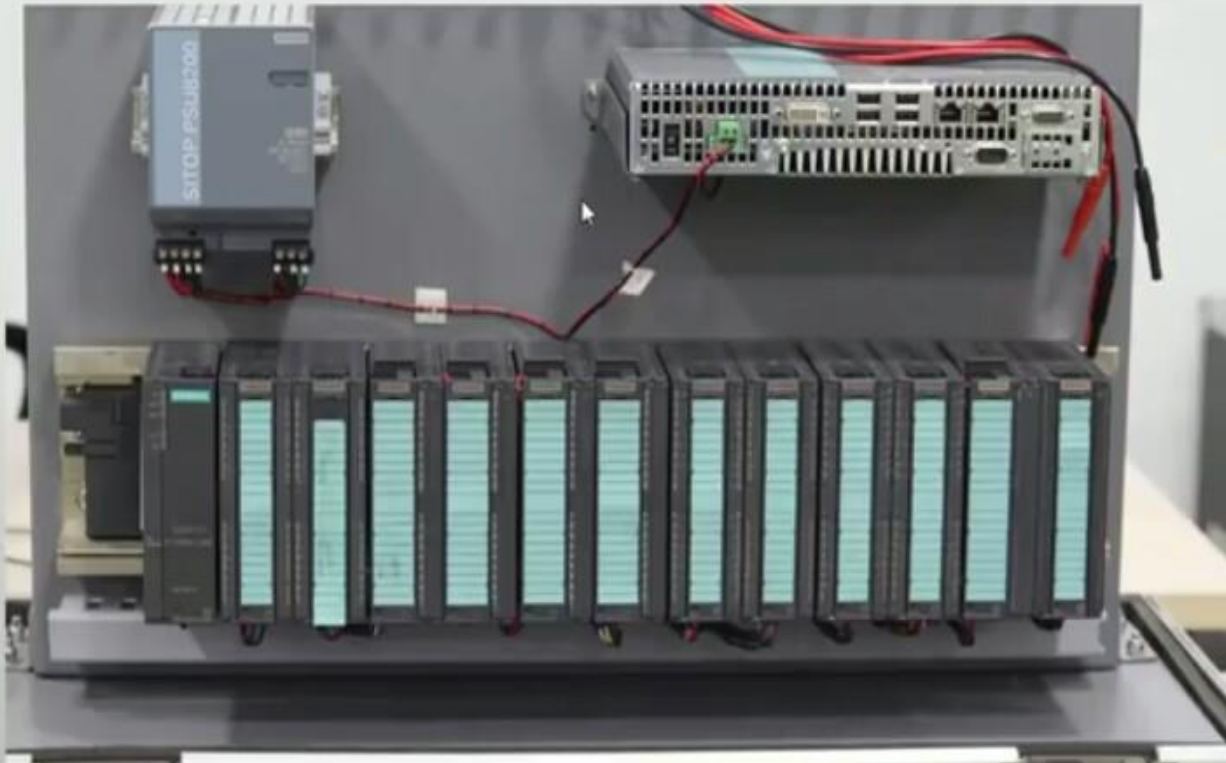


BASIC COMPONENTS OF DCS

Distributed IOs or Remote IOs

- It can be placed near to field devices (sensors and actuators) or certain locations where these field devices are connected via communication link. It receives instructions from the engineering station like set point and other parameters and directly controls field devices.
- It can sense and control both analog and digital inputs/ outputs by analog and digital I/O modules. These modules are extendable according to the number of inputs and outputs. It collects the information from discrete field devices and sends this information to operating and engineering stations.

Distributed IO or Remote IO



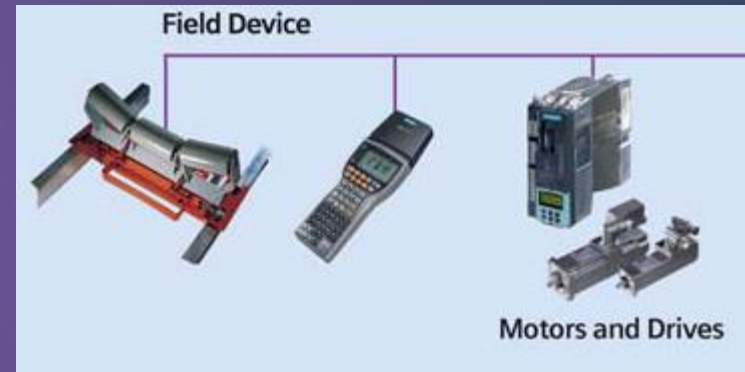
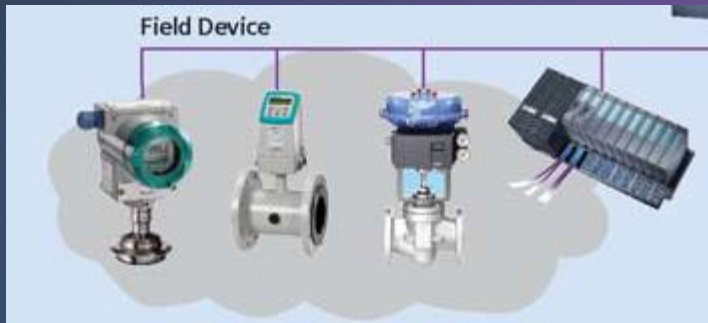
BASIC COMPONENTS OF DCS

Field Bus and Plant bus/Terminal Bus

- Field bus is communication bus from field device to device coupler which are in field area or potentially explosive area.
- Plant bus is communication bus from device coupler to Automation station or operating station for supervisory and monitoring level.
- For field bus Profibus PA, DP, HART, AS-I, Modbus. These protocols are used.
- In Plant bus mostly Profinet, Industrial Ethernet, TCP/IP or RS232, RS485 are used.

Field Devices

- Field devices control local operations such as opening and closing valves, breakers, collecting data from sensor systems and monitoring the local environment for alarm conditions.



➤ Examples- Transmitter, Electrical Drives etc.

DCS

V/S

PLC



- DCS's are designed to control processes.
- DCS are made available to the user in a way that only configuration in form of a Functional Block has to be carried out.
- Scan time of the DCS is comparatively higher.
- A DCS has inherently multiple processor capability thus Engineer has to put in less efforts for intercommunication of the processors.
- A DCS takes much longer to process data, so it's not the right solution when response times are

- PLC is in discrete control of manufacturing processes.
- In PLC complete programming has to be implemented using any one of the different languages available in the system.
- Scan time of the PLC is lower.
- This is possible now in PLC but more efforts have to be put in.
- Response times of 1/10 of a second make the PLC an ideal controller for near real time actions such as a safety shutdown or firing control.
- Redundancy is not possible at greater levels.



THANK YOU...