IN-PLANT TRAINING
Report

ATTENDED BY: ANANDHAGOPI V (18TI0003)
                         INSTRUMENTATION AND CONTROL ENGINEERING

GUIDED BY: Mr.ELANGOVAN V

Acknowledgement

I would like to express a deep sense of gratitude to my Internship guide Mr.ELANGOVAN sir for guiding me immensely through the course of work. He always evicted keen interest in my work. His constructive advice and constant positive motivation have been helpful for the successful completion of the in-plant training .
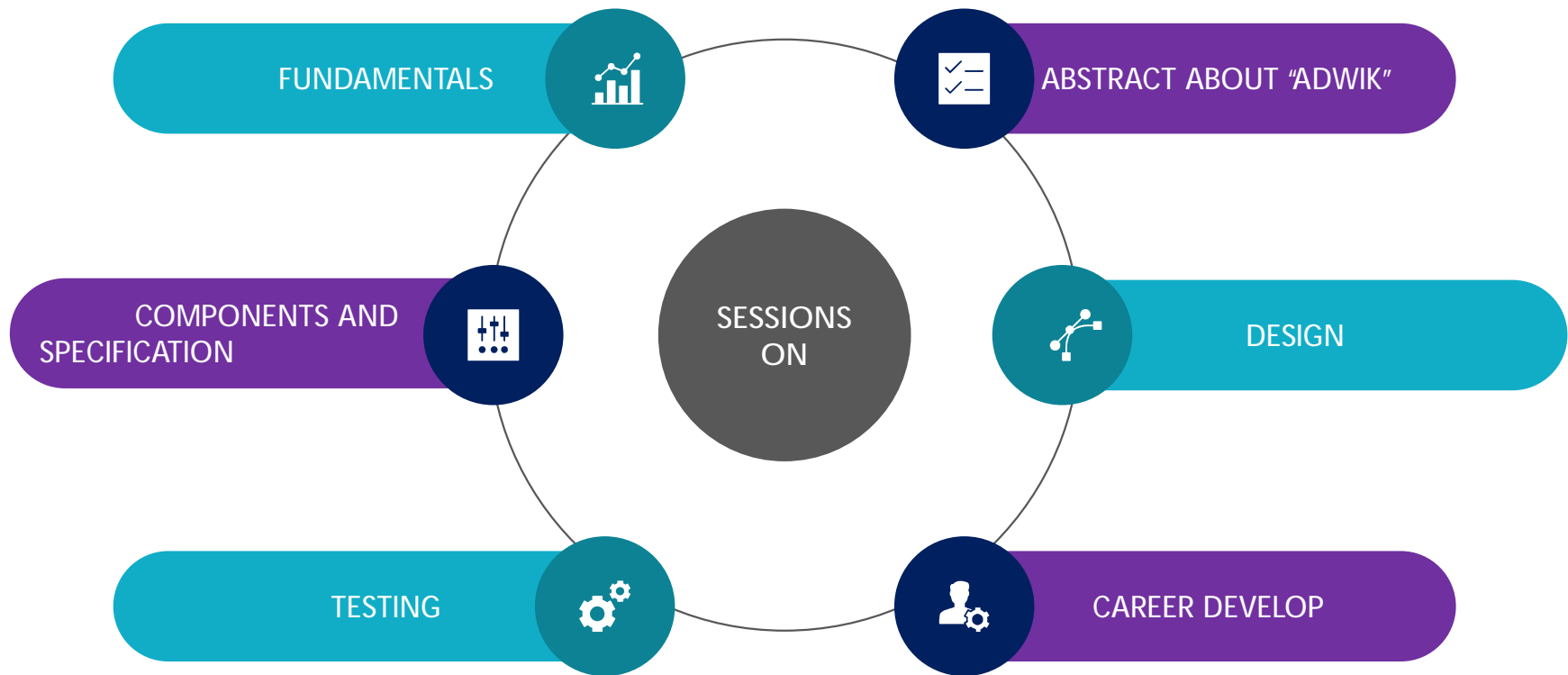
I would like to thank Mrs.M.REKHA professor Department of ICE , Sri Manakula Vinayagar Engineering college for her efforts and supporting me to this good opportunity for my career.

I am highly indebted to DR.L.M.VARALAKSHMI professor and Head of the Department of ICE ,for trusting my efforts towards my path and providing me the way to pursue this opportunity.

I am extremely great full to all the Department staffs (electrical , Design , Project Management , Sales , Production and Assembly , Accounts) and all my Senior Brothers for their support and hospitality they provided.
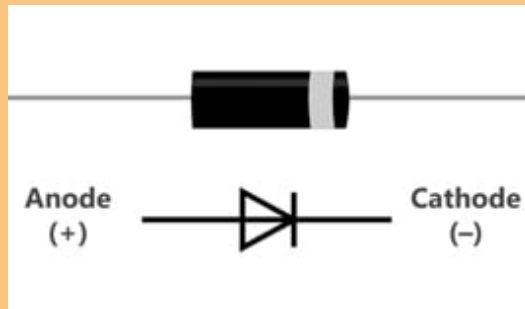
Last but not least I sincerely thank all the working technician for tolerating me with my questions and answering patiently throughout the period.

IN-PLANT TRAINING

FUNDAMENTALS

ABSTRACT ABOUT "ADWIK"

COMPONENTS AND SPECIFICATION

DESIGN

SESSIONS ON

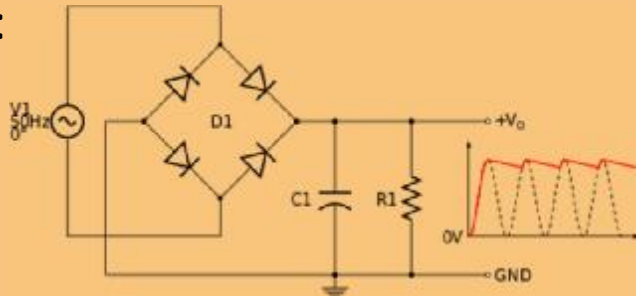TESTING

CAREER DEVELOP

Fundamentals

DIODE:

A diode is a semiconductor device used to conducting current in one direction either Forward or backward depending the connection to the diode from the power supply.

In a theoretical words in forward direction of current flow have zero resistance and reverse direction of current flow it has infinite resistance. The forward direction is known to be <u>Forward biased</u> and the reverse flow known to be <u>Reverse Biased.</u>

These diodes are made of doping p-type semi conductor and N-type semiconductor and P type and N-type are fabricated to form a PN diode.

RECTIFIERS:

Rectifiers are the electronic devices which comprises of two or more diodes for converting pulsating Alternative current to non pulsating Direct current (AC to DC).and the attenuating DC signal is dehazed with the help of Filters like(capacitor, resistor and inductor).
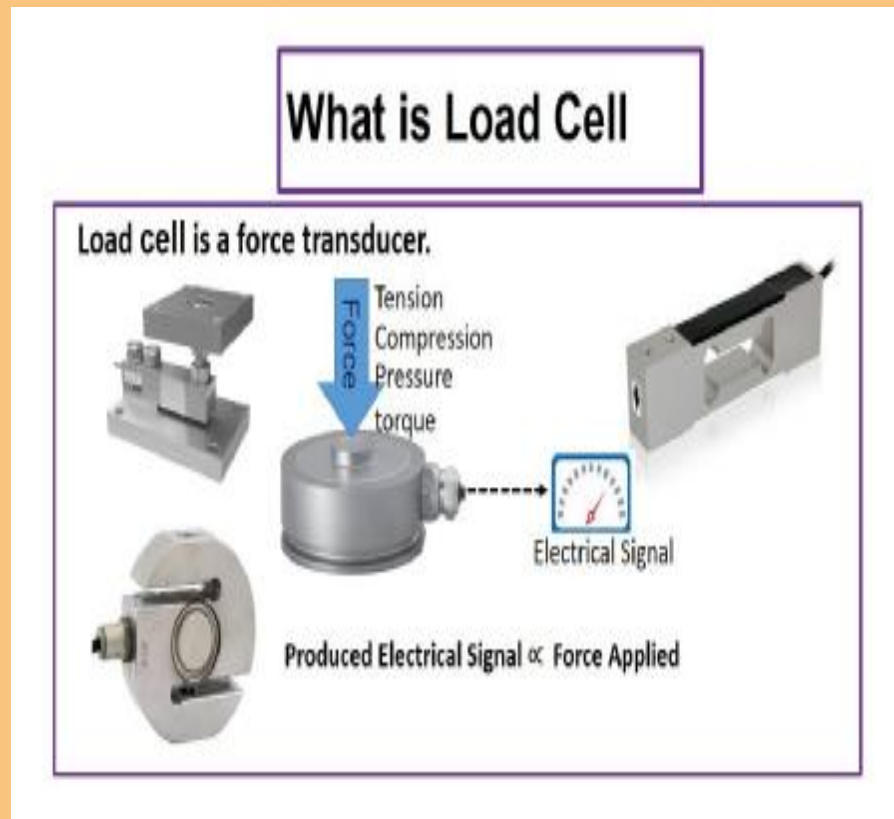
types:

1. Half Wave rectifiers: Conducts current only at first Half of cycle (+ve) of input AC current

2. Full wave rectifiers : Conduct current at both the cycle (+ve and –ve)half of input Ac supply

Type:
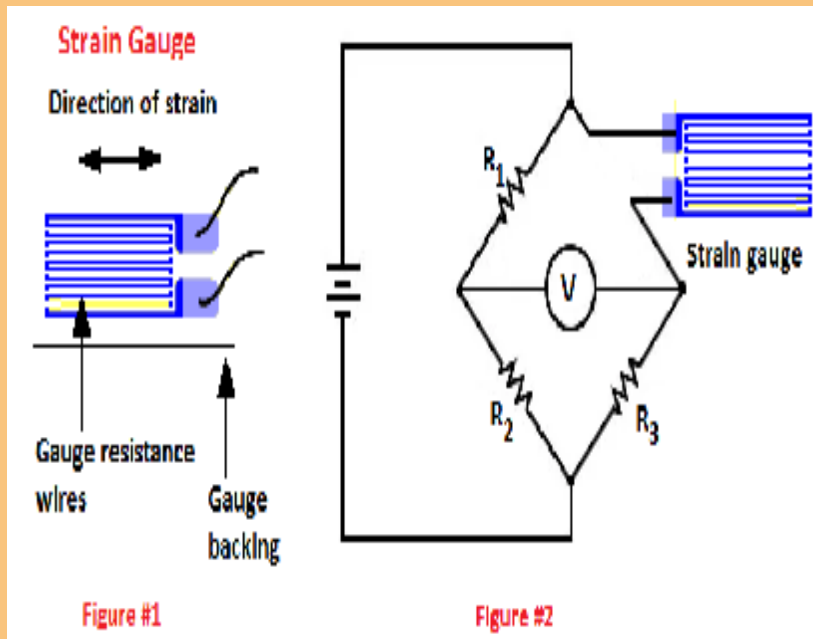* Center tapped rectifiers
* Bridge Rectifiers

Load Cell:

- load cell is a transducer that is used to create an electrical signal those magnitude is directly proportional to the force being measured. The various load cell types include hydraulic, pneumatic, and strain gauge.

- Strain Gauge is the resistor which is connected in the Wheatstone bridge circuit form . When the strain or deformation in the strain gauge recorded the resistor resistance gets changed hence the resistance change leads to deflection in the voltage connected in the bridge circuit
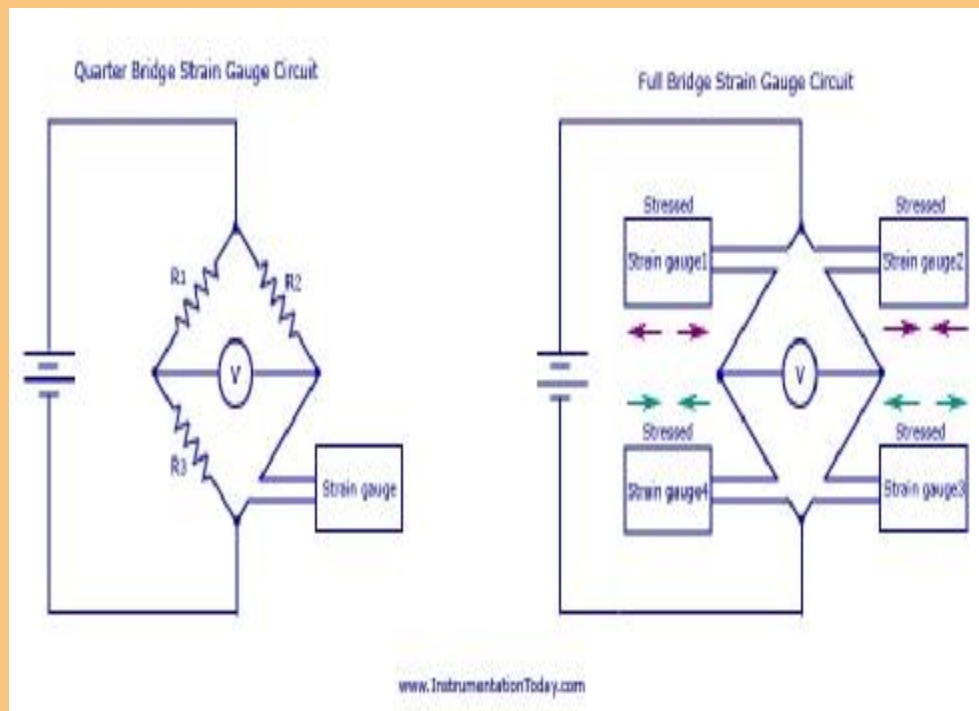
Wheatstone Bridge:

Figure #1

Figure #2

- Wheat Stone Bridge is used for measuring accurate electrical resistance in the circuit.

- There are two known resistor and a variable resistor and an unknown resistor in the circuit . The Galvanometer in the circuit is fixed to null by adjusting the variable resistance.

- Here by the when the current through the galvanometer is zero then the ratio between two known resistor and the variable resistance and the unknown resistance.

$$R_2/R_1 = R_x/R_3$$

$$R_x = R_3R_2/R_1$$

Wheatstone Full Strain Gauge Bridge:

Quarter Bridge Strain Gauge Circuit

Full Bridge Strain Gauge Circuit

www.InstrumentationToday.com

A full bridge circuit is used in applications where complimentary pair of strain gauges is to be bounded to the test specimen.

A full bridge circuit is said to be more linear than other circuits.

An external supply is given to the bridge as shown in the diagram. Initially, when there is no application of strain, the output measurement will be zero. Thus, the bridge is said to be balanced. With the application of a stress to the device, the bridge will become unbalanced and produces an output voltage that is proportional to the input stress.
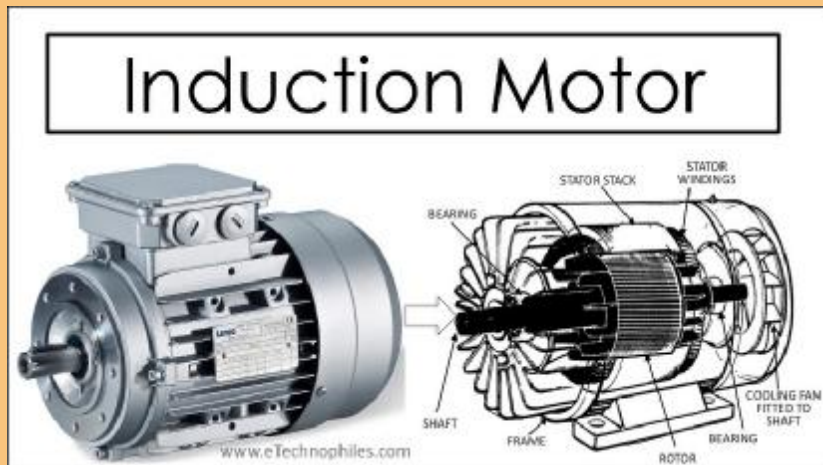
Belt Conveyor:

1. Belt Conveyor used here to transport the solid polymer from place to another and the transporting polymer weight is measured with the help of bending type <u>LOAD CELL</u> on the four corners of the belt conveyor.

2. The Electrical unit from the four load cell denotes the proportional weight in millivolt and thus calibrated and indicator in the transducer aka weigh Indicator.
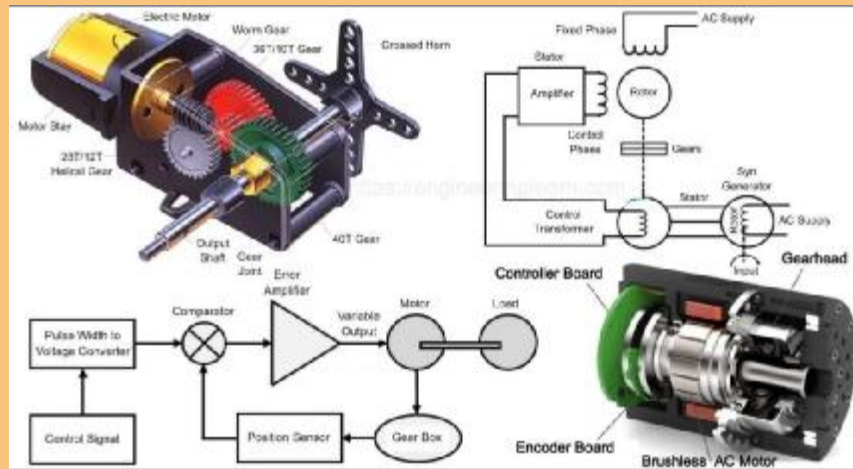
Components and Specification

- Unlike the DC motor The AC supply is only fed to the stator and not to the rotor.

- To the rotor The Rotor is supplied with AC supply and based on the Faraday's First law "Electro Magnetic Induction" the Ac supply is induced to the Rotor Hence it is known as Induction motor.

•Now, induced current in rotor will also produce alternating flux around it. This rotor flux lags behind the stator flux. The direction of induced rotor current, according to "Lenz's Law" is such that it will tend to oppose the cause of its production.

•As the cause of production of rotor current is the relative velocity between rotating stator flux and the rotor, the rotor will try to catch up with the stator RMF. Thus the rotor rotates in the same direction as that of stator flux to minimize the relative velocity. However, the rotor never succeeds in catching up the synchronous speed. This is the basic working principle of induction motor .

Components and Specification
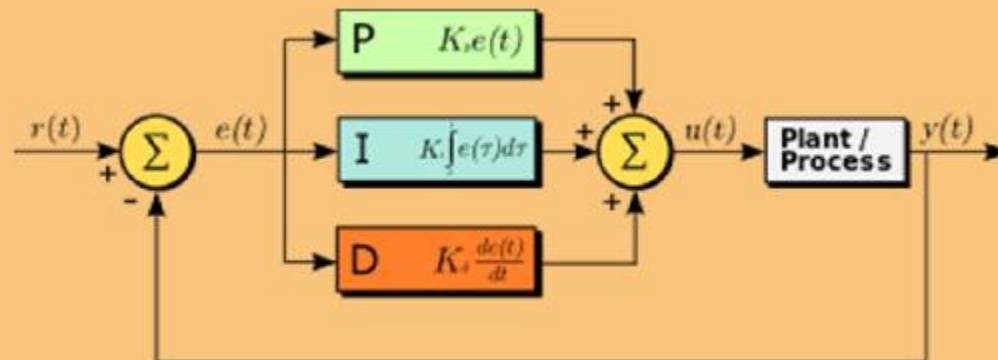
Servo Motor:

- This motor which Follows the servo mechanism so what it is known to be Servo motor, if the motor powered by AC then it's a AC servomotor and if DC then as DC servo motor.
- Servo motor comprises of three parts:
  - *Controlled device
  - *Output sensor
  - *Feedback system
- This servo motor is a close loop system in which the precision of the desired output is accomplished via a Negative Feedback loop

Components and Specification

The closed loop control system contains a measurement device which measures the position and then converts it into an electrical signal. Such measurement devices are called encoders. The system also contains an amplifier whose purpose is to amplify the signal so as to work with it more precisely and properly.
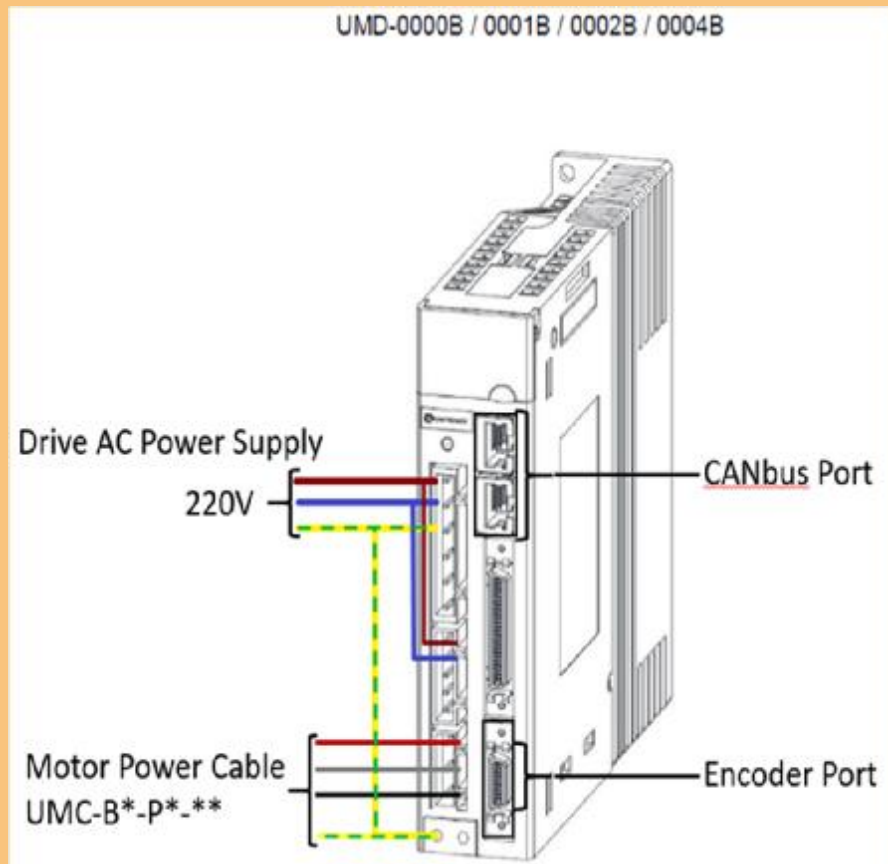
The simplest of servomotors measure only position. Thus they are only equipped with position encoders. They have a set point for the position which is called as command position. They measure the actual position with command position and if there is difference in the values then that means the error is not zero in the closed loop control system. The error has to be brought to zero by the controller by changing the actual position.

The simplest of servomotors use potentiometers as encoders. These cannot be used in complex applications. They are not common in industrial applications. Although for some industrial applications, the position signal can be electrically differentiated in order to bring speed control into the system. These encoders coupled with PID controller warrant precise control for some industrial operations

Servo Drive:

UMD-0000B / 0001B / 0002B / 0004B

Drive AC Power Supply
220V
CANbus Port

Motor Power Cable
UMC-B*-P*-**
Encoder Port
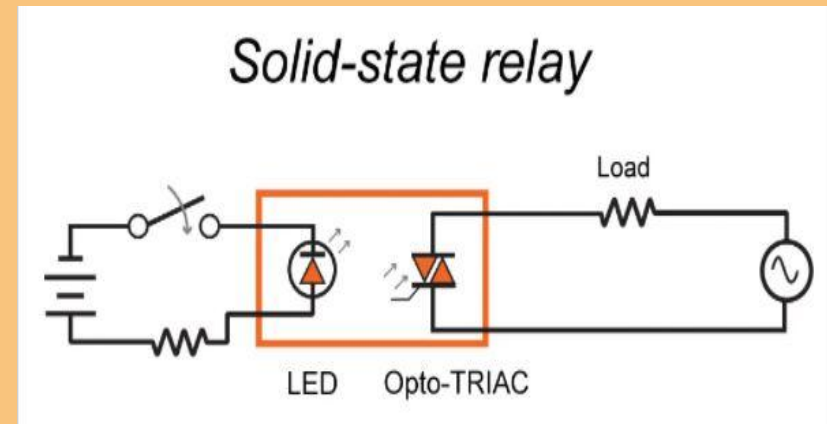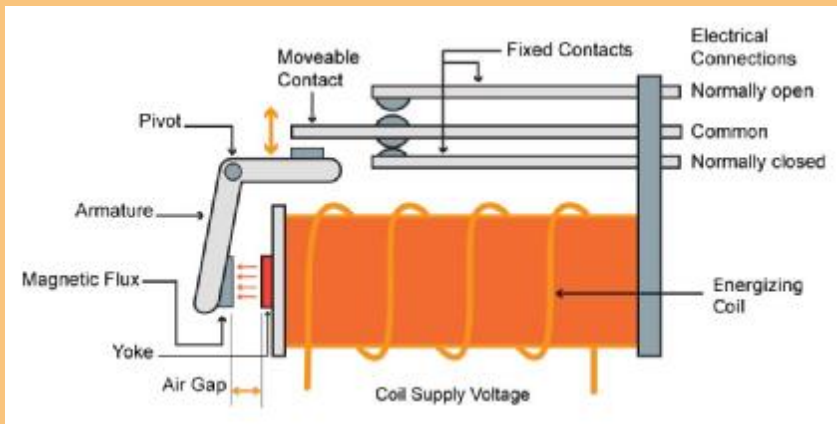
- Servo drives are electronic devices made out of circuit boards, microchips, wires, and connectors. They are connected to electric motors to control the motor's spin. They can make the motor speed up, slow down, stop, or even go backwards at any time.

- They accomplish this by controlling and directing the flow of electricity through the motor's wires. Without a servo drive, a motor might just spin uncontrollably or not spin at all.

- the amount of current through the windings controls the amount of torque (how hard it turns), while the voltage controls the motor's speed (how fast it turns). By regulating the current and voltage supplied, the servo drive controls the motor shaft's torque, speed, and position.

- servo drives are connected to: The motor windings, the controller, and the power supply. But there's a 4th element that the servo drives are connected to that makes them so effective: The motor feedback device.

RELAYS:

- Relays are the switches which is used for opening and closing the circuit electronically or electro mechanically based on the need and the construction.

- Relay used to control several circuit with one signal also with a low power signal. This helps us to achieve isolation and protection between controlled and controlling unit.

ELECTRO MAGNET RELAY:

- The working mechanism of electromagnetic relays is simple to understand. The electromagnetic relay operates largely as per the principle of electromagnetic induction, which also means that as the electric current is passed on the conductor, the conductor behaves like a magnet.

- So, as you switch on the power in the low-voltage control circuit, the current goes through the coil of the electromagnet and the coil gets activated by a supply system. Thus, generates a magnetic field.

- On this, the armature generates a suction force to connect the movable contact and stationary contact. The power circuit of the motor switches on and it starts to work

- In the process to switch off, the attraction of the electromagnet disappears. Further, the armature gets back to its initial position under tension of the spring to part the movable contact from the stationary contact (normally closed contract or NC).

- The relays condition and quality can be checked by the following Test:

  *Coil Resistance
  *Contact resistance
  *Pull in voltage and Pull in current
  *Release voltage and Release current

Solid State Relay(SSR):

Solid-state relays are similar to electromechanical relays, in that both use a control circuit and a separate circuit for switching the load. But their operating principle is different.
The working principle of a solid relay can be described like following:

1.When voltage is applied to the input of the solid-state relay, the relay is energized by a photocoupler or another electronic device (Diode, LED, resistor, and transistor). The photocoupler changes electric signals into optical signals and relays the signals through space, thus fully isolating the input and output sections while relaying the signals at high speed.

2.An electric signal is transferred to the trigger circuit in the output circuits.

3.The switching element in the output circuit turns ON.

4.When the switching element turns ON, load current flows, and the device connected to the output can be controlled.

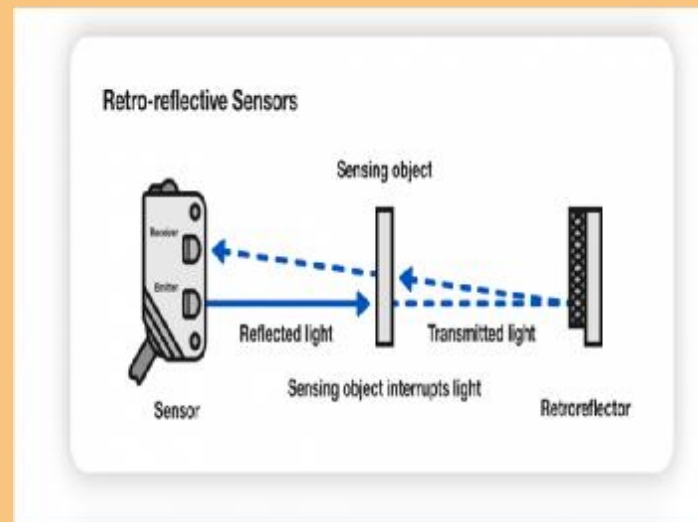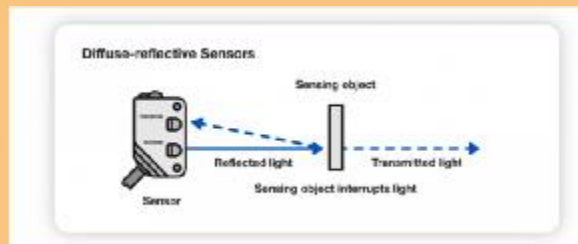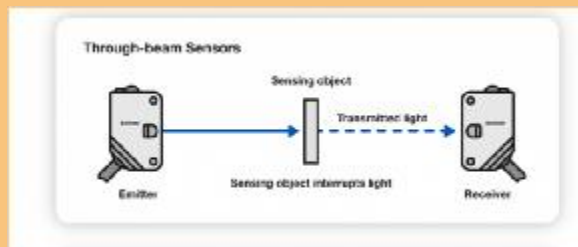5.Removal of the input voltage disables the control circuit and the solid-state switch is turned off.

Photoelectric Sensor:

A photoelectric sensor or Photo Eye sensor emits and infrared rays on a target and captures the signals reflected back to it . It works under the principle of Photo electric effect.
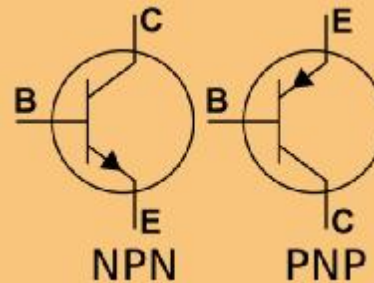
There are three major classification in the respective sensor based on their Housing styles :

*Reflective or Diffusive
*Thru-Beam
*Retro-Reflective

Output methods of sensor to plc:

*Sourcing (PNP) :

With sourcing outputs, current flows in the following order :
" Positive power supply line" to "Sensor" to "Load" to "Negative power supply line". This is the same as a PNP transistor.
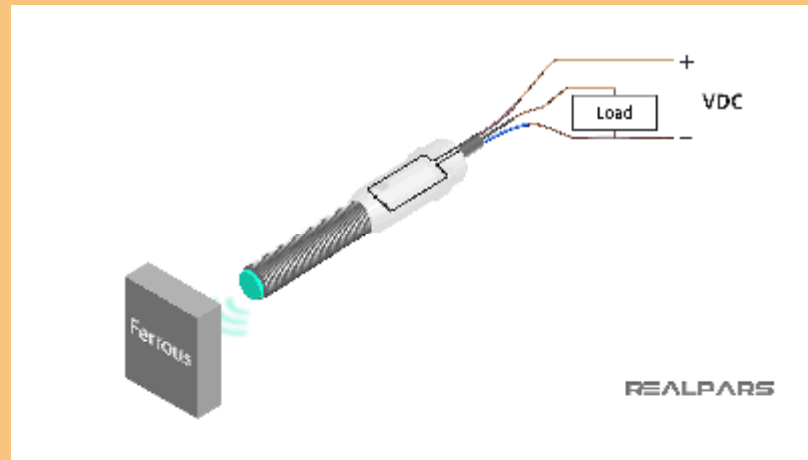
*Sinking (NPN) :

With sinking outputs, current flows in the following order:
"Positive power supply line" to "Load" to "Sensor" to "Negative power supply line". This is the same as for an NPN transistor.

Proximity sensor :

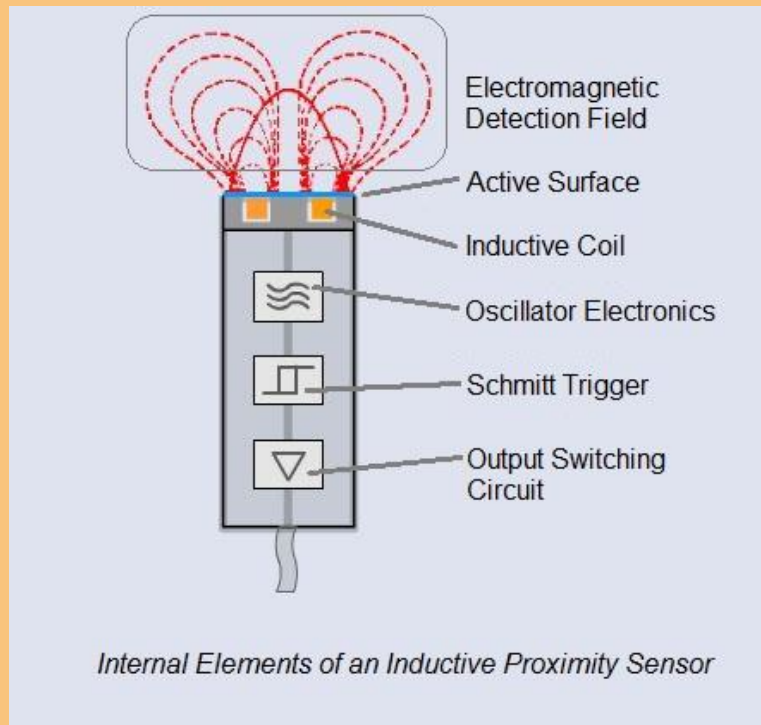- A proximity is a sensor which detect the presence or movement of the objects in a non-invasive way, when it senses a obstacle it records the information and covert into an electrical signal.
- Proximity sensor is used for its following features:
  - *Contactless sensing
  - *Unaffected by surface conditions
  - *Suitability for wide range of applications
  - *Longer service life
  - *High speed response rate

Inductive Proximity Sensors:

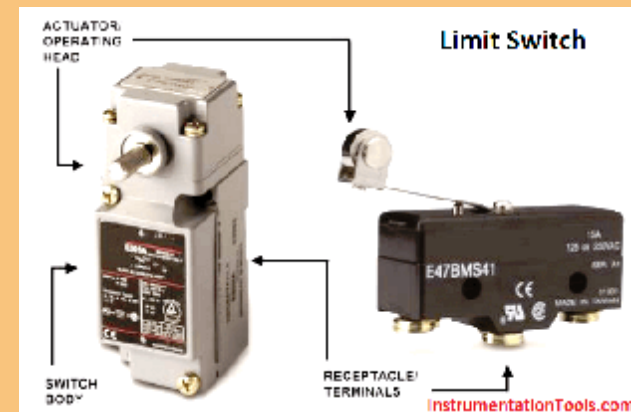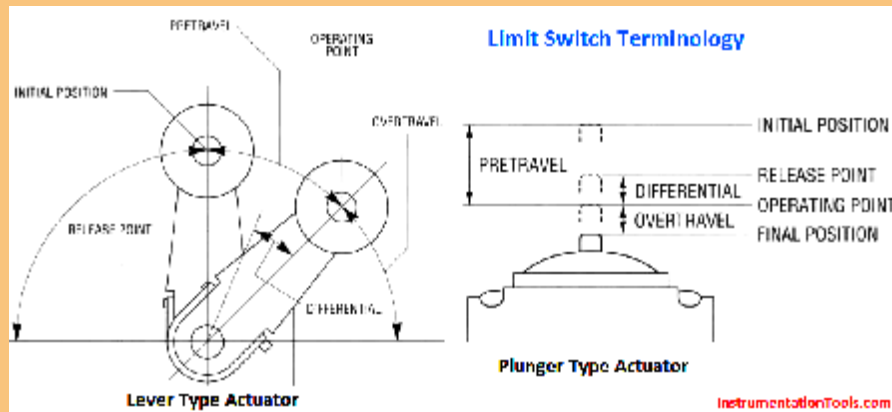Internal Elements of an Inductive Proximity Sensor

- Inductive proximity sensors are contactless sensors used to only detect metal objects. It's based on the law of induction, driving a coil with an oscillator once a metallic object approaches it.
- Unshielded: Electromagnetic field generated by the coil is unrestricted, allowing for wider and greater sensing distances
- Shielded: Electromagnetic field generated is concentrated in the front, where sides of the sensor coil are covered up

working:
1. An alternating current is supplied to the coil, generating an electromagnetic detection field
2. When a metal object comes closer into the magnetic field, eddy currents build-up, and result in coil inductance changes
3. When coil inductance changes, the circuit that has been continuously monitoring, will trigger the sensor's output switch

Limit switch:

- Limit switch are Type of sensor used to detect the presence or absence of an object .
- When the objects makes a contact the actuator of the switch it eventually moves the actuator to its "Limit" where the contact state changes
- Mechanical limit switches are contact sensing device ,the operation technique terms the name "Mechanical switch"
- There are other switches like photoelectric sensor, Inductive and capacitive proximity performs the same operation but the sensing method will be in a non contact manner.

REED Switch:

- A reed switch sensor is a magnetic proximity sensor that is switched "ON" when an axially aligned magnetic field is applied to it. The magnetic poles of an axially aligned magnet are next to each other in the axial plane. As the axially aligned magnet approaches the reed sensor a magnetic field parallel to the reed switch is generated

- A reed switch is composed of a pair of ferromagnetic metal reeds, which are enclosed in a sealed glass tube. Without the presence of a magnetic field the metal reeds will be separated, and the sensor will be switched "OFF". When the cylinder piston passes the switch and applies a magnetic field strong enough to attract the reeds together the sensor will become switched "ON"

Pneumatic cylinder:

- It is used to provide linear or rotary motion and the force to Automated system and process
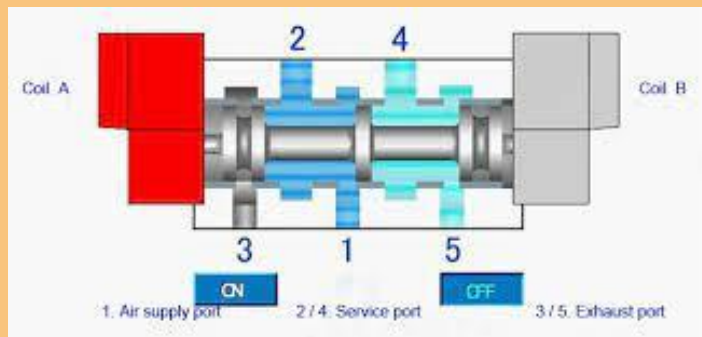- It works when compressed air is forced into cylinder itself in order to move a piston housed within it and the movement is carried out <u>when mechanism is directed to the piston</u>

- Working: Pneumatic actuators are reliant on the presence of form of pressurized gas or compressed air tension a chamber where a pressure is built up once the required pressure level in contrast to the Atmos pressure out state of the chamber it creates a controlled kinetic movement with the piston or gears which can be discrete straight or circular.
- When will the mechanism gets actuated?

Pneumatic cylinder linear position sensors/Reed switch are used to detect the linear position of the piston during operation. Pneumatic cylinders are typically made with a magnet already attached internally to the piston, so that the use of magnetic proximity sensors can be used if desired. Depending on where the sensor is mounted, it can detect individual positions along the cylinder body. Pneumatic cylinders with position sensors allow for added security and feedback to ensure the piston location

Solenoid Valve:

- When an electrical current is passed through the solenoid coil, a magnetic field is generated which causes a ferrous metal rod to move. This is the basic process that opens the valve and it works either directly or indirectly on the air.

- At the simplest level, solenoids can be controlled using a manually operated electrical on/off switch, which is sufficient in some applications. Most of the time however, more complex control is required using a control board. Control boards digitally set valves to operate at timed intervals or can be programmed to operate the valve when certain conditions are met, for instance when it receives a signal from a pressure switch. Solenoid valves can be controlled by a computer, making them easier to integrate into Industry 4.0 systems.

- Types: Direct acting, internally piloted, Externally piloted.

Components and Specification

MCB:

MCB stands for Miniature Circuit Breaker. It automatically switches OFF electrical circuit during any abnormal condition in the electrical network such as overload & short circuit conditions. However, fuse may sense these conditions but it has to be replaced though MCB can be reset. The MCB is an electromechanical device which guards the electric wires &electrical load from overcurrent so as to avoid any kind of fire or electrical hazards.

MCCB:

MCCB stands for Molded Case Circuit Breaker. It is another type of electrical protection device which is used when load current exceeds the limit of a miniature circuit breaker. The MCCB provides protection against overload, short circuit faults and is also used for switching the circuits. It can be used for higher current rating and fault level even in domestic applications. The wide current ratings and high breaking capacity in MCCB find their use in industrial applications.

RCCB:

RCCB stands for Residual Current Circuit Breaker. This residual current device is basically an electrical wiring device that disconnects the circuit whenever there is leakage of current flow through the Human body or the current is not balanced between the phase conductor. It is the safest device to detect and trip against electrical leakage currents, thus ensure protection against electric shock caused by direct contacts. RCCB is generally used in series with an MCB which protects them from over current and short circuit current.

MPCB:

MPCB stands for Motor Protection Circuit Breaker. MPCBs are used specially for motor protections. MPCB as a standalone device offers protection against Overload, Short Circuit & Single Phasing, thus is used specifically for motor applications.
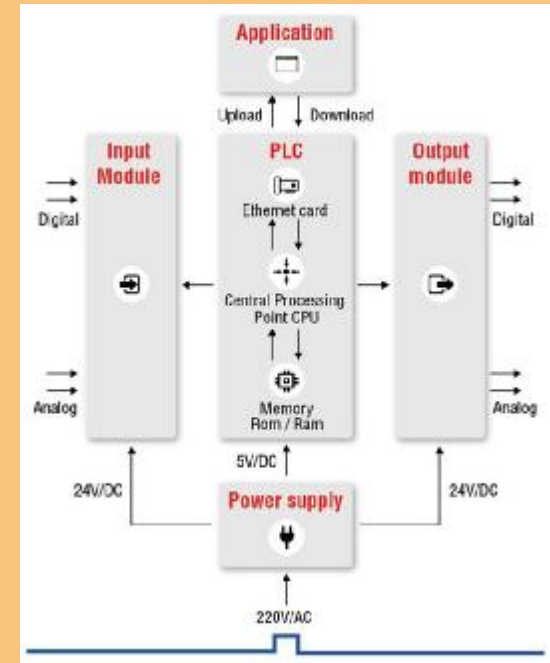
Programmable Logic Controller(PLC):

- A Programmable Logic Controller, or PLC, is a ruggedized computer used for industrial automation. These controllers can automate a specific process, machine function, or even an entire production line.

- The PLC receives information from connected sensors or input devices, processes the data, and triggers outputs based on pre-programmed parameters.
  Depending on the inputs and outputs, a PLC can monitor and record run-time data such as machine productivity or operating temperature, automatically start and stop processes, generate alarms if a machine malfunctions, and more. Programmable Logic Controllers are a flexible and robust control solution, adaptable to almost any application.
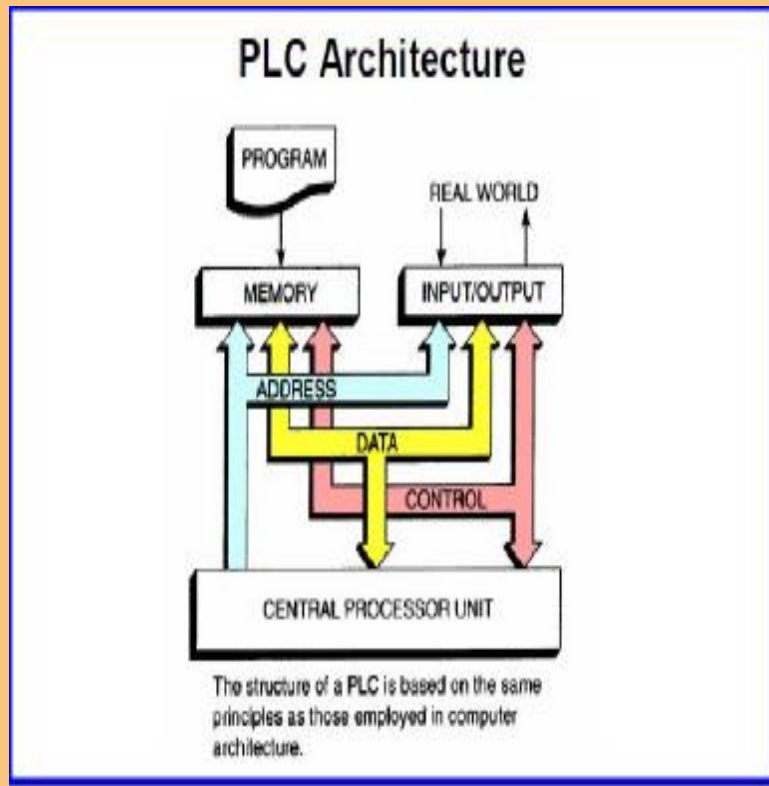

Types of plc in Allen Bradley

1. MicroLogix
2. CompactLogix
3. ControlLogix

Selection of PLC based on the application (i.e.) I/O need , Memory unit , Ethernet Sufficiency

PLC ARCHITECTURE:

PLC Architecture

The structure of a PLC is based on the same principles as those employed in computer architecture.

Hardware:

The main components of a PLC consist of a central processing unit (CPU), power supply, programming device, and input and output (I/O) modules

CPU
The CPU is the brain of the PLC and carries out programmed operations. These operations or outputs are executed based on signals and data provided from connected inputs.

I/O Modules
PLC input modules connect various external devices, such as sensors, switches, and push buttons to the PLC to read various digital and analog parameters, such as temperature, pressure, flow, speed, etc. Output modules convert signals from the CPU into digital or analog values to control output devices.

Power Supply
The power supply provides power to the PLC by converting the available incoming AC power to the DC power required by the CPU and I/O modules to operate properly.

Software:

PLC Programming Methods:

Ladder Logic
Ladder Logic is a graphical PLC programming language and is the most common method of programming. Ladder Logic can be used to execute tasks such as sequencing, counting, timing, data manipulation, and more. Ladder Logic is structured similarly to relay logic; however, the physical switches and coils used in relay logic are replaced by the PLC's memory locations and I/O.
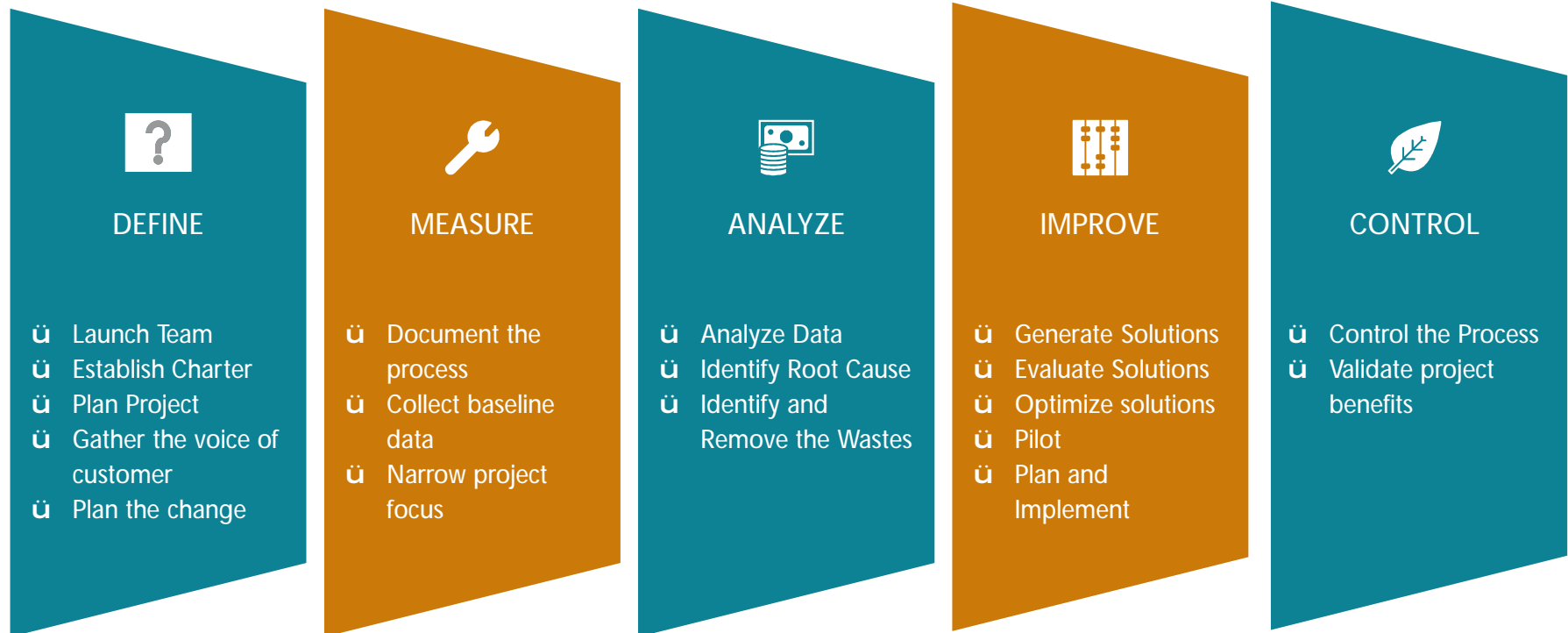
Structured Text
Structured text is a text-based PLC programming language and is similar to Python, Visual Basic, or C coding languages. Programming with structured text has multiple advantages, such as the program requiring less space due to being text based instead of graphic based. Additionally, the structured text can be combined with other programming languages, such as creating function blocks containing functions written in structured text.

Function Block
Function block PLC programs are represented in the form of graphical blocks. Signals or data flow into the function block from inputs connected to the PLC. When the incoming signals or data triggers the function block's pre-programmed function, the PLC executes one or more outputs. Function blocks can have standard functions such as timers, counters, calculating min and max values, obtaining averages, and more.

R and D Approach

DEFINE

ü Launch Team
ü Establish Charter
ü Plan Project
ü Gather the voice of customer
ü Plan the change

MEASURE

ü Document the process
ü Collect baseline data
ü Narrow project focus

ANALYZE

ü Analyze Data
ü Identify Root Cause
ü Identify and Remove the Wastes

IMPROVE

ü Generate Solutions
ü Evaluate Solutions
ü Optimize solutions
ü Pilot
ü Plan and Implement

CONTROL

ü Control the Process
ü Validate project benefits

Thank You