MOTION COMMANDS

Motion commands are the instructions that control how the robot moves in its workspace.
They define robot position, speed, orientation, path, and joint movements.

Types of Motion Commands:

1) Point-to-Point Motion (PTP / MoveJ)

- Moves robot from one point to another without controlling the exact path.
- Robot only cares about start and end points, not intermediate trajectory.
- Used when path accuracy is NOT important.

Characteristics:

- Fastest movement
- Follows joint-space movement
- Suitable for pick-and-place

General Example Command:

PTP P1

or

MOVEJ P1

2) Linear Motion (LIN / MoveL)

- Robot moves in a straight-line path between points.
- Used for operations needing accurate path control.

Applications:

- Welding, cutting
- Assembly
- Glue dispensing

Example:

LIN P2

or

MOVEL P2

3) Circular Motion (CIRC / MoveC)

- Robot moves along a circular arc.
- Requires two points:
  - Intermediate point (P2)
  - Target point (P3)

Example:

CIRC P2, P3

4) Joint Motion Commands

Controls robot's joint angles individually.

Example:

JOINT {J1=45, J2=30, J3=10}

5) Speed / Velocity Commands

Controls how fast the robot moves.

VEL 30 ; 30% speed

6) Orientation Control Commands

Used to set robot's TCP (Tool Center Point) orientation.

ORIENT 0, 90, 180 ; Roll, Pitch, Yaw angles

SENSOR COMMANDS:

Sensor commands allow robots to monitor their environment and take decisions.

Robots use different sensors like:

- Proximity sensor
- Limit switch
- Vision camera
- Force/torque sensors
- Infrared (IR) sensors
- Temperature sensors

Sensor commands help in **industrial automation, adaptive control, intelligent robotics**.

Types of Sensor Commands

1) Digital Sensor Commands

These sensors give only ON/OFF values.

Example: Limit switch, IR sensor, proximity switch.

Command Format:

```
IF INPUT1 == ON THEN
   PTP P3
ENDIF
```

Meaning:

If the sensor detects an object, robot moves to P3.

2) Analog Sensor Commands

Analog sensors give continuous values like voltage, distance, temperature.

Command Format:

READ A1 -> VALUE

Example:

Force sensor reading, temperature sensor reading.

3) Vision Sensor Commands

Used when robot uses a camera for object detection.

Command Example:

VISION_SCAN

IF OBJECT_FOUND == TRUE THEN

GRIPPER_CLOSE

ENDIF

4) Force/Torque Sensor Commands:

Used for assembly, polishing, grinding.

FORCE_CONTROL 10N

Robot maintains 10 Newton force.

5) Touch Sensor Commands

Detects physical contact.

IF TOUCH == TRUE THEN STOP

END EFFECTOR COMMANDS

End effectors are tools attached to robot arms:

- Grippers
- Welding torch
- Spray gun
- Soldering iron
- Screw driver
- Vacuum suction cup

End effector commands control how these tools operate.

Types of End Effector Commands

1) Gripper Commands

Used for mechanical grippers.

Commands:

GRIPPER_OPEN

GRIPPER_CLOSE

2) Pneumatic (Air Pressure) Commands

Used for vacuum grippers or air tools.

AIR_ON

AIR_OFF

3) Vacuum Suction Commands

Used in pick-and-place applications.

VACUUM_ON

VACUUM_OFF

4) Welding Commands

Used in welding robots.

WELD_ON

LIN P5

WELD_OFF

5) Spray Painting Commands

SPRAY_START

MOVEL P4

SPRAY_STOP

6) Drilling / Screw Driving Commands

TOOL_ROTATE CW 200RPM

TOOL_STOP

7) Soldering Commands

SOLDER_ON

SOLDER_OFF