LEAD-THROUGH PROGRAMMING

Lead-Through Programming is one of the earliest robot programming methods where the operator physically moves the robot's arm through the desired path. The robot controller records these motions as a sequence of points, time stamps, and actions. Later, the robot can repeat the same motions automatically.

This technique is mainly used in:

- Spray painting
- Welding
- Polishing
- Continuous-path applications

Lead-through programming creates a continuous motion trajectory, unlike teach pendant programming which is point-to-point.

Types of Lead-Through Programming

1. Mechanical Lead-Through

- Operator physically grabs the robot arm and moves it.
- Robot is equipped with force sensors or powered joints that reduce resistance.
- Positions and paths are recorded automatically.

2. Servo Lead-Through (Powered Lead-Through)

- Robot joints are powered, and movements are made using compliant servo motors.
- Operator applies slight force; servo amplifies the motion.
- Suitable for heavy robots.

Advantages:

- Very intuitive and human-friendly
- No programming knowledge required
- Ideal for continuous-path tasks
- High accuracy in recording natural movements

Disadvantages:

- Physical strain on operator
- Robot must be stopped during programming → downtime
- Not suitable for tasks requiring high precision
- Difficult for complex industrial robots
- Safety risk if robot is large or heavy
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Applications:

Lead-Through Programming is widely used in:

- Spray painting
- Arc welding
- Polishing & grinding
- Surface finishing
- Deburring
- Gluing & sealing

Simple Lead-Through Program:

Program Name: PAINT_PATH

PROGRAM PAINT_PATH

```
SPEED 20

MOVE START        ; Starting point of paint stroke
SPRAY ON          ; Start paint spray

MOVES PATH1       ; Continuous motion along taught paint path
MOVES PATH2       ; Continue painting trajectory
MOVES PATH3

SPRAY OFF         ; Stop paint spray
MOVE FINISH       ; Move to finish point

END
```

Note:

- **PATH1, PATH2, PATH3** are continuous path points recorded during lead-through.
- **START** and **FINISH** are first and last manually guided points.