DIY

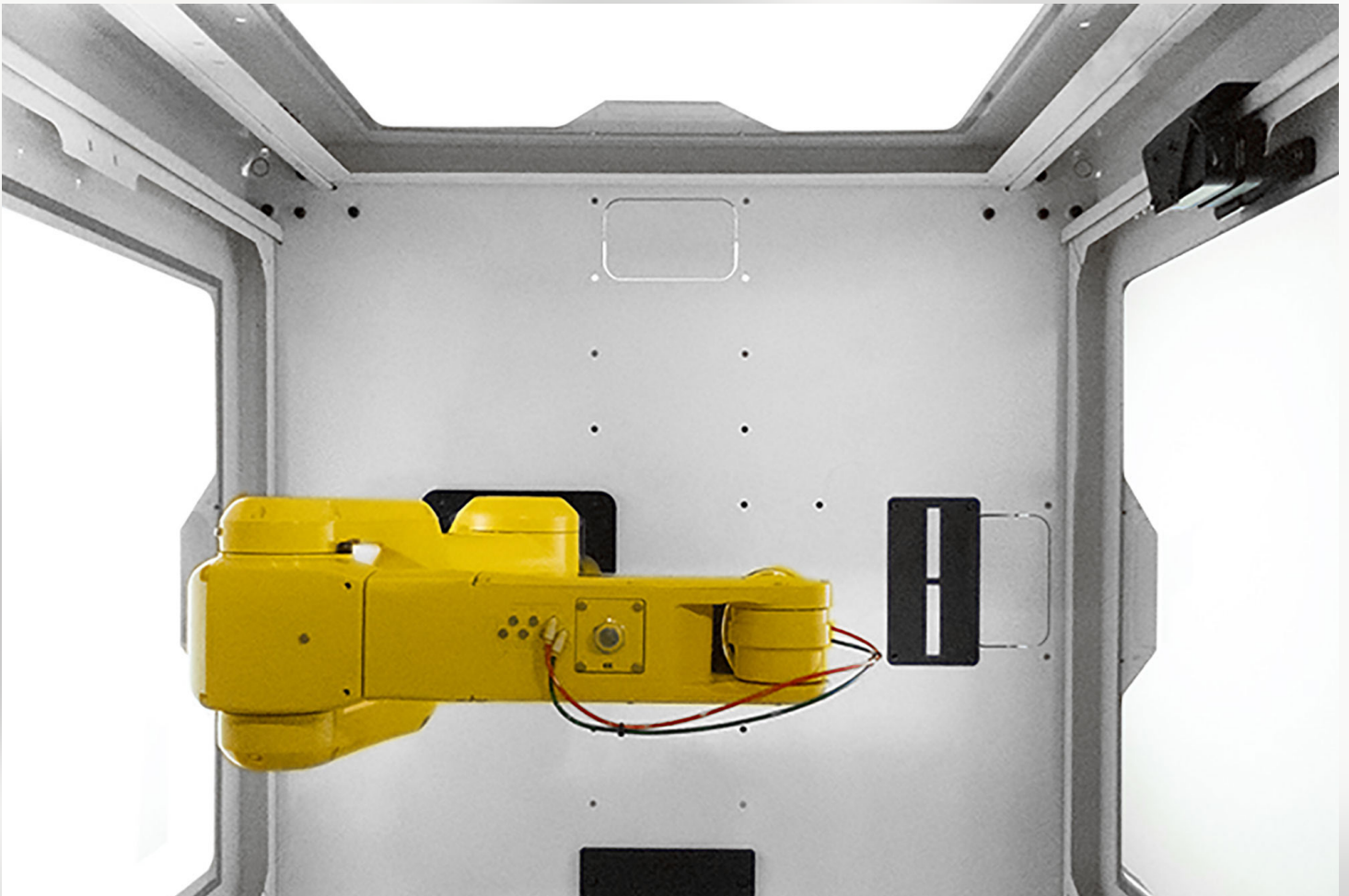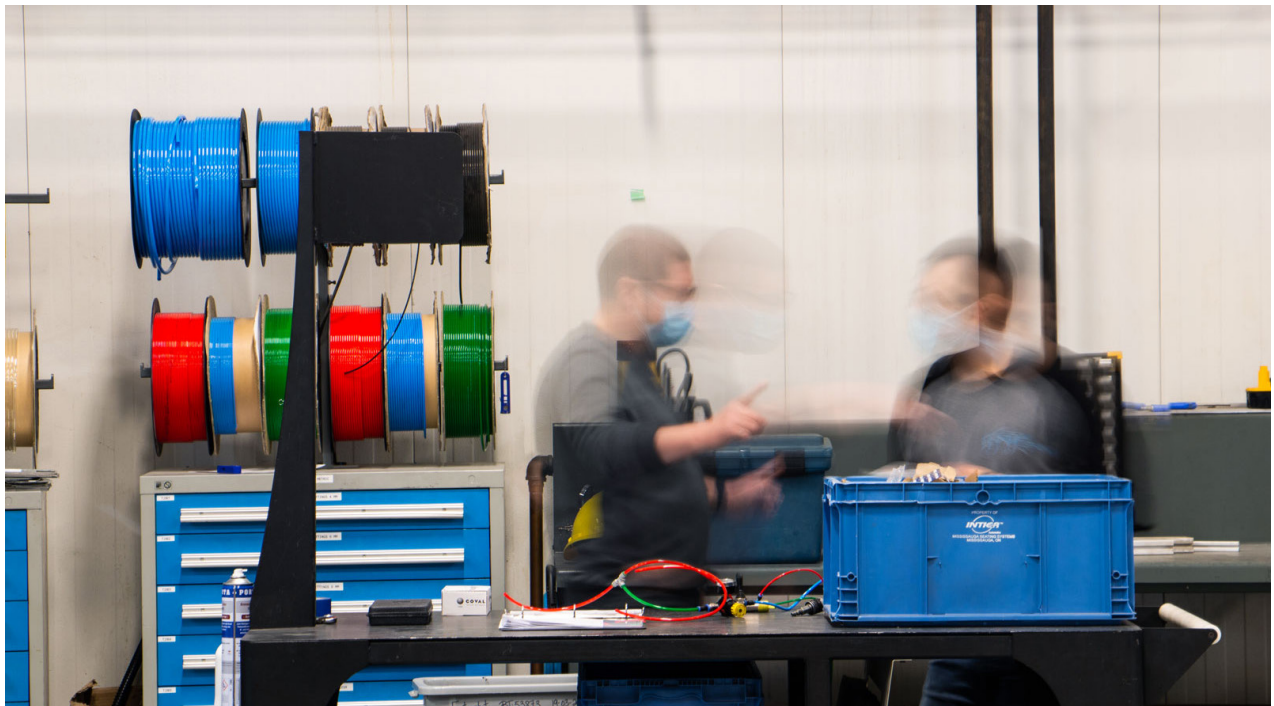## ROBOTICS

TRAINING PLAN

Training Plan - Introduction

This training aims to provide your staff with the skills required to perform tasks on a robotic cell. The training focuses on the use of a Fanuc robot in a DIY Robotics cell.

The subjects covered in this training include safety, manual robot jogging, robot path programming, logic programming, input and output signal configuration, camera detection and more.

Participants will perform several programming exercises throughout the training.

The complete training takes about 30 hours.

Module 1 - Basics of a robotic cell

This module introduces the participants to the DIY Robotics cell's basic components. It presents the basic connections and safety devices. Participants will learn to **manually move (jog)** the robot according to different **coordinate systems**.

1. DIY Robotics cell installation

    1. Components

    2. Transport and work environment

    3. Electrical and pneumatic connections

2. Safety
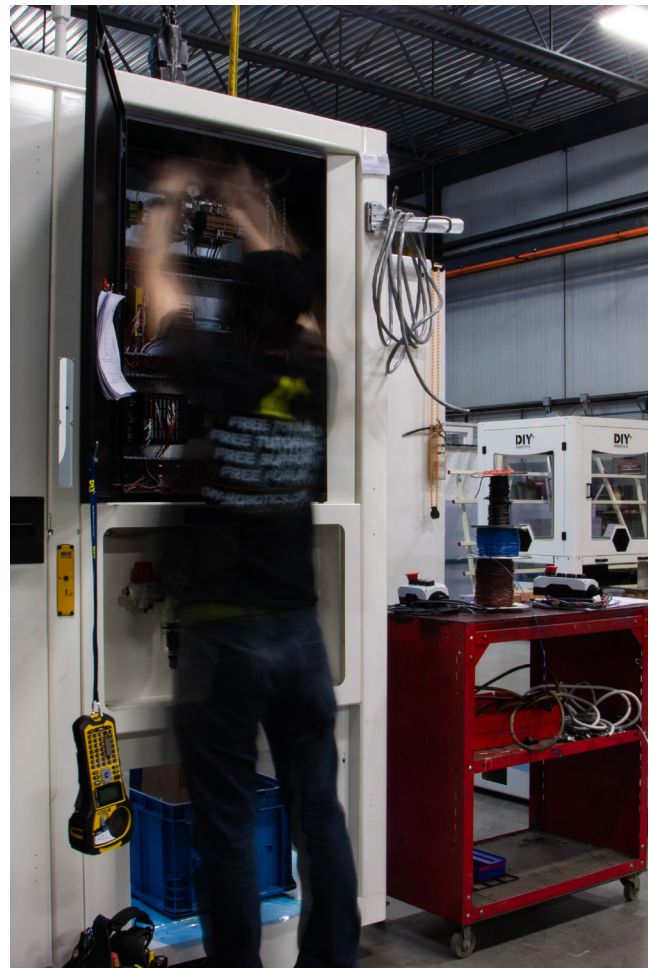
    1. Emergency stop and fence channels

    2. Safety regarding robot modes T1/ AUTO

    3. Lockout procedure

3. FANUC

    1. Robot

    2. Teach Pendant

    3. Controller

    4. Documentation

4. Jogging the robot

    1. Robot modes T1/ AUTO

    2. Coordinate systems

    3. TCP Speed (T1 mode)

Module 2 - Robot motion

In this module, participants will learn to teach a **robotic tool (Tool Frame)** and a **robotic work plane (User Frame)**. The motion instructions will be analyzed and the theory on robotic configuration will be discussed. Following this module, the participant will be able to create **robot paths**.

1. Tool Frame

    1. Direct entry

    2. Three point

    3. Six point (xz)

2. User Frame

    1. Direct entry

    2. Three point

    3. Motion instructions

3. Motion type

    2. Position indicator

    3. Position type

    4. Speed

    5. Termination types

    6. Motion Options

4. Configuration types

Module 3 - Programming

Creation of **robotic programs, programming instructions, robot coding structure, background programming, and user alarms** will be covered in this module. Finally, participants will perform two different types of robot program backups.

1. Creation of a .TP program

2. Programming instructions
    1. Remark
    2. Register (R[x])
    3. Position register (PR[x])
    4. String register (SR[x])
    5. I/O
    6. IF/SELECT
    7. JUMP/LBL[x]
    8. FOR/ENDFOR
    9. WAIT
    10. CALL, END
    11. MACRO
    12. URFRAME / UTOOL
    13. Multiple control/ Program control
    14. Monitoring
    15. Payload
    16. Collision detection
    17. Timers
    18. User alarms (UALM[x])

3. Basic code structure

4. Background logic

5. Program associated with controller power up

6. User alarms

7. Backup to USB drive
    1. "All of above" backup
    2. Restoring a .TP from a backup
    3. "Image" backup

Module 4 - IO signals and Ethernet configuration

This module explains how to **differentiate, configure, and use the input and output signals of a robotic cell**. The communication between the robotic cell and external injection molding machines though EUROMAP interfaces will also be covered.

1. Robot inputs and outputs (RI/RO)

    1. Electrical

    2. Pneumatic

2. Remote Ethernet I/O (DO/DI)

    1. Weidmuller USB driver installation procedure

    2. Weidmuller configuration procedure

    3. Remote Ethernet I/O configuration

    4. Adding Weidmuller U-Remote cards

    5. Description of standard signals

    6. Rack & Slot

3. Electric and pneumatic panels

    1. 24VDC electric panel

    2. Power electric panel

    3. Pneumatic panel

4. Euromap inputs and outputs

    1. Euromap 67

    2. Euromap 73

    3. Use of relays

5. "User Operator Panel" inputs and outputs (UI/UO)

    1. UI[x] Signals

    2. UO[x] Signals

6. Remote iPendant

Module 5 - Safety zones

In this module, the two main safety zone functions will be covered **(DCS and Space Function)**. The participants will learn how to **create, configure, and use safe robotic zones**. Participants will also learn how to use **reference positions**.

1. Dual Check Safety (DCS)

    1. Joint position check

    2. Cartesian position check

        1. Working zone (Diagonal)

        2. Restricted zone (Diagonal)

        3. Working zone (Lines)

        4. Restricted zone (Lines)

    3. Adding a tool to the robot model

    4. DCS Validation

2. Space Function

    1. Main parameters

    2. Definition of the common space

    3. Using Space Functions in programs

    4. Space Function validation

    5. Reference Positions

    6. HOME Position

    7. GET_HOME and HOME_DIRECT programs

    8. HOME_AUTO and Px_HOMING programs

Module 6 - Advanced path modification methods

Following this module, participants will be able to **make robot path modifications and adjustments** using FANUC advanced functions.

1. Program Adjust

2. Program Shift

    1. Offset

    2. Offset + Rotation

3. Tool Offset

    1. Robot fixed

    2. TCP fixed

4. Frame Offset function

    1. With data conversion

    2. Without data conversion

Module 7 - Robot vision with iRVision

This module introduces participants to the **Fanuc iRVision option** which allows **camera detection and inspection**. Participants will learn to calibrate the camera, configure vision programs, and use these vision programs with instructions in a robot program.

1. Introduction to iRVision

2. Camera calibration

    1. Fixed camera

    2. Camera on robot

3. Creation of a vision program

    1. Basic configurations

    2. Advanced configurations

4. Instructions related to iRVision