MTRN 3060

PRACTICAL WEEK 1

Introduction to RobotStudio

Learning outcome:

- Students will be able to use RobotStudio or similar software to design, simulate and program various types of industrial robots for different applications and scenarios.
- Students will be able to identify and compare the features and capabilities of different types of industrial robots, such as Collaborative Robots, SCARA, delta and cartesian robots.

TASKS:

- **ABB RobotSudio**

What is ABB RobotStudio

RobotStudio is a powerful software developed by ABB, a leading robotics and industrial automation company. It is designed to facilitate the programming, simulation, and offline configuration of industrial robots. RobotStudio provides a virtual environment where users can create, simulate, and optimize robot applications before deploying them in a real-world manufacturing setting.

With RobotStudio, users can visually program robots using a drag-and-drop interface, allowing for intuitive and efficient robot programming. The software supports a wide range of ABB robot models, enabling users to simulate and test robot movements, trajectories, and tasks. This helps streamline the robot programming process and allows for the identification and resolution of potential issues or optimizations before the robot is physically implemented.

Additionally, RobotStudio offers tools for offline robot programming and configuration, eliminating the need for continuous robot downtime during programming. Users can create and modify robot programs offline and then transfer them to the actual robot when ready, saving time and reducing production interruptions.

RobotStudio has a wide range of industry applications across various sectors. Some of the key applications include:

a. Manufacturing: RobotStudio is extensively used in manufacturing industries to program, simulate, and optimize robot applications for tasks such as assembly, welding, material handling, and machine tending. It enables manufacturers to improve productivity, flexibility, and efficiency in their production processes.
b. Automotive: RobotStudio is commonly utilized in the automotive industry for tasks like robot programming, cell layout optimization, and offline robot simulation. It helps

automotive manufacturers streamline their production lines, enhance quality control, and improve the overall efficiency of assembly and welding operations.

c. Electronics: In the electronics industry, RobotStudio is employed for programming and simulating robots used in tasks such as pick-and-place operations, soldering, and inspection. It allows for precise robot control and optimization, ensuring accurate assembly and manufacturing of electronic components.
d. Packaging and Logistics: RobotStudio finds applications in packaging and logistics industries for tasks like palletizing, packaging, sorting, and warehouse automation. It enables efficient and flexible robot programming to handle varying packaging requirements and optimize material flow.
e. Pharmaceuticals and Healthcare: In the pharmaceutical and healthcare sectors, RobotStudio can be utilized for tasks such as laboratory automation, drug manufacturing, and surgical assistance. It ensures precise and controlled robot movements, improving accuracy, safety, and reliability in these critical domains.
f. Food and Beverage: RobotStudio is employed in the food and beverage industry for applications like food handling, packaging, and quality control. It helps ensure compliance with hygiene standards, enhance production efficiency, and maintain product integrity.

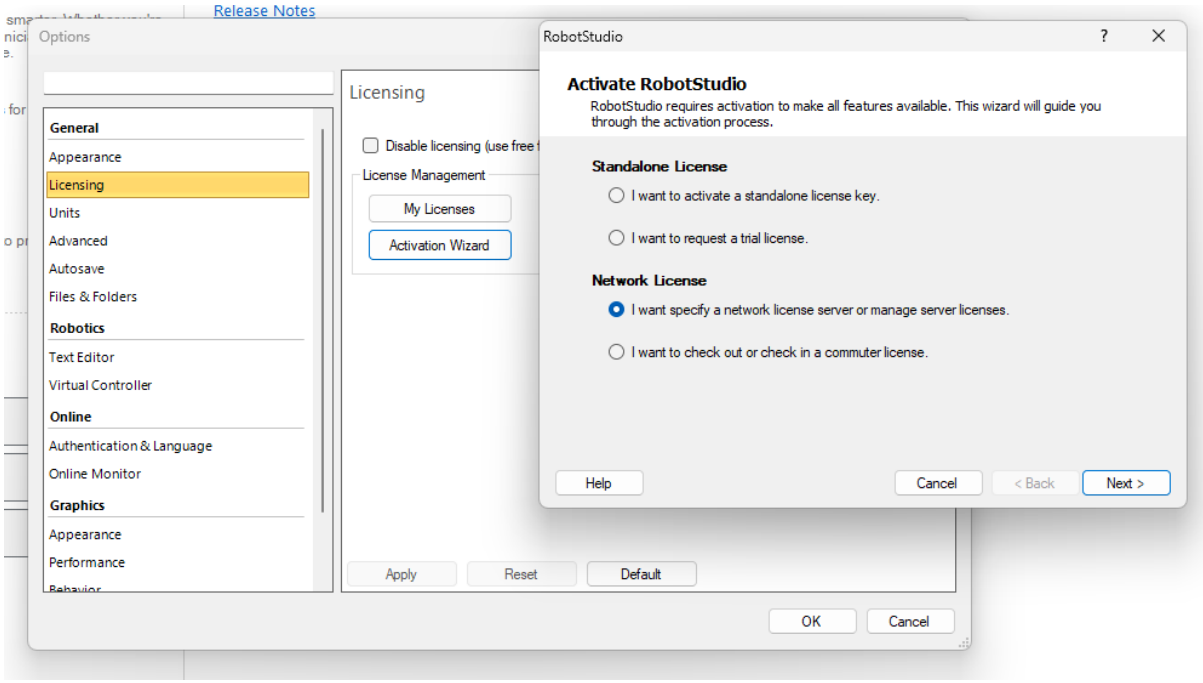
- **Prepare:**
    - Read chapter 1 and 2 of RobotStudio manual.
    - RobotStudio installation instruction (Already installed in lab laptops):

1. Download RobotStudio 2022.3.2 from:

https://new.abb.com/products/robotics/robotstudio/downloads

Next you need to give your details to receive the download link via email. Try to give your personal email here (i.e. Gmail). If you use an email server like MQ, it may mistakenly identify the email as spam, resulting in delays in receiving the link.

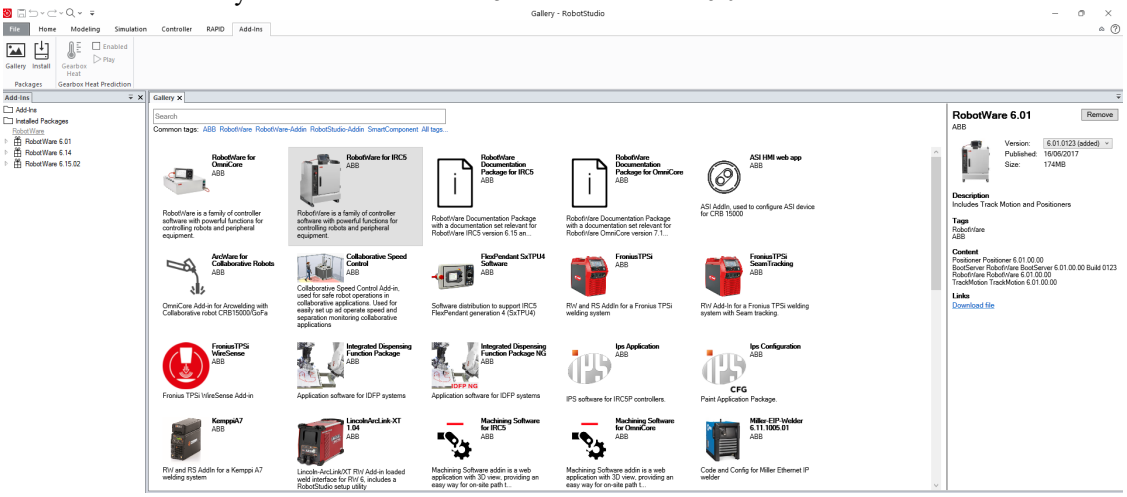
2. Unzip the file → open RobotStudio folder → run setup.exe.
3. To Activate license
4. File → Options → Licensing → Activation Wizard → Network license



5. Ask tutor for the server address.

Note: The license with be automatically withdraw when disconnected from the university network and will be automatically activated when connect to the university network.

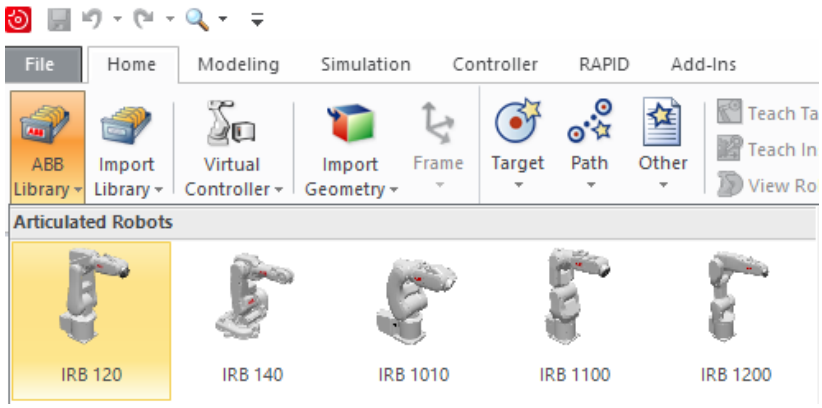
6. Restart RobotStudio
7. Download robotware
   Add-ins tab → Gallery → Robotware for IRC5 → select Version 6.01→ Install.



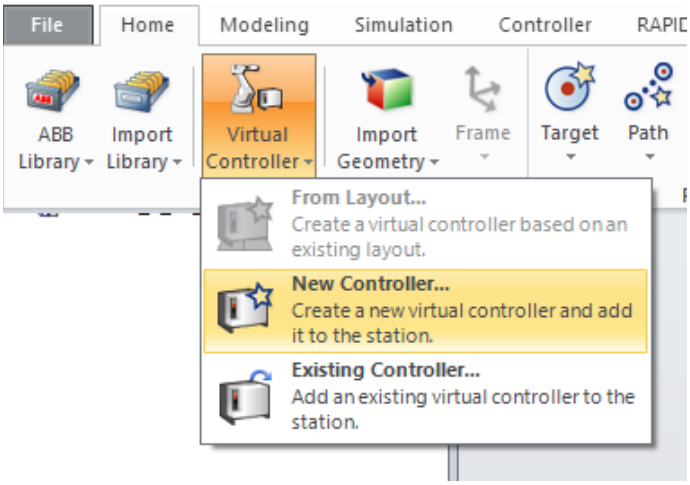
(note: you can install newest version for the demo station with newer features, but it might not working with the robot in the lab)

TASK 1. CREATE ROBOT WORKSTATION IN ROBOTSTUDIO

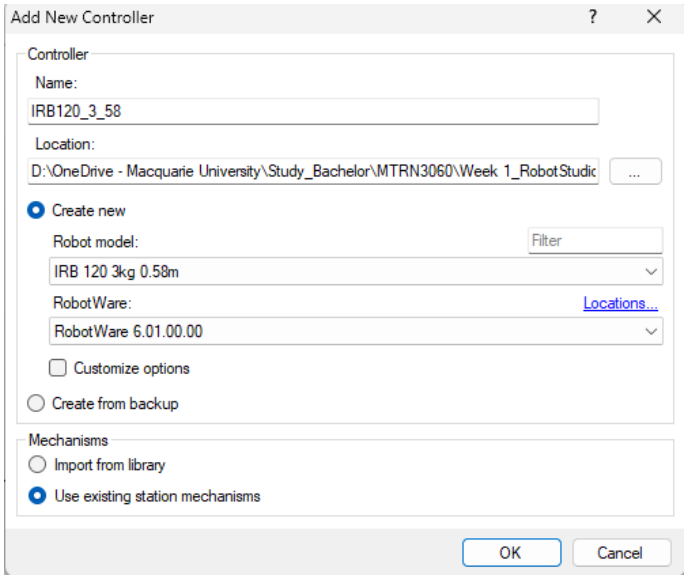
1.1: Open RobotStudio → New → File: station → Create
1.2: To add robot model: Home → ABB Library → IRB120



1.3: To add robot controller: Home→Virtual Controller → new controller

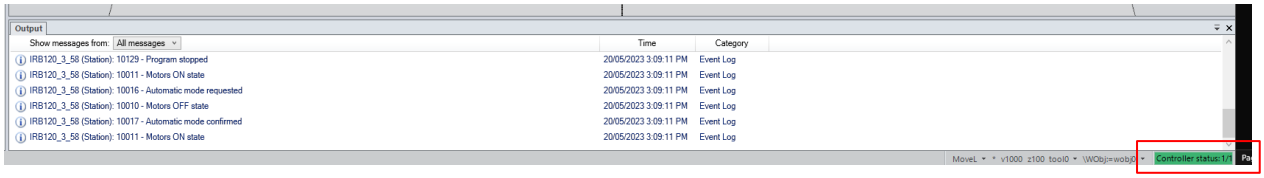


1.4: Select:



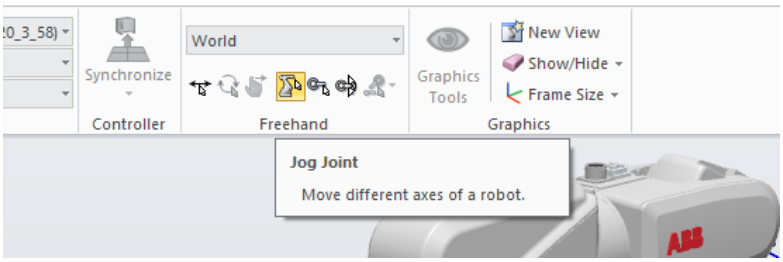
1.4.1. Robot Model: IRB120
1.4.2. RobotWare: 6.01
1.4.3. Use existing station mechanisms.

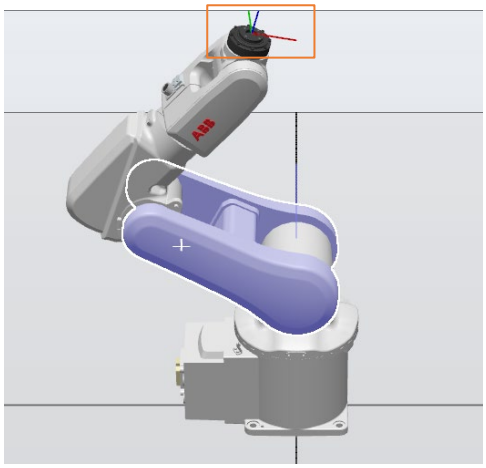
1.5: Wait until controller status is green.
1.6: To manipulate views: try different combinations of button on mouse, ctrl and shift.



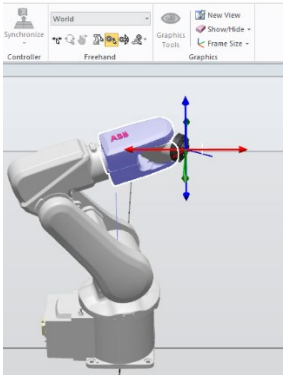
TASK 2. MANUAL JOGGING IN THE SIMULATION

2.1: Change to jog joint  :



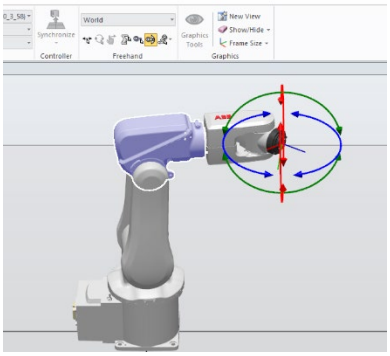


2.2: Describe the jog joint function. What is does? How does it effect the End Effector (EE) position? (Note: An end effector is a device at the end of a robotic arm, in this case it is the robot flange – orange box)



2.3: Change to jog linear  :

2.4: Describe the jog linear function. What is does? How does it effects the joints position?



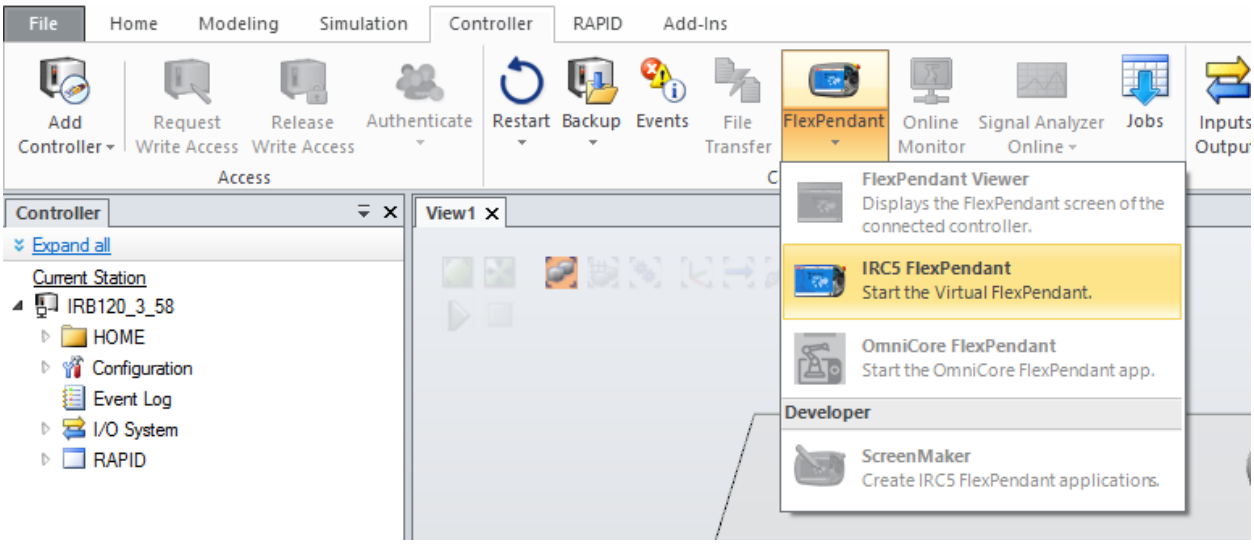
2.5: Change to jog reorient :

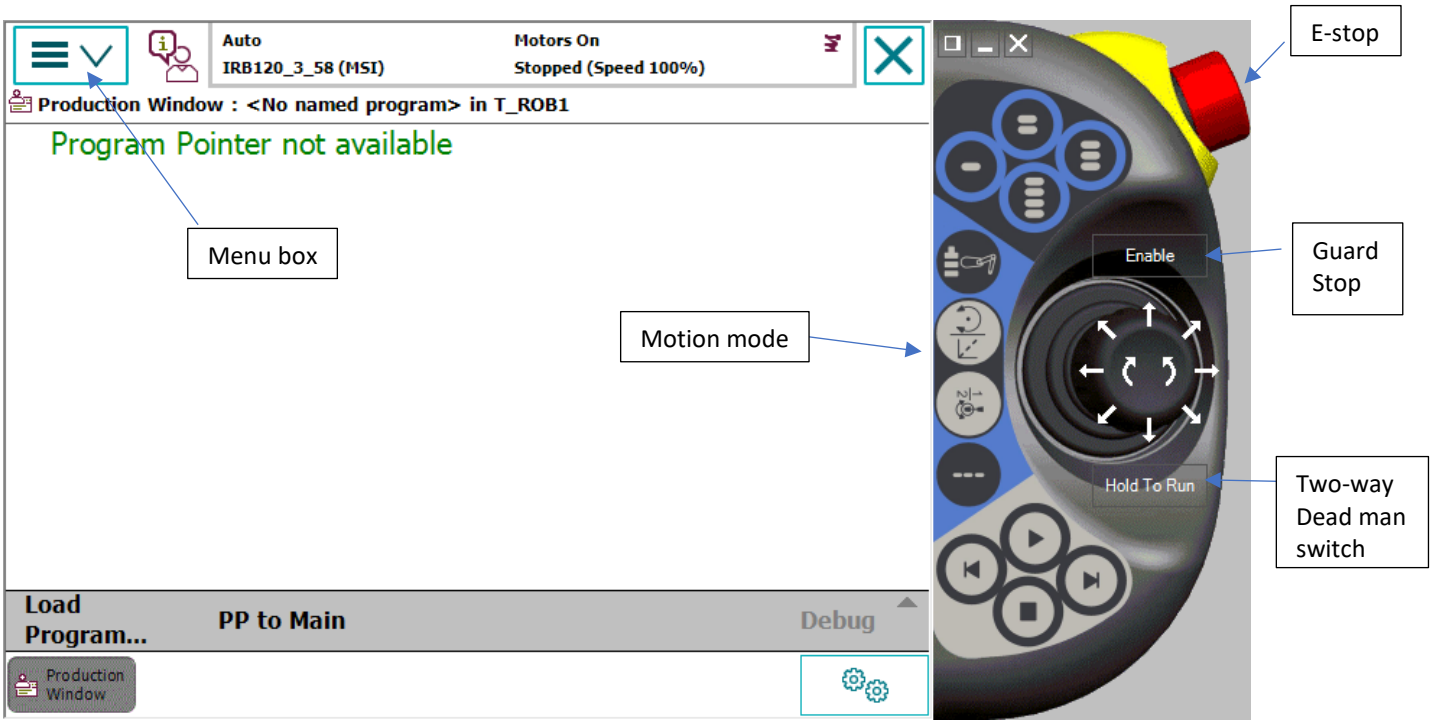
2.6: Describe the jog reorient function. What is does? How does it effects the joints position?

TASK 3. MANUAL JOGGING THE ROBOT USING FLEXPENDANT

A FlexPendant is a user-friendly and intuitive device that allows you to interact with and control an industrial robot. It is connected to the robot controller by a cable and has a touch screen, buttons, and a joystick for easy navigation. A FlexPendant can be used to program, teach, monitor, and operate the robot in various applications. FlexPendant is useful because it provides a graphical user interface that can be customized and adapted to different needs and preferences..

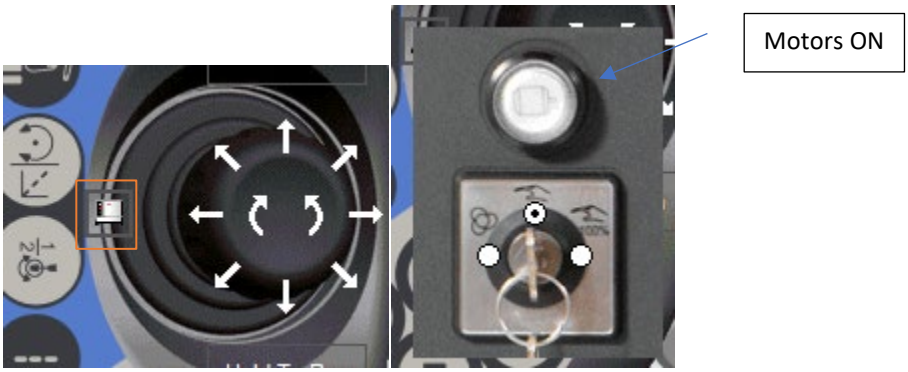
3.1: To open it: Controller →FlexPendant →IRC5 FlexPendant





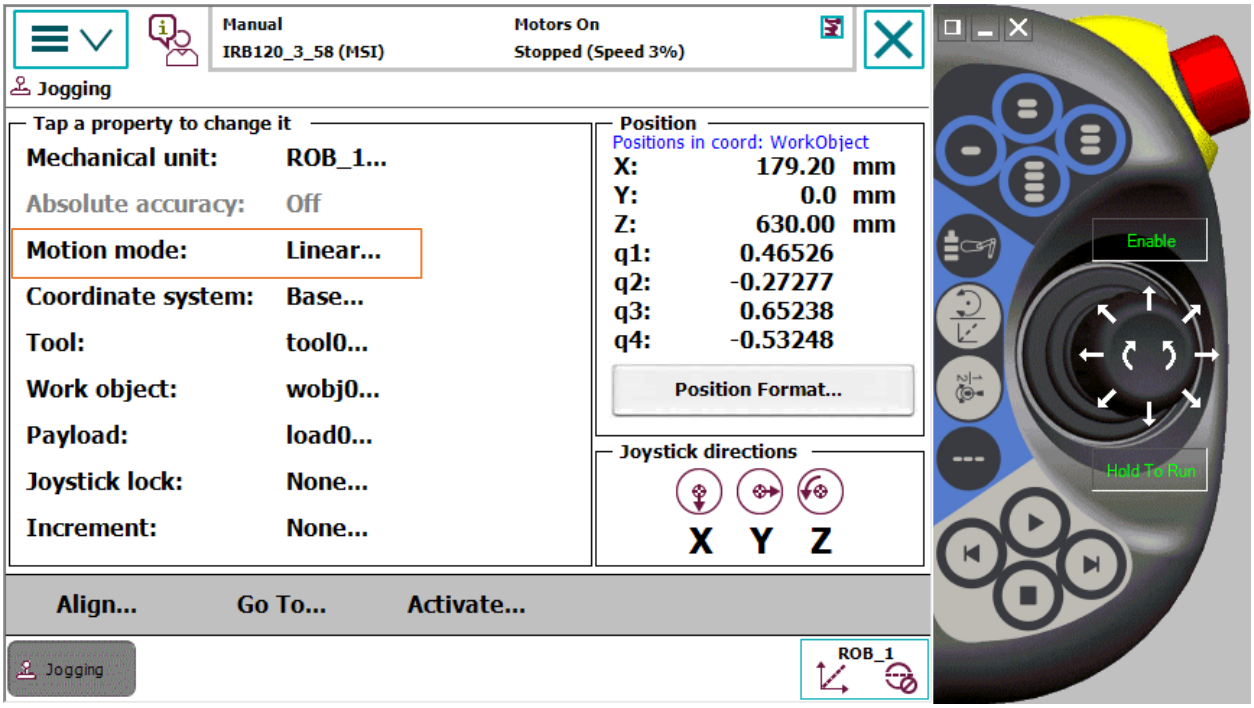
3.2: To manual jogging the robot:

3.2.1. Release E-stop
3.2.2. Open the controller box (click in the white box icon) → switch key to Manual mode → Press the Motors ON signal



3.2.3. Enable Guard stop.
3.2.4. Click Menu Box → jogging

3.2.5. Click the Motion mode button to change mode.
3.2.6. Hold the "Dead man switch" button.



3.2.7. Move the joystick to move the robot manually.

3.3: Write down the joystick directions and corresponding movement:

Motion mode	Joystick	Joint/End Effect
Axis 1-3	-X	Joint 1 rotation
Axis 1-3	-Y	Joint 2 rotation
Axis 1-3	-Z	Joint 3 rotation
Axis 1-3	+X	
Axis 1-3	+Y	
Axis 1-3	+Z	
Axis 1-3	XY	Joint 1 and 2 rotation
Axis 4-6	X	Joint 4 rotation
Axis 4-6	Y	Joint 5 Rotation
Axis 4-6	Z	Joint 6 Rotation
Axis 4-6	XY	Joint 4 and 5 Rotation
Linear	X	Rotates all joints to move end effector linearly
		along the X axis (relative to j6)
Linear	Y	Rotates all joints to move end effector linearly
		along the Y axis (relative to j6)
Linear	Z	Rotates all joints to move end effector linearly
		along the Z axis (relative to tj6)
Linear	XY	Rotates all joints to move end effector linearly
		along the XY axis (relative j6)
Reorient	X	Rotates end effector about the X axis (relative j6)
Reorient	Z	End effector rotation about Z axis
Reorient	Y	End effector rotation about Y axis (relative to j6)
Reorient	XY	End effector rotation about XY axis (relative to j6)

Motion mode	Joystick	Joint/End Effect

TASK 4. DIFFERENT TYPES OF ROBOTS IN INDUSTRIAL

There are many different types of robots because they are designed for different purposes, functions, and applications. Robots can be classified based on different criteria, such as use, movement, and structure. Some common types of robots are cobots, Cartesian robots, SCARA robots, cylindrical robots, delta robots, and polar robots. Robots are used to drive efficiency, expedite processes, improve safety, and enhance experiences across many industries.

Robot type	**Degrees of freedom**	**Speed**	**Accuracy**	**Flexibility**	**Cost** (USD)
Articulated	Anywhere from two to six or more	Approx 450deg/s	+- 1mm	High - different DOF for different applications	$50k to $500k depending on size
SCARA	Four DOF	Very fast, up to 7000mm/s or more	+-0.01mm to <10 microns	Limited payload - typically designed for pick and place	Varies with size $25k to $400k
Delta	4 - Three for XYZ One for rotation of end effector	High speed due to low member weight	+-0.1mm, less accurate than SCARA	Limited payload and limited motion options	Varies with size, relatively cheap as low as $5k
Cartesian	3 DOF	5m/sec or more	Very accurate,	Cannot reach around obstructions	Low due to its simplicity (as low as $1k)
Cylindrical	3 DOF	1000mm/s or more, up to 10,000mm/s	Average accuracy Depends on hardware	Many applications, low range of movement	Varies with size $5000 - $15k
Polar	3 DOF - Depends on design	Relatively slow	Relatively inaccurate	Large footprint, large payload	Expensive given size

Search the "**Industry Robot (IRB)" and "Collaborative Robot (CRB)"** concept on the Internet and compare them using the following table:

Aspect	**Industry Robot (IRB)**	**Collaborative Robot (CRB)**
Safety	Requires training, risk assessments, lockout procedures, and safety measures.	Built in safety features with cameras and sensors. Can adjust speed and position.
Speed	Maximum is under 1m/sec	Fully collaborative robot moves about 250mm/sec

Aspect	**Industry Robot (IRB)**	**Collaborative Robot (CRB)**
Task		
Programming		
Flexibility		
Accessibility		
Sensing capabilities		
Performance		