MTRN3060 Practical Logbook

# Week 1:

## TASK 2

2.2. The jog joint function rotates the corresponding joint about its axis. Jogging joint 0 rotates the base, jogging joint 6 rotates the robot wrist etc.

2.4. The jog linear function moves the coordinate of the end effector linearly to a given point. This adjusts the joints automatically to reach the given point, similar to how it would reach a point defined in a workobject.

2.6. Jog reorient is rotates the end effector coordinates. This alters the joint position to achieve the desired position.

## TASK 3

|  |  |  |
| --- | --- | --- |
| **Motion Mode** | **Joystick** | **Joint** |
| **Axis 1-3** | X | Joint 1 jog |
| Y | Joint 2 jog |
| Z | Joint 3 jog |
| **Axis 4-6** | X | Joint 4 jog |
| Y | Joint 5 jog |
| Z | Joint 6 jog |
| **Linear** | X | Linearly moves end effector along X axis |
| Y | Linearly moves end effector along Y axis |
| Z | Linearly moves end effector along Z axis |
| **Reorient** | X | Rotates end effector coordinates about X axis |
| Y | Rotates end effector coordinates about Y axis |
| Z | Rotates end effector coordinates about Z axis |

## TASK 4

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Type** | **DOF** | **Speed** | **Accuracy** | **Flexibility** | **Cost (USD)** |
| Articulated | 4 or more | Approx. 450deg/s max | +- 1mm | High, depending on DOF | Wide range (10k – 150k) |
| SCARA | 4 | Very fast (up to 7m/s) | +-0.01mm to <10microns | Limited payload mainly pick and place | Varies with size  25k – 400k |
| Delta | 4 (X, Y, Z and end effector) | Fast due to low weight | +- 0.1mm | Limited payload limited motion | As low as 5k |
| Cartesian | 3 DOF | 5m/s or more | Very accurate | Cannot reach around obstruction | As low as 1k |
| Cylindrical | 3 DOF | 1000m/s to 10,000m/s | Average. Depends on hardware | Many applications but low range of movement | 5k to 15k |
| Polar | 3 DOF depend on | Relatively slow | Relatively inaccurate | Large footprint large payload | Expensive given size |

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| **Aspect** | **Industry Robot (IRB)** | **Collaborative Robot (CRB** |
| **Safety** | Requires training, risk assessment, lockout procedures | Built in safety with sensors and cameras. Can adjust speed and position based on sensor input. |
| **Speed** | Max under 1m/s | Fully collaborative robots move about 250mm/s |
| **Task** | Whatever the robot is designed for | Whatever the robot is designed for |
| **Programming** | Coding (C++ RAPID Java Python) | Learn by observation of humans completing tasks |
| **Flexibility** | Low, requires reprogramming | High, can be taught new tasks easily |
| **Accessibility** | Low, requires training and expertise | High, can be used safely by anyone with minimal training. |
| **Performance** | High performance | Low performance for safety |

# Week 2:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Feature** | **Revolute** | **Linear** | **Twisting** | **Orthogonal** | **Revolving** |
| **Structure** | Pin or knuckle  joint through a  rotary bearing | Rail or telescoping mechanism and piston | Two shafts connected with a bearing parallel | Rail with a output link running perpendicular to it | Two shafts connected with a bearing perpendicular |
| **Mobility** | One degree of  freedom  (rotation) | One degree of freedom (linear) | One degree of freedom (rotation) | One degree of freedom (linear) | One degree of freedom (rotation) |
| **Example** | Elbow, knee,  interphalangeal  joints | Gas lift in a chair | Wheel on a skateboard | Overhead power lines for trains | Propeller and hub |

|  |  |  |
| --- | --- | --- |
| **No** | **Type** | **Mobility** |
| 0 | Twisting | 1 Degree of freedom |
| 1 | Revolute | 1 Degree of freedom |
| 2 | Revolute | 1 Degree of freedom |
| 3 | Twisting | 1 Degree of freedom |
| 4 | Revolute | 1 Degree of freedom |
| 5 | Twisting | 1 Degree of freedom |

2.1. The IRB120 has a roughly spherical work envelope with a gap at the back where it would interfere with its own connections. It also has a gap near the base of the robot where it would collide with itself.

2.2 The IRB120 uses polar configuration, as it has a spherical work envelope based around a fixed base point.

2.3 The end effector coordinate is offset perpendicular to the flange by 20cm.

# Week 3:

Here are highlights of this week’s practical:

* Introduced to RAPID programming and became familiar with paths and programs in the RobotStudio environment.
* Learned to mount tools to the end of the IRB120
* Learned how to use autopath to generate paths around geometry perimeters.
* Learned how to transfer RAPID code to the real IRB120
* Experimented with creating a new pen holder in CAD

# Week 4:

Using MHS3-20D

***1.4.1. What is the Bore dimension? What does the Bore dimension mean?***

20mm, the "bore dimension" refers to the diameter of the central hole or opening within the gripper's body.

***1.4.2. What is the maximum Pressure and Internal Force of 20mm fingers?***

0.6 MPa pressure and approximately 36N

***1.4.3. Why are there two locations for mounting the Auto switch?***

Provides flexibility of mounting options for sensor placement. Different applications will require different sensing capabilities.

***1.4.4. How to mount the adapter to the robot flange?***

Given “The adaptor and fingers are customized parts for each Robot and tool” the mounting procedure differs for each custom adapter. Although typically it involves passing fasteners through the adapter into the appropriate mounting holes in the adapter, and into the mounting holes on the robot.

***1.4.5. How to mount the MHS3-20D gripper to the adapter?***

This process varies from adapter to adapter.

# Week 5:

***EEPROM***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Address | Data/Function Name | Usage | Access | Initial Value |
| 0 | Model Number (L) | Lowest byte of model number | R | 12 |
| 1 | Model Number (H) | Highest byte of model number | R | 0 |
| 2 | Version of Firmware | Info on version of firmware | R | - |
| 3 | ID | ID of dynamixel | RW | 1 |
| 4 | Baud Rate | Baud rate of dynamixel | RW | 1 |
| 5 | Return Delay Time | Return delay time | RW | 250 |
| 6 | CW Angle Limit(L) | Lowest byte of clockwise angle limit | RW | 0 |
| 7 | CW Angle Limit(H) | Highest byte of clockwise angle limit | RW | 0 |
| 8 | CCW Angle Limit(L) | Lowest byte of CC angle limit | RW | 255 |
| 9 | CCW Angle Limit(H) | Highest byte of CC angle limit | RW | 3 |
| 11 | Highest Limit Temp | Internal limit temp | RW | 70 |
| 12 | Lowest Limit Voltage | Lowest limit voltage | RW | 60 |
| 13 | Highest Limit Voltage | Highest limit voltage | RW | 140 |
| 14 | Max Torque (L) | Lowest byte of max torque | RW | 255 |
| 15 | Max Torque(H) | Highest byte of max torque | RW | 3 |
| 16 | Status return level | Status return level | RW | 2 |
| 17 | Alarm LED | LED for alarm | RW | 36 |
| 18 | Alarm Shutdown | Shutdown for Alarm | RW | 36 |

***RAM***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Address | Data/Function Name | Usage | Access | Initial Value |
| 24 | Torque Enable | Torque on/off | RW | 0 |
| 25 | LED | LED on/off | RW | 0 |
| 26 | CW Compliance Margin | CW Compliance Margin | RW | 1 |
| 27 | CCW Compliance Margin | CCW Compliance Margin | RW | 1 |
| 28 | CW Compliance Slope | CW Compliance Slope | RW | 32 |
| 29 | CCW Compliance | CCW Compliance Slope | RW | 32 |
| 30 | Goal Position L | Lowest byte of goal position | RW |  |
| 32 | Goal Position H | Highest byte of goal position | RW |  |
| 34 | Torque limit L | Lowest byte of torque limit | RW | ADD14 |
| 35 | Torque limit H | Highest byte of torque limit | RW | ADD15 |
| 36 | Present position L | Lowest byte of current position | R |  |
| 37 | Present position H | Highest byte of current position | R |  |
| 38 | Present speed L | Lowest byte of current speed | R |  |
| 39 | Present speed H | Highest byte of current speed | R |  |
| 40 | Present load L | Lowest byte of current load | R |  |
| 41 | Present load H | Highest byte of current load | R |  |
| 42 | Present voltage | Current voltage | R |  |
| 43 | Present temp | Current temp | R |  |
| 44 | Registered | Means if instruction is registered | R | 0 |
| 46 | Moving | Means if there is any movement | R | 0 |
| 47 | Lock | Locking EEPROM | RW | 0 |
| 48 | Punch L | Lowest byte of punch | RW | 32 |
| 49 | Punch H | Highest byte of punch | RW | 0 |