Expt. No. 1 Page No. 1

Expt. Name Introduction to Robot simulation. Date : 5/2/24

LAB OBJECTIVES:

- Understand the functionality of robot actuators.
- Explore the kinmatic structure of the ABB IRB - 1520 robot
- Learn about the importance of robot safety systems and implimentation

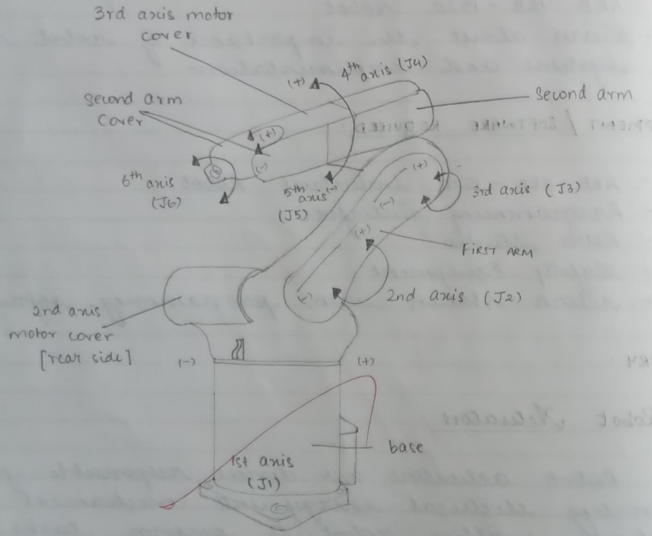
EQUIPMENT / SOFTWARE REQUIRED :

- ABB IRB - 1520 industrial Robot
- Programming Interface
- Robo studio
- Safety Equipment
- Work station with programming software.

THEORY :

→ Robot Actuators :

Robot actuators are divices responsible for converting electrical energy into mechanical motion, enabling robot to perform tasks. In the ABB IRB - 1520, actuators control the movement of joints and the end - effector. Common types of actuators include electric motors, hydraulic actuators, and pneumatic



actuators. Understanding the function and operation of actuators is crucial for programming robot movements accurately and efficiently.

Robot Kinematics :

Robot Kinematics is the study of the movement of robot components without considering the forces causing the motion. The kinematic structure of ABB IRB - 1520 includes multiple joints and linkages that allow for complex motion patterns. By analyzing kinematics, programmers can determine the relationship between joint angles and end-effector positions. This understanding is essential for motion planning, trajectory generation and optimizing robot performance.

Robot Safety Systems :

Robot safety systems are designed to minimise the risk of accidents and injuries in industrial environments. The ABB IRB - 1520 is equipped with various safety features, including emergency stop buttons, safety fences and collision detection sensors. These systems help prevent collisions with obstacles or human operators, ensuring a safe working environment. Understanding and implementing

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safety protocols are essential aspects of robot programming to protect both personnel and equipment.

INDUSTRIAL ROBOT PROGRAMMING LANGUAGES :

Industrial robots are programmed using specialised programming languages tailored to their control systems. Common industrial robot programming languages include :

Rapid : ABB robots, including the IRB-1520, use Rapid as their native programming language. It is a high-level, task oriented language designed for ease of use and quick deployment of robot applications.

KUKA Robot Language (KRL) : KUKA robots use KRL for programming, which is a high-level language similar to C++ and Pascal.

Fanuc Robot Language (FRL) : Fanuc Robot utilize FRL, a language optimized for controlling robotic movements and tasks.

LAB GUIDELINES :

1. Follow all safety protocols outlined by the instructor.

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2. Work in pairs or groups to troubleshoot and solve programming languages.

3. Keep the workspace clean and organized.

4. Report any equipment malfunctions or safety concerns promptly.

Expt. No. 2 Page No. 5

Expt. Name BASIC SIMULATION OF IRB 1520 ROBOT Date : 12/2/24.

AIM : Basic simulation of industrial robot IRB 1520.

ROBOT SPECIFICATIONS :

- Robot Make : ABB
- Model : IRB 1520
- Pay load capacity : 4.5 kg
- Maximum reach : 1.5M
- Configuration : Articulated / joined arm.
- gripper type : Mechanical gripper
- no. of axis : 6 axis.

PROCEDURE :

- Turn on the robot and connect it steadily.
- For major axis :
  - use left and right for axis 1
  - use up and down for axis 2
  - use clockwise and anticlockwise for axis 3
- For minor axis :
  - use left and right for axis 4.
  - use up and down for axis 5.
  - use clockwise and anticlockwise for axis 6.

RESULT :

The basic simulation of the industrial robot was carried out successfully.

Expt. No. 3. Page No. 6

Expt. Name SIMPLE PICK AND PLACE OPERATION. Date : 12/2/24.

AIM :

To move an object by basic simulation, simple pick and place operation.

ROBOT SPECIFICATIONS :

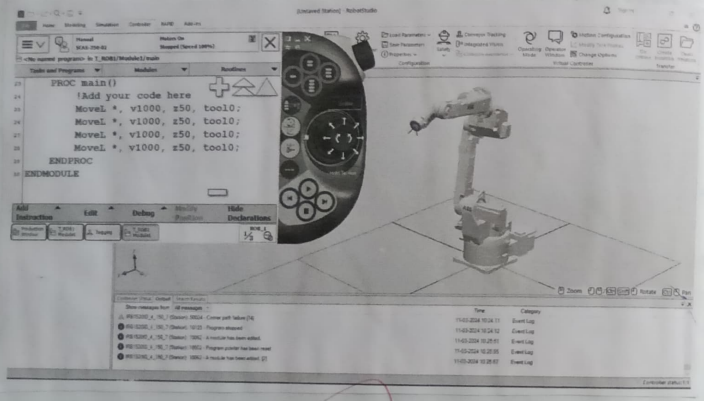
- Robot make : ABB
- Model : IRB 1520
- Pay load capacity : 4.5 kg
- Maximum reach : 1.5M
- configuration : Articulated / joined arm
- gripper type : mechanical gripper
- no. of axes : 6.

PROCEDURE :

- Turn on the robot and connect it steadily
- For major axis :
  - use left and right for axis 1.
  - use up and down for axis 2
  - use clockwise and anticlockwise for axis 3.
- For minor axis :
  - use left and right for axis 4.
  - use up and down for axis 5.
  - use clockwise and anticlockwise for axis 6.
- Use these functions to perform simple pick and place operation.

RESULT :

Thus, simple pick and place was performed successfully.



Expt. No. 4. Page No. 7.

Expt. Name Simple programming using Move L command. Date : 19/2/24.

AIM:

To perform a simple programming using Move L command instructions for IRB1520 ID robot in robot studio.

APPARATUS REQUIRED:

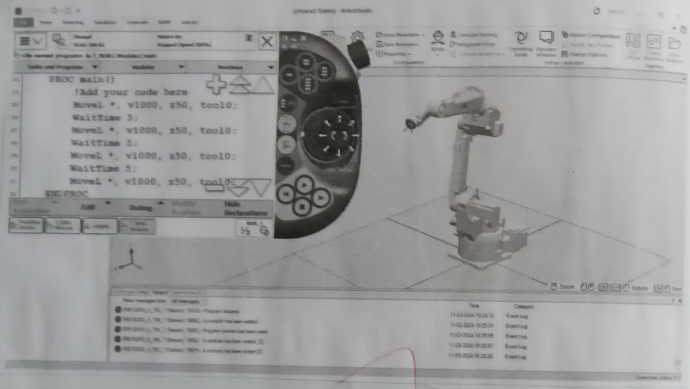
Robot Studio simulation software

PROCEDURE:

i) Open IRB1520 robot controller from virtual controller.
ii) Open the flex pendant and turn it to manual mode.
iii) Open the program editor and start the program
iv) Select the Move L command from 'add instruction' section and modify the position.
v) Move the robot after modifying the position
vi) Play the simple program in auto mode.

Results:

Thus simple programming using Move L instruction in Robot Studio performed successfully



Expt. No. 5. Page No. 8

Expt. Name simple programming using wait time command. Date : 04/3/24

AIM:

To perform a simple programming using WaitTime command in IRB1520 robot in Robot Studio.

APPARATUS REQUIRED:

Robot Studio simulation software.

PROCEDURE:

i) Open IRB1520 robot controller from virtual controller.
ii) Open the flex pendant and turn it to Move L command.
iii) Open the program editor and start the program.
iv) After performing Move L command add WaitTime of 5 seconds.
v) Play the simple program in automode and verify.

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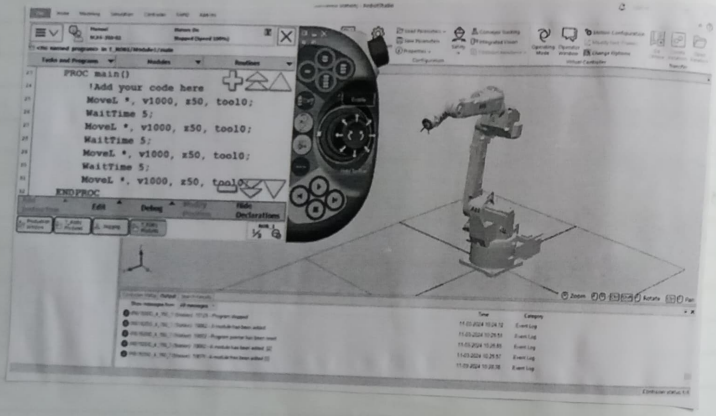
Expt. Name _____ Date : _____

PROGRAM :

```
PROC main ( ) :
    MoveL *, V1000 , Z50 , tool0 ;
    WaitTime 10;
    MoveL *, V1000, Z50 , tool0 ;
    WaitTime 10;
END PROC
END MODULE
```

Result :

Thus, simple programming using waitTime command in IRB1520 ID robot in robot studio was performed successfully.



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Expt. Name _____ Date : _____

AIM:

Simulation of simple program using WAIT command in Automatic mode using Robot Studio.

APPARATUS REQUIRED:

Robot Studio simulation software.

PROCEDURE:

i) Open IRB1520 ID robot controller from virtual controller.

ii) Open the program editor and start the program.

iii) After performing basic moveL command, add Wait command from the add instructions section with a wait time of 10 seconds.

iv) Switch the flex pendant to automatic mode.

v) Play and verify the program.

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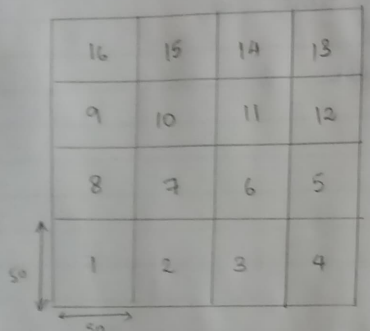
Expt. Name _____ Date : _____

PROGRAM :

```
PROC Main ()
    MoveL *, v1000, z50, tool0;
    WaitTime 10;
    MoveL *, v1000, z50, tool0;
    WaitTime 10;
END PROC
END MODULE.
```

Result :

Thus the simple programming by adding Wait Time command in automatic mode in Robot Studio is performed successfully.



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Expt. Name _____ Date : _____

AIM :

To perform simple program of palletizing operation in the given pallet with IRB1520ID industrial robot.

ROBOT SPECIFICATIONS:

i) Robot make : ABB
ii) Robot model : IRB 1520
iii) Pay load capacity : 4.5 kgs
iv) maximum reach : 1.5 m
v) configuration : Articulated arm
vi) gripper type : mechanical gripper
vii) no. of axis : 6 axis.

PROCEDURE :

i) Turn on the robot and connect it steadily.
ii) For major axis :
- use left and right for axis 1
- use up and down for axis 2
- use clockwise and anticlockwise for axis 3.
iii) For minor axis :
- use left and right for axis 4
- use up and down for axis 5
- use clockwise and anticlockwise for axis 6.
iv) use these functions to perform palletizing operation in the given

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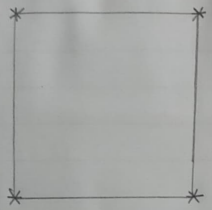
pallet.

Result:

Thus, the palletizing operation was performed successfully.



Expt. No. 8. Page No. 14

Expt. Name _____ Date : _____

AIM :

Performing square tracing operation in Robot Studio.

APPARATUS :

Robot Studio simulation software.

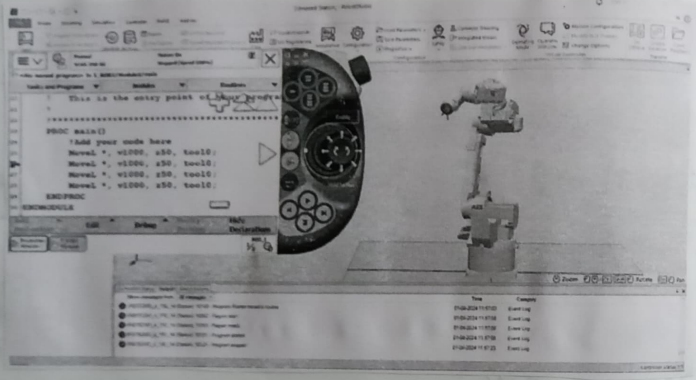
PROCEDURE :

i) Open IRB1520 ID robot controller from virtual controller.

ii) Open the program editor and start the program.

iii) Using Move L command, modify the target positions of the end effector in such a way that it moves in a square tracing path.

iv) Switch the flex pendant to automatic mode.



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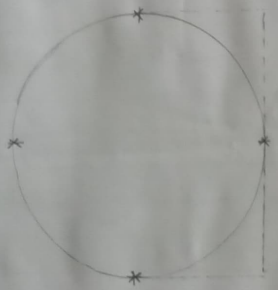
Expt. Name _____ Date : _____

CODE :

```
PROC main()
    MoveL*, v1000, z50, tool0;
    MoveL*, v1000, z50, tool0,
    MoveL*, v1000, z50, tool0;
END PROC
END MODULE
```

Result :

Thus, the square tracing operation is performed in the Robot Studio.



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Expt. Name _____ Date : _____

AIM :

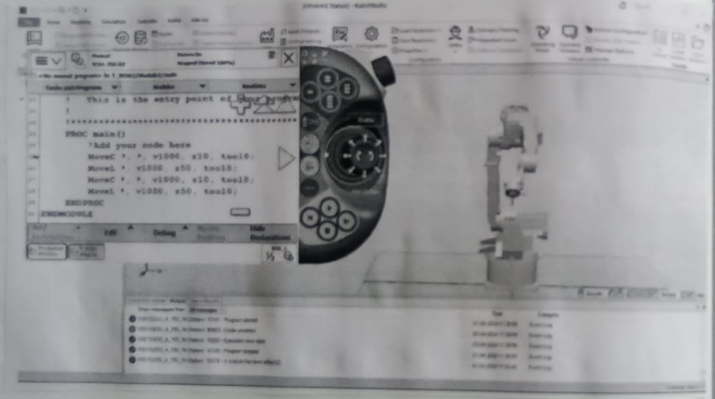
Performing circle tracing operation in Robot Studio.

APPARATUS :

Robot simulation software.

PROCEDURE :

i) Open IRB1520 ID robot controller from virtual controller
ii) Open the flex pendant and turn it to manual mode
iii) Open the program editor and start the program there.
iv) Modify the positions of the end effector in orthogonal position using Move C.
v) Repeat the same steps to trace a complete circle
vi) Switch the flex pendant to automatic mode.
vii) Play and verify the program.



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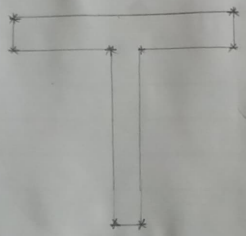
Expt. Name _____ Date : _____

CODE :

```
PROC main()
    MoveC *, *, v1000, z10, tool0;
    MoveL *, v1000, z50, tool0;
    MoveC *, *, v1000, z10, tool0;
    MoveL *, v1000, z50, tool0;
END PROC
END MODULE
```

Result :

Thus, the circle tracing operation was successfully performed in Robot Studio.



Expt. No. 10. Page No. 18

Expt. Name _____ Date : _____

AIM :

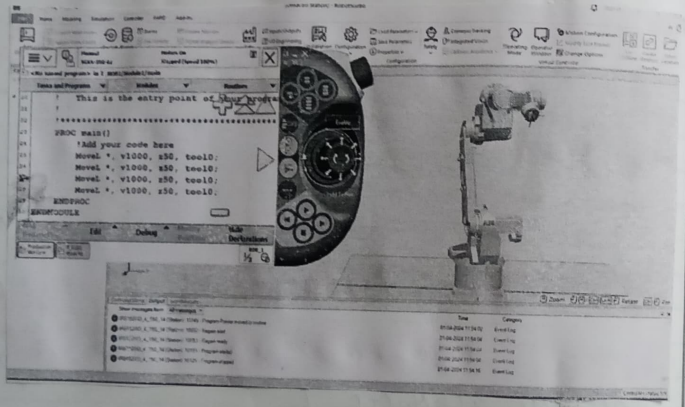
Performing letter tracing operation in Robot Studio.

APPARATUS :

Robot Studio simulation software.

PROCEDURE :

i) Open IRB1520 ID robot controller from virtual controller.
ii) Open the flex pendant and turn it to manual mode
iii) open the program editor and start your program.
iv) Using MoveL command, modify the target positions of the end effector in such a way that it moves in path of the alphabet T.
v) Switch the flex pendant to automatic mode
vi) Play and verify the program.



Expt. No. _____ Page No. 19.

Expt. Name _____ Date : _____

CODE :

```
PROC main ()
    MoveL *, V1000, Z50, tool 0;
    MoveL *, V1000, Z50, tool 0;
    MoveL *, V1000, Z50, tool 0;
    MoveL *, V1000, Z50, tool 0;
END PROC
END MODULE.
```

Result :

Thus, the tracing operation of the letter T in Robot studio was performed successfully.