

Drexel University
Goodwin College
School of Technology and Professional Studies
Engineering Technology
MET 205: Robotics and Mechatronics
Lab 1 Dual-axis Robot Controller

Objective:

1. To learn the basics of a robot (YPX Series)
2. To learn about the robot Controller. (DRC Series)
3. To learn to teach points.
4. To write a Simple program.

YPX Robot

YAMAHA YP-X series robot is Yamaha's original pick & place type robot developed in pursuit of higher speed, more compact size and more ease of use.

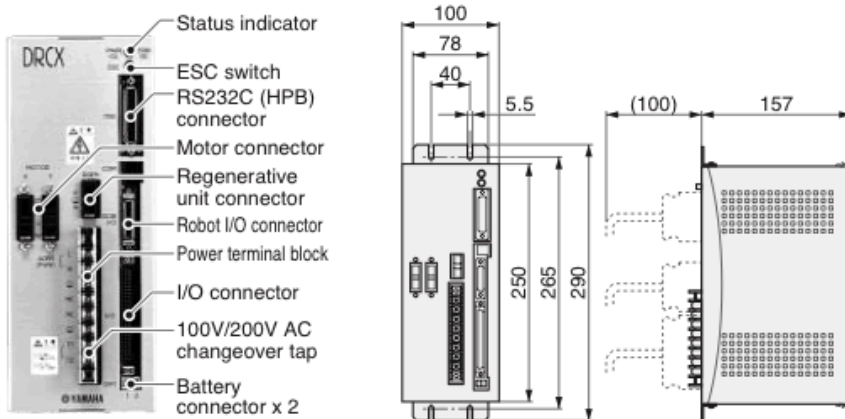


Features of YP 220 X:-

1. Compactly designed super high speed 2 axes robots with belt driven X and Z axes combined
2. Super high speed type with 0.45sec cycle time as standard. Although as compact as 109mm in overall width, the operation area size is 200mm for X axis and 100mm for Z axis.
3. Highly rigid Z axis guide assures 3kg payload at the end section.

The YP-X series robots use the QRCX, TRCX, and DRCX as their robot controllers. We are going to use DRCX series.

DRC X model: (Dual –axis Robot Controller)



The DRC Series can be used in combination with the single-axis FLIP series 2 Axis YK or Cartesian robot for positioning or pick and place work of various machine parts and devices. With the DRC Controller, either the DPB programming unit or a personal computer can be operated, depending on how connection is made.

DRCX controllers do not have batteries to keep the origin position in the memory when the power is turned off. So, every time this controller is turned on return to origin operation should be done.

To perform Return to Origin:



- 1) Press F2 (OPRT) on the initial Screen.
- 2) Next, Press F1 (ORG)
- 3) Select the axis to perform return-to-origin. To perform return-to-origin on all axes, press **F1** (ALL). To perform return-to-origin on the X-axis only, press **F2** (X). To perform return-to-origin on the Y-axis only, press **F3** (Y).
- 4) To perform return-to-origin, press **F1** (yes). To cancel the operation, press **F2** (no).
- 5) When return-to-origin is completed normally, the machine reference appears on the lower right of the screen. Press the **ESC** key returns to the screen of step 2.

Editing Points:



There are three methods to enter point data: manual data input (MDI), teaching playback, and direct teaching.

- Manual data input allows you to directly enter point data with the TPB number keys.
- Teaching playback moves the robot in manual operation to a desired position and then obtains that position as point data.
- Direct teaching is basically the same as teaching playback, except that you move the robot by hand.

Manual Data Input:

- 1) On the initial screen, press **F1** (EDIT).
- 2) Next, press **F2** (PNT).
- 3) Press **F1** (MDI).
- 4) The currently selected X axis point data in the program being executed is displayed on the screen. If the point data to be edited is different from that displayed, press the (STEP UP) and (STEP DOWN) keys to scroll the point data. To switch directly to a certain point data, press the **F1** (CHG) key.
- 5) Input the point number to be edited with the number keys, and press the  key.
- 6) Input point data with number keys. To edit the X axis data again, press (XZ±). To edit the Y axis data, press (YR±). After the X axis data and Y axis data are input, finally press .

Teaching Playback:

- 1) On the initial screen, press **F1** (EDIT).
- 2) Next, press **F2** (PNT).
- 3) Press **F2** (TCH).
- 4) The currently selected point data in the execution program appears on the screen. If you want to edit another point data, press the (STEP UP) and (STEP DOWN) keys to scroll the point data. To directly select the point data, press **F1** (CHG).
- 5) Enter the point number you want to edit with the number keys, and press .
- 6) Move the robot to the teaching position and press the key . The current position is input as point data.

Method to create and run a program

1. Creating a new Program:

EDIT > PGM > CHG > enter Program no. > Confirm Message > write a program.

With the help of other keys we can correct, add, delete, and insert a step.

2. Running your Program:

OPRT > AUTO > CHG > enter the program no. > RUN

Programming DRCX:

The DRCX controller uses the YAMAHA robot language that is very similar to BASIC. It allows you to easily create programs for robot operation. In programs created with the YAMAHA robot language, the robot position data (absolute position, amount of movement) are not expressed in terms of direct numeric values. Instead, point numbers are used to express the position data indirectly. Point numbers and their corresponding position information are stored as point data separately from programs.

Some Common Commands:

1. MOVA

Function: Moves to a point specified by a point number (Moves to an absolute position relative to the origin point).

Format: MOVA <point number>, <maximum speed>

2. JMP

Function: Jumps to a specified step in a specified program.

Format: JMP <label number>, <program number>

3. L

Function: Defines the jump destination for JMP, JMPF or JMPB statements, etc.

Format: L <label number>

4. TIMR

Function: Waits for a specified amount of time before advancing to the next step.

Format: TIMR <time>

5. MOVI

Function: Moves a distance specified by a point number from the current position.

Format: MOVI <point number>, <maximum speed>

Sample Program:

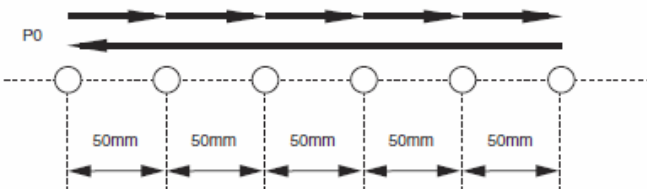
Moving between two points



Program		Comment
[NO0]		
001: L	0	; Label definition
002: MOVA	1, 100	; Moves to P1
003: MOVA	2, 100	; Moves to P2
004: TIMR	100	; Delays for one second
005: JMP	0, 0	; Returns to L0

Exercise: (Replace the 50 mm to 10 mm)

Moving at an equal pitch



Define two points and use MOVA & MOVI commands to move 5 equal pitches with 1 second delay on each point and then go back to the first point. Keep the robot in the loop until the stop button is pressed.

- Requirements:
1. Robotic calibration in XY coordinate: Gently but firmly tape a pencil or marker closed around the robot arm. Bring the robot to a position in which the pencil point touches a mark of a ruler. Calibrate if the robot moves to the positions (actual) as the positions programmed in teach pendant. Record the positions (mm) the robot moves.
 2. Try 4 different speeds at 2%, 4%, 6%, and 8% of system speed for running the program and record the cycle time for each test. Plot a graph of cycle time vs. speed percent.
 3. Calculate speeds in terms of mm/s and ipm (inch per minute). Plot graphs of speed vs. speed percent.
 4. What is the effect of cycle time on productivity and quality in a production line?