



Western Technical College

10620165 Robotic Maintenance

Course Outcome Summary

Course Information

Description	This course reinforces prior knowledge from previous robotics classes. An emphasis will be placed on Robot I/O, external I/O, and integrating the controller with other automation devices.
Career Cluster	Manufacturing
Instructional Level	Associate Degree Courses
Total Credits	2
Total Hours	54

Pre/Corequisites

Prerequisite 10664107 Intro to Industrial Robotics

Textbooks

Yaskawa DX200 Robotic Maintenance Kit - Revised March, 8, 2017. Publisher: Yaskawa Academy. Required.

Success Abilities

1. Cultivate Passion: Expand a Growth-Mindset

Program Outcomes

1. Repair electrical and mechanical systems

Course Competencies

1. Identify components of the DX200 pendant hardware.

Assessment Strategies

- 1.1. Written Objective Test - minimum score of 70%
- 1.2. Skill Demonstration

Criteria

You will know you are successful when

- 1.1. you locate the hardware on the DX200 pendant.
- 1.2. you describe the function of the hardware on the DX200 pendant.
- 1.3. you locate and manipulate basic controls on the DX200 pendant.

Learning Objectives

- 1.a. Identify the location and function of the Mode Selector switch.
- 1.b. Identify the location and function of the E-Stop.
- 1.c. Identify the location and function of the Start.
- 1.d. Identify the location and function of the Button.
- 1.e. Identify the location and function of the Hold Button.
- 1.f. Identify the location and function of the Servo.
- 1.g. Identify the location and function of the On Ready.
- 1.h. Identify the location and function of the Servo Enable.
- 1.i. Identify the location and function of the Area Key.
- 1.j. Identify the location and function of the Cursor Key.
- 1.k. Identify the location and function of the Select Key.
- 1.l. Identify the location and function of the Cancel Key.
- 1.m. Identify the location and function of the Editing Keys.
- 1.n. Identify the location and function of the Main Menu Key.

2. Jog the robot using available coordinate systems.

Assessment Strategies

- 2.1. Skill Demonstration

Criteria

You will know you are successful when

- 2.1. you differentiate between SLURBT and the rectangular coordinate system.
- 2.2. you jog the robot in the SLURBT coordinates.
- 2.3. you jog the robot in the rectangular coordinate system.

Learning Objectives

- 2.a. Investigate the following coordinate systems: S,L,U,R,B,T, and X,Y,Z,Rx,Ry, and Rz
- 2.b. Investigate the rectangular coordinate system.
- 2.c. Investigate User Frame coordinate system.
- 2.d. Investigate Tool coordinate system.
- 2.e. Investigate the cylindrical coordinate system.
- 2.f. Use the axis keys as S,L,U,R,B,T to jog the robot in Joint coordinates at different Manual Speeds.
- 2.g. Display the robot motors' positions in PULSE.
- 2.h. Use the axis keys as X,Y,Z,Rx,Ry,Rz to jog the robot in RECT/CYL, & TOOL coordinates at different Manual Speeds.
- 2.i. Display the robot's TCP position in ROBOT Frame data type.

3. Execute various job functions for robot motion.

Assessment Strategies

- 3.1. Skill Demonstration

Criteria

You will know you are successful when

- 3.1. you create, display, select a job and set a master job.
- 3.2. you create a new job, program steps, and verify playback with forward/reverse and interlock test start.
- 3.3. you play a job in the three cycle settings and demonstrate the use of the start, hold, and estop buttons

- within play mode.
- 3.4. you delete, undelete, copy, and rename jobs as well as display the job list and job header.

Learning Objectives

- 3.a. Create a new job.
- 3.b. Display the Active Job.
- 3.c. Select a job.
- 3.d. Set/identify a Master Job.
- 3.e. Create a new job that contains joint and linear motions.
- 3.f. Program with the last step of job in same position as the first.
- 3.g. Perform path confirmation using the two recommended methods.
- 3.h. Play the new job in various cycle settings.
- 3.i. Use HOLD, E-Stop, TEACH, to stop execution.
- 3.j. Copy an existing job.
- 3.k. Delete an existing job.
- 3.l. Undelete a job.
- 3.m. Rename an existing job.
- 3.n. Display job list by NAME or DATE and activate the DETAIL footer.
- 3.o. Display the job header.

4. Define and adjust Pulse and Cube Soft Limits.

Assessment Strategies

- 4.1. Demonstration

Criteria

You will know you are successful when

- 4.1. you set SOFT LIMITS for S, L, U, R, B, and T.
- 4.2. you identify the temporary release of SOFT LIMITS.
- 4.3. you define/modify operating soft limits of individual axes.
- 4.4. you set the soft limit by numerical value.
- 4.5. you set the current value to the soft limit.
- 4.6. you set the soft limit (+) / the soft limit (-) to the initial factory value.
- 4.7. you display BASE XYZ position to determine Cube limit data.
- 4.8. you define cube soft limits of TCP.
- 4.9. you display pulse position to determine soft limit data.

Learning Objectives

- 4.a. Set SOFT LIMITS for S, L, U, R, B, and T.
- 4.b. Examine the soft limit setting functions.
- 4.c. Examine the Cube soft limit (TCP operating envelope).
- 4.d. Examine the temporary release of SOFT LIMITS.

5. Identify the major components in the DX200 Controller.

Assessment Strategies

- 5.1. Demonstration

Criteria

You will know you are successful when

- 5.1. you identify the YPU54.
- 5.2. you identify the YIF01-2E.
- 5.3. you identify the YCP21-E.
- 5.4. you identify the YSF21-E.
- 5.5. you identify the YPS21-E.
- 5.6. you identify the YBK21-E.
- 5.7. you identify the SERVO PACK.
- 5.8. you identify the detail components of each.

Learning Objectives

- 5.a. Identify the YPU54.
- 5.b. Identify the YIF01-2E.

- 5.c. Identify the YCP21-E.
- 5.d. Identify the YSF21-E.
- 5.e. Identify the YPS21-E.
- 5.f. Identify the YBK21-E.
- 5.g. Identify the SERVO PACK.
- 5.h. Identify the detail components of each.

6. Employ recovery procedures.

Assessment Strategies

- 6.1. Demonstration

Criteria

You will know you are successful when

- 6.1. you cancel an error message.
- 6.2. you reset a minor alarm.
- 6.3. you display alarm history and details.
- 6.4. you perform Overrun, S-Sensor, and Internal shock sensor recovery.
- 6.5. you perform internal shock sensor recovery.
- 6.6. you confirm position for the second home specified point.
- 6.7. you troubleshoot problems and alarms.

Learning Objectives

- 6.a. CANCEL an ERROR Message.
- 6.b. RESET a Minor Alarm.
- 6.c. Display ALARM HISTORY and DETAILS.
- 6.d. Perform OVERRUN & S-SENSOR recovery.
- 6.e. Perform Internal Shock Sensor recovery.
- 6.f. CONFIRM POSITION for the SECOND HOME Specified Point.

7. Examine Input and Output functions.

Assessment Strategies

- 7.1. Written Objective Test
- 7.2. Skill Demonstration

Criteria

You will know you are successful when

- 7.1. you locate machine safety unit.
- 7.2. you locate external emergency stop, external Servo ON, external hold, safety plug, external enable switch, external axes overrun, emergency stop output, and Direct-in (servo) 1 to 6.
- 7.3. you monitor universal inputs.
- 7.4. you monitor universal outputs.
- 7.5. you interpret logical relay addressing.
- 7.6. you interpret binary status and I/O groups.
- 7.7. you locate YIO21 Fuses (I/O).
- 7.8. you locate input connections, transistor outputs, and relay outputs.
- 7.9. you locate connection of external power supply.
- 7.10. you locate connection for tool shock sensor (SHOCK).

Learning Objectives

- 7.a. Locate machine safety unit.
- 7.b. Locate system I/O signal related to starting and stopping.
- 7.c. Monitor inputs and outputs.
- 7.d. Interpret logical relay addressing.
- 7.e. Interpret binary status and I/O groups.
- 7.f. Locate YIO21 Fuses (I/O).
- 7.g. Locate hardware connections.
- 7.h. Locate connection of external power supply.
- 7.i. Locate connection for tool shock sensor (SHOCK).

8. Identify preventative maintenance procedures and inspections.

Assessment Strategies

8.1. Demonstration

Criteria

You will know you are successful when

- 8.1. you establish an inspection schedule.
- 8.2. you grease replenishment/exchange.
- 8.3. you perform preventive maintenance for hardware.
- 8.4. you perform preventative maintenance for speed reducer setup.
- 8.5. you check for gaps or damage of the sealed construction.
- 8.6. you perform cooling fan inspections.
- 8.7. you perform emergency stop inspections.
- 8.8. you perform battery inspections.
- 8.9. you perform power supply voltage conformation.
- 8.10. you complete an open phase check.
- 8.11. you maintain notes on inspections and maintenance.
- 8.12. you identify encoders in control systems.

Learning Objectives

- 8.a. identify inspection schedule.
- 8.b. Examine grease replenishment/ exchange.
- 8.c. Identify preventative maintenance for hardware.
- 8.d. Identify preventative maintenance for speed reducer.
- 8.e. Explore batter unit replacement in the manipulator.
- 8.f. Perform control inspections.
- 8.g. Document maintenance requirements.
- 8.h. Explore encoders in control systems.

9. Remove and replace a robot motor and drive.

Assessment Strategies

9.1. Demonstration

Criteria

You will know you are successful when

- 9.1. you follow procedures to replace SERVO motor.
- 9.2. you follow procedures to replace SERVO drive.
- 9.3. you perform coarse calibration of servo motor abso-data.
- 9.4. you perform a deviation check.
- 9.5. you fine tune absolute data.
- 9.6. you perform manual entry of abso-data.
- 9.7. you perform ABSO data recovery.

Learning Objectives

- 9.a. Follow procedures to replace SERVO motor.
- 9.b. Follow procedures to replace SERVO drive.
- 9.c. Perform home position calibration.
- 9.d. Perform position deviation.
- 9.e. Fine tune Servo Motor Abso-data.
- 9.f. Perform absolute data recovery.