

## Curriculum Framework – Computer Integrated Manufacturing

### Unit 3 Elements of Automation – Lesson 3.3 Robotic Programming and Usage

#### Desired Results *(stage 1)*

##### **ESTABLISHED GOALS**

*It is expected that students will...*

- G1 – Demonstrate an ability to identify, formulate, and solve engineering problems.
- G2 – Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- G3 – Demonstrate an ability to design and conduct experiments, as well as to analyze and interpret data.
- G4 – Demonstrate an ability to apply knowledge of mathematics, science, and engineering.

##### Transfer

**TRANSFER:** *Students will be able to independently use their learning to ...*

- T1 – Allow separate systems to communicate to solve a problem. (ABET 2014-2015, criterion 3e)
- T2 – Develop a program and test its effectiveness. (NGSS Engineering Practice 2)

##### Meaning

**UNDERSTANDINGS:** *Students will understand that ...*

- U1 – Many everyday products use microcontrollers.
- U2 – Robots are used to perform diverse functions and work in diverse environments.
- U3 – A variety of robots and unique programming languages are used in the manufacturing industry.
- U4 – Basic programming skills include variable declaration, loops, and debugging.
- U5 – The size of a robot is based on the work envelope and payload needed to perform the task.

**ESSENTIAL QUESTIONS:** *Students will keep considering ...*

- Q1 – How communication between systems can be used to solve a problem?
- Q2 – How a robotic system can be part of a solution to a problem?
- Q3 – How can a physical system be simulated as part of a design process?

<ul style="list-style-type: none"> <li>• G5 – Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.</li> <li>• G6 – Pursue the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.</li> <li>• G7 – Demonstrate an understanding of professional and ethical responsibility.</li> <li>• G8 – Demonstrate an ability to function on multidisciplinary teams.</li> <li>• G9 – Demonstrate an ability to communicate effectively.</li> <li>• G10 – Gain knowledge of contemporary issues.</li> <li>• G11 – Recognize the need for, and develop an ability to engage in life-long learning.</li> </ul>	<p style="text-align: center;"><b>Acquisition</b></p> <p><b>KNOWLEDGE:</b> <i>Students will...</i></p> <ul style="list-style-type: none"> <li>• K1 – Describe robot components including drive systems, electrical components. U1, U2, U3</li> <li>• K2 – Describe the envelope of common robot types. U2</li> <li>• K3 – Describe how robot geometry affects robot motion. U2, U5</li> <li>• K4 – Identify elements of a robotic program. U2, U3, U4</li> </ul>	<p><b>SKILLS:</b> <i>Students will...</i></p> <ul style="list-style-type: none"> <li>• S1 – Match robot type to application. U2</li> <li>• S2 – Predict robot motion resulting from movement of an actuator. U2, U5</li> <li>• S3 – Create a program to control a robotic arm. U1, U2, U3, U4, U5</li> <li>• S4 – Create programs for a robotic arm to communicate with a related machine. U1, U2, U3, U4, U5</li> </ul>
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Evidence (stage 2)		
Activities (A) Projects (P) Problems(B)	Assessment FOR Learning	Assessment OF Learning
3.3.1.A Configuring Lynxmotion	<ul style="list-style-type: none"> <li>• Essential questions</li> </ul>	<ul style="list-style-type: none"> <li>• Correctly configured robot arm</li> <li>• Conclusion questions</li> </ul>
3.3.2.A Record A Sequence	<ul style="list-style-type: none"> <li>• Essential questions</li> <li>• Accurate flowchart</li> <li>• Correct sketch of the robot</li> <li>• Correct robot sequence organizer</li> </ul>	<ul style="list-style-type: none"> <li>• Accurate flowchart</li> <li>• Correct sketch of the robot</li> <li>• Accuracy of robot to complete the required operation</li> <li>• Conclusion questions</li> </ul>
3.3.3.A Inputs	<ul style="list-style-type: none"> <li>• Essential questions</li> <li>• Accurate flowchart</li> <li>• Correct sketch of the robot</li> </ul>	<ul style="list-style-type: none"> <li>• Accurate flowchart</li> <li>• Correct sketch of the robot</li> <li>• Accuracy of robot to complete the required operation</li> <li>• Conclusion questions</li> </ul>
3.3.4a.A Lynx-Lynx Handshake	<ul style="list-style-type: none"> <li>• Essential questions</li> <li>• Accurate flowchart</li> <li>• Correct sketch of the robot</li> </ul>	<ul style="list-style-type: none"> <li>• Accurate flowchart</li> <li>• Correct sketch of the robot</li> <li>• Accuracy of robot to complete the required operation</li> <li>• Conclusion questions</li> </ul>
3.3.4b.A Ctrl System Handshake	<ul style="list-style-type: none"> <li>• Essential questions</li> <li>• Accurate flowchart</li> <li>• Correct sketch of the robot</li> </ul>	<ul style="list-style-type: none"> <li>• Accurate flowchart</li> <li>• Correct sketch of the robot</li> </ul>

Learning Plan (stage 3)	
Activities (A) Projects (P) Problems(B)	Knowledge and Skills
3.3.1.A Configuring Lynxmotion	K1, K2, K3, S2
3.3.2.A Record A Sequence	K3, K4, S2, S3
3.3.3.A Inputs	K3, K4, S2, S3, S4
3.3.4a.A Lynx-Lynx Handshake	K3, K4, S2, S3, S4
3.3.4b.A Ctrl System Handshake	K3, K4, S2, S3, S4

		<ul style="list-style-type: none"> <li>• Accuracy of robot to complete the required operation</li> <li>• Conclusion questions</li> </ul>
3.3.4c.A Lynx-Ctrl System Handshake	<ul style="list-style-type: none"> <li>• Essential questions</li> <li>• Accurate flowchart</li> <li>• Correct sketch of the robot</li> </ul>	<ul style="list-style-type: none"> <li>• Accurate flowchart</li> <li>• Correct sketch of the robot</li> <li>• Accuracy of robot to complete the required operation</li> <li>• Conclusion questions</li> </ul>

3.3.4c.A Lynx-Ctrl System Handshake	K3, K4, S2, S3, S4