

<b>TSC Category</b>	Technology Management					
<b>TSC</b>	Automated System Design					
<b>TSC Description</b>	Design and commission automated systems					
<b>TSC Proficiency Description</b>	<b>Level 1</b>	<b>Level 2</b>	<b>Level 3</b>	<b>Level 4</b>	<b>Level 5</b>	<b>Level 6</b>
		<b>AER-RAO-2003-1.1</b>	<b>AER-RAO-3003-1.1</b>	<b>AER-RAO-4003-1.1</b>	<b>AER-RAO-5003-1.1-1</b>	
		Programme, test and debug programmable logic controllers (PLCs)	Apply robots and robotic systems in operational settings	Develop automation systems, taking into account space constraints, process constraints, unique process tool requirements and priority loading	Develop simple human machine interface (HMI) to design supervisory control system	
<b>Knowledge</b>		<ul style="list-style-type: none"> <li>Control requirements for automation systems</li> <li>Types, characteristics and operating principles of binary and analogue input and output devices</li> <li>Types and characteristics of PLC, programming devices and programming software</li> <li>Types of inputs and outputs, memory, programming languages and PLC communications</li> <li>Operation and use of programming devices</li> <li>Programming software syntax</li> <li>Connection of programming device to PLC</li> <li>Use of programme performance checklists</li> </ul>	<ul style="list-style-type: none"> <li>Definitions and classifications of robots</li> <li>Trends for robotics in different applications</li> <li>Robot components, degrees of freedom, joints, coordinates, reference frames and workspaces</li> <li>Principles for path and trajectory planning</li> <li>Principles for design of point-to-point motion planning</li> <li>Programming for robots utilised in operational settings</li> </ul>	<ul style="list-style-type: none"> <li>Project management flow from design, requirement specification, installation, commissioning to final acceptance of automated material handling systems (AMHS)</li> <li>AMHS capacity (from-to table) moves, derived from process moves and storage patterns</li> <li>Risk assessment analysis for new AMHS equipment roll-in, and working procedure to be performed</li> <li>Two-dimensional (2D) and three-dimensional (3D) mechanical drawings</li> <li>AMHS simulation tools</li> <li>AMHS semiconductor equipment and materials international (SEMI) specifications</li> <li>Computer-aided design (CAD) software</li> <li>Operational process steps</li> </ul>	<ul style="list-style-type: none"> <li>Fundamentals of HMI and supervisory control</li> <li>HMI implementation considerations and key steps involved</li> <li>HMI trends and emerging standards and software and hardware selection criteria</li> <li>Machine communication and interface methods</li> <li>Principles of programmable logic controller (PLC) and ladder logic</li> <li>Telegrams to communicate with a PLC</li> <li>Alternative approaches and system architectures for HMI and supervisory control</li> <li>Project development and software development life cycles</li> </ul>	

**SKILLS FRAMEWORK FOR AEROSPACE  
TECHNICAL SKILLS AND COMPETENCIES (TSC) REFERENCE**

<p><b>Abilities</b></p>		<ul style="list-style-type: none"> <li>• Interpret details of control requirements for systems</li> <li>• Identify number and types of inputs and outputs, based on control requirements</li> <li>• Identify models of PLC, programming devices and software required to be used with PLC</li> <li>• Carry out syntax tests during programme writing processes to identify syntax errors</li> <li>• Compile and save software programmes after writing processes are completed</li> <li>• Obtain relevant information from built-in software documentation</li> <li>• Connect programming devices to PLC for testing of software programmes</li> <li>• Download software programmes using programming devices in accordance with manufacturers' procedures</li> <li>• Verify software programme performance in accordance with control sequence and requirements using programme performance checklist</li> <li>• Debug and modify software programmes to meet control requirements</li> </ul>	<ul style="list-style-type: none"> <li>• Select appropriate robots based on the mechanisms and applications</li> <li>• Determine the direct kinematics transfer and work spaces of robots</li> <li>• Design appropriate paths and trajectories for the robots</li> <li>• Programme robots for point-to-point movement and path following</li> </ul>	<ul style="list-style-type: none"> <li>• Plan and develop routes for robots</li> <li>• Use statistical and automation software to monitor robots' performances</li> <li>• Establish acceptance criteria, specifications and standard operating procedures (SOPs)</li> </ul>	<ul style="list-style-type: none"> <li>• Develop PLC ladder logic applications</li> <li>• Design HMI systems with menu tree, graphical user interface (GUI), graphics with inputs, outputs and animations</li> <li>• Select and configure appropriate interface methods with PLC</li> <li>• Develop GUI for alarm logging and parameter trending</li> <li>• Develop GUI for retrieval and saving of data to external database</li> <li>• Design supervisory control systems for machine process monitoring</li> <li>• Design supervisory control and data acquisition (SCADA) tracking systems for automated material handling system</li> </ul>	
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