

**SKILLS FRAMEWORK FOR PRECISION ENGINEERING  
TECHNICAL SKILLS AND COMPETENCIES (TSC) REFERENCE DOCUMENT**

<b>TSC Category</b>	Systems Integration					
<b>TSC</b>	Embedded Systems Integration					
<b>TSC Description</b>	Implement control systems to perform pre-defined tasks and also real-time monitoring for the real world					
<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>PRE-SYS-2001-1.1-1</b>	<b>PRE-SYS-3001-1.1-1</b>	<b>PRE-SYS-4001-1.1</b>	<b>PRE-SYS-5001-1.1</b>	
		Select, assemble and test electrical sensors and circuits	Model, operate and integrate a variety of sensors and actuators for real world applications	Design and develop embedded system processes for the interfacing of embedded systems to the real world	Lead the evaluation of the performance of embedded systems against specified requirements and user expectations	
<b>Knowledge</b>		<ul style="list-style-type: none"> <li>Workplace safety and health (WSH) requirements</li> <li>Interpretation of circuit diagrams</li> <li>Types and uses of electrical sensors, electrical devices and components</li> <li>Connections for electrical devices and components of control circuits</li> <li>Operational procedures related to switching on and off power supplies to equipment</li> <li>Methods for assessing power supply voltages</li> <li>Methods for verifying connections to and from electrical sensors</li> <li>Electrical sensors wiring systems</li> <li>Types of general purpose tools, test instruments and materials</li> </ul>	<ul style="list-style-type: none"> <li>Underlying concepts pertaining to performance specification and analysis</li> <li>Implementation of component interconnections and signal conditioning concepts</li> <li>Applications of analogue sensors and transducers</li> <li>Applications of the digital transducers</li> <li>Actuator networks</li> </ul>	<ul style="list-style-type: none"> <li>Definition of embedded systems</li> <li>Requirements, specifications and challenges involved in designing embedded systems</li> <li>Product design, development cycle and management</li> <li>Building blocks of an embedded system</li> <li>Real-world interfacing</li> <li>Considerations and constraints of systems development process</li> </ul>	<ul style="list-style-type: none"> <li>Embedded systems requirements</li> <li>Embedded systems user expectations and/or needs</li> <li>Software metrics to be evaluated</li> </ul>	
<b>Abilities</b>		<ul style="list-style-type: none"> <li>Select appropriate tools and equipment, and check them for safe and useable conditions prior to installation work</li> </ul>	<ul style="list-style-type: none"> <li>Execute performance specification and analysis of sensors and actuators for real life applications</li> </ul>	<ul style="list-style-type: none"> <li>Design and develop processes of embedded systems</li> </ul>	<ul style="list-style-type: none"> <li>Analyse the main characteristic roles of a processor in the embedded systems design</li> </ul>	

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		<ul style="list-style-type: none"> <li>• Conduct pre-operational checks of electrical sensors, devices and components</li> <li>• Isolate main power supplies to electrical control systems and switch off power supply units in systems, in accordance with operational procedures</li> <li>• Mount electrical sensors and connect wiring systems, in accordance with given circuit diagrams</li> <li>• Connect main power supplies to electrical control systems and switch on power supplies, in accordance with the operational procedures</li> <li>• Activate electrical sensors, devices and components to operate control circuits, in accordance with given circuit diagrams and work instructions</li> <li>• Verify control circuits' functionalities for compliance with job requirements</li> <li>• Shut-down electrical control systems, in accordance with operational and WSH procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Utilise commonly adopted component interconnections and signal conditioning principles in automation</li> <li>• Apply analogue sensors and transducers to solve real world control problems</li> <li>• Apply digital transducers to solve real world control problems</li> <li>• Develop actuator networks with stepper and continuous drive actuators</li> </ul>	<ul style="list-style-type: none"> <li>• Interface and implement embedded systems to the real world</li> <li>• Implement exception and interrupt handling</li> <li>• Implement user acceptance testing (UAT) environments for product testing</li> </ul>	<ul style="list-style-type: none"> <li>• Appraise the qualifying factors of processors performance and key features of high level language (HLL) in embedded system development</li> <li>• Examine the architecture and operating principles of data structures in embedded systems programming</li> <li>• Evaluate real-time operating system (RTOS) functions and task scheduling models in embedded systems against user expectations and/or needs</li> <li>• Propose improvements to the embedded systems</li> </ul>	
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