

Enterprise Integration Engineer

Alternate Titles: Advanced Process Controls Engineer, Enterprise Application Integration Engineer, Analyst – Control and Optimization, Technical Analyst, Systems Integrator, Technical Solutions Engineer

Description: Enterprise Integration Engineers devise strategy definitions (competitive, supply chain, operational), performance evaluation systems, process design/re-design, and enabling technologies. They consider all these issues in an integrated way to align the company strategy with process improvement projects in order to achieve excellent performance.

They provide prompt, accurate system integration and support to client’s customers worldwide. This ranges from assistance with using client products, complex software engineering analysis and integration of client software onto different set-top boxes and developing test programs to validate the porting interfaces. In general, engineers should be familiar with several areas of client technology and be able to intelligently assess specific problems encountered in the field and determine an appropriate path to resolution.

Sources of Material: Certified Automation Professional Body of Knowledge, Automation Competency Model.

Performance Domains:

- Domain I: Define Customer Requirements
- Domain II: Business and Physical Integration
- Domain III: Application Integration
- Domain IV: Testing and Technical Support

Domain I: Define Customer Requirements – identify and analyze customer requirements to determine optimal integration solutions.	
Task 1: Determine the type/degree of integration required through cost/benefit analysis in order to meet the business need.	
Knowledge of:	Business integration Physical integration Application integration Various cost/benefit tools Control and information technologies (MES) and equipment Information technology and equipment Company procedures Performance metrics
Skill in:	Analyzing cost versus benefit (e.g., life cycle analysis)

	Choosing the type/degree of integration Estimating the cost of control equipment and software Leading a individual or group discussion Communicating effectively Writing in a technical and effective manner Building consensus
Task 2: Conduct technical studies for the preliminary integration strategy by gathering data and conducting an appropriate analysis relative to requirements in order to define development needs and risks.	
Knowledge of:	Process control theories Machine control theories and mechatronics Risk assessment techniques
Skill in:	Conducting technical studies Conducting risk analyses Defining primary control strategies Writing in a technical and effective manner Compiling and summarizing information efficiently Presenting information
Task 3: Perform a justification analysis by generating a feasibility cost estimate and using an accepted financial model to determine project viability.	
Knowledge of:	Financial models (e.g., Return On Investment, Net Present Value) Business drivers Costs of control equipment Estimating techniques
Skill in:	Estimating the cost and scope of the system Running the financial model Evaluating the results of the financial analysis for the automation portion of the project
Domain II: Business and Physical Integration – determine solutions to integrate physical and business systems to increase interoperability, usability, and security.	
Task 1: Design and implement solutions to integrate business systems with information and operations systems.	
Knowledge of:	Business Integration and Manufacturing Operations Management (MOM) <ul style="list-style-type: none"> ▪ Detailed Production Scheduling ▪ Integration with Business Planning and Logistics ▪ Level 3 Equipment Hierarchy ▪ Level 3-4 Boundary ▪ Other Manufacturing Activities ▪ Production Operations Management Supply Chain Logistics
Skill in:	Evaluating strategies Design

Task 2: Perform security analyses, and regulatory compliance assessments by identifying key issues and risks in order to comply with applicable standards, policies, and regulations.	
Knowledge of:	Applicable standards (e.g., ISA S84, IEC 61508, 21 CFR Part 11, NFPA) Company standards
Skill in:	Assessing security requirements or relevant security issues Applying regulations to design
Task 3: Establish standards, templates, and guidelines as applied to the automation system using the information gathered in the definition stage and considering human-factor effects in order to satisfy customer design criteria and preferences.	
Knowledge of:	Process Industry Practices (PIP) (Construction Industry Institute) IEC 61131 programming languages Customer standards Vendor standards Template development methodology Field devices Electrical codes and standards (e.g. NEC, UL, FM, etc.) ISA standards (e.g., S88)
Skill in:	Developing programming standards Selecting and sizing equipment Designing low-voltage electrical systems Preparing drawing using CAD software
Task 4: Create detailed equipment specifications and data sheets based on vendor selection criteria, characteristics and conditions of the physical environment, regulations, and performance requirements in order to purchase equipment and support system design and development.	
Knowledge of:	Computer and server hardware Network hardware & components Electrical codes and standards (e.g. NEC, UL, FM, etc.) Vendors' offerings
Skill in:	Designing low-voltage electrical systems Selecting and sizing computers Selecting and sizing network hardware and components Selecting and sizing control equipment Evaluating vendor alternatives
Task 5: Select the physical communication media, network architecture, and protocols based on data requirements in order to complete system design and support system development.	
Knowledge of:	Vendor protocols Object Linked Embedding for Process Control (OPC) Ethernet and other open industrial and enterprise networks Physical requirements for networks/media Physical topology rules/limitations

	<p>Network design Security requirements Grounding and shielding practices</p>
Skill in:	Designing networks based on chosen protocols
Task 6: Develop a functional description of the automation solution (e.g., control scheme, alarms, HMI, reports) using rules established in the definition stage in order to guide development and programming.	
	<p>Control theory Visualization, alarming, database/reporting techniques Documentation standards Vendors' capabilities for their hardware and software products General control strategies used within the industry Process/equipment to be automated Operating philosophy</p>
	<p>Writing functional descriptions Interpreting design specifications and user requirements Communicating the functional description to stakeholders</p>
Task 7: Perform the detailed design for the project by converting the engineering and system design into purchase requisitions, drawings, panel designs, and installation details consistent with the specification and functional descriptions in order to provide detailed information for development and deployment.	
Knowledge of:	<p>Field devices, control devices, visualization devices, computers, and networks Installation standards and recommended practices Electrical and wiring practices Specific customer preferences Functional requirements of the system/equipment to be automated Applicable construction codes Documentation standards</p>
Skill in:	<p>Performing detailed design work Documenting the design</p>
Domain III: Application Integration – direct development of necessary software, programming of databases and configuration of networks to allow efficient and secure transactions among computer systems.	
Task 1: Establish detailed requirements and data including network architecture, communication concepts, safety concepts, standards, vendor preferences, instrument and equipment data sheets, reporting and information needs, and security architecture through established practices in order to form the basis of the design.	
Knowledge of:	<p>Network architecture Network Configuration</p> <ul style="list-style-type: none"> ▪ Cable (Wire and Fiber Optic) Networks ▪ Network Component Configuration ▪ Network Diagnostics

	<ul style="list-style-type: none"> ▪ Network Management ▪ Wireless Networks <p>Communication protocols, including field level Safety concepts Industry standards and codes Reliability concepts and standards. Security requirements Safety standards (e.g., ISA, ANSI, NFPA) Control systems security practices</p>
Skill in:	<p>Conducting safety analyses Determining which data is important to capture Selecting applicable standards and codes Identifying new guidelines that need to be developed Defining information needed for reports Completing equipment data sheets</p>
Task 2: Define the data structure layout and data flow model considering the volume and type of data involved in order to provide specifications for hardware selection and software development.	
Knowledge of:	<p>Data requirements of system to be integrated Data structures of control systems Data flow of controls systems Productivity tools and software Entity relationship diagrams Data Management</p> <ul style="list-style-type: none"> ▪ Data Documentation ▪ Data Quality Issues ▪ Data Security ▪ Data Storage and Retrieval ▪ Database Operations and Maintenance ▪ Database Software ▪ Database Structure and Types ▪ Special Requirements of Real-Time Process Databases <p>Data integration Web based systems Metadata</p>
Skill in:	<p>Modeling data Tuning and normalizing databases</p>
Task 3: Develop Human Machine Interface (HMI) in accordance with the design documents in order to meet the functional requirements.	
Knowledge of:	<p>Specific HMI software products Tag definition schemes Programming structure techniques Network communications</p>

	<ul style="list-style-type: none"> Alarming schemes Report configurations Presentation techniques Database fundamentals Computer operating systems Human/ergonomic factors HMI supplier options
Skill in:	<ul style="list-style-type: none"> Presenting data in a logical and aesthetic fashion Creating intuitive navigation menus Implementing connections to remote devices Documenting configuration and programming Programming configurations
Task 4: Develop database or data warehouse and reporting functions in accordance with the design documents in order to meet the functional requirements.	
Knowledge of:	<ul style="list-style-type: none"> Relational database theory Specific database software products Specific reporting products Programming/scripting structure techniques Network communications Structured Query language Report configurations Entity diagram techniques Computer operating systems Data mapping Meta data
Skill in:	<ul style="list-style-type: none"> Presenting data in a logical and aesthetic fashion Administering databases Implementing connections to remote applications Writing queries Creating reports and formatting/printing specifications for report output Documenting database configuration Designing databases Interpreting functional description
Task 5: Develop control configuration or programming in accordance with the design documents in order to meet the functional requirements.	
Knowledge of:	<ul style="list-style-type: none"> Specific control software products Tag definition schemes Programming structure techniques Network communications Alarming schemes I/O structure Memory addressing schemes Hardware configuration

	<ul style="list-style-type: none"> Computer operating systems Processor capabilities Standard nomenclature (e.g., ISA) Process/equipment to be automated
Skill in:	<ul style="list-style-type: none"> Interpreting functional description Interpreting control strategies and logic drawings Programming and/or configuration capabilities Implementing connections to remote devices Documenting configuration and programs Interpreting P&IDs Interfacing systems
Task 6: Implement data transfer methodology that maximizes throughput and ensures data integrity using communication protocols and specifications in order to assure efficiency and reliability.	
Knowledge of:	<ul style="list-style-type: none"> Specific networking software products (e.g., I/O servers). Network topology Network protocols Physical media specifications (e.g., copper, fiber, RF, IR) Computer operating systems Interfacing and gateways Data mapping
Skill in:	<ul style="list-style-type: none"> Analyzing throughput Ensuring data integrity Troubleshooting Documenting configuration Configuring network products Interfacing systems Manipulating data
Task 7: Implement security methodology in accordance with stakeholder requirements in order to mitigate loss and risk.	
Knowledge of:	<ul style="list-style-type: none"> Basic system/network security techniques Customer security procedures Control user-level access privileges Regulatory expectations (e.g., 29 CFR Part 11) Industry standards (e.g., ISA)
Skill in:	<ul style="list-style-type: none"> Documenting security configuration Configuring/programming of security system Implementing security features
Task 8: Review configuration and programming using defined practices in order to establish compliance with functional requirements.	
Knowledge of:	<ul style="list-style-type: none"> Specific control software products Specific HMI software products

	Specific database software products Specific reporting products Programming structure techniques Network communication Alarming schemes I/O structure Memory addressing schemes Hardware configurations Computer operating systems Defined practices Functional requirements of system/equipment to be automated
Skill in:	Programming and/or configuration capabilities Documenting configuration and programs Reviewing programming/configuration for compliance with design requirements
Task 9: Test the system using the test plan in order to determine compliance with functional requirements.	
Knowledge of:	Testing techniques Specific control software products Specific HMI software products Specific database software products Specific reporting products Network communications Alarming schemes I/O structure Memory addressing schemes Hardware configurations Computer operating systems Functional requirements of system/equipment to be automated
Skill in:	Writing test plans Executing test plans Documenting test results Programming and/or configuration capabilities Implementing connections to remote devices Interpreting functional requirements of system/equipment to be automated Interpreting P&IDs
Task 10: Assemble all required documentation and user manuals created during the development process in order to transfer essential knowledge to customers and end users.	
Knowledge of:	General understanding of automation systems Computer operating systems Documentation practices Operations procedures

	Functional requirements of system/equipment to be automated
Skill in:	Documenting technical information for non-technical audience Using documentation tools Organizing material for readability
Domain IV: Testing and Technical Support	
Task 1: Execute system-level tests in accordance with the test plan in order to ensure the entire system functions as designed.	
Knowledge of:	Test methodology Field devices System/equipment to be automated Networking and data communications Safety systems Security systems Regulatory requirements relative to testing
Skill in:	Executing test plans Documenting test results Testing of entire systems Communicating final results to facility personnel Troubleshooting (i.e., resolving issues and retesting) Writing test plans
Task 2: Perform periodic inspections and tests in accordance with written standards and procedures in order to verify system or component performance against requirements.	
Knowledge of:	Performance requirements Inspection and test methodologies Acceptable standards
Skill in:	Testing and inspecting Analyzing test results Communicating effectively with others in written or oral form
Task 3: Provide technical support for facility personnel by applying system expertise in order to maximize system availability.	
Knowledge of:	All system components Processes and equipment Automation system functionality Other support resources Control systems theories and applications Analytical troubleshooting and root-cause analyses
Skill in:	Troubleshooting (i.e., resolving issues and retesting) Investigating and listening Programming and configuring automation system components
Task 4: Perform continuous improvement by working with facility personnel in order to increase capacity, reliability, and/or efficiency.	
Knowledge of:	Performance metrics

	Control theories System/equipment operations Business needs Optimization tools and methods
Skill in:	Analyzing data Programming and configuring Communicating effectively with others Implementing continuous improvement procedures
Task 5: Document lessons learned by reviewing the project with all stakeholders in order to improve future projects.	
Knowledge of:	Project review methodology Project history Project methodology and work processes Project metrics
Skill in:	Communicating effectively with others Configuring and programming Documenting lessons learned Writing and summarizing