



International Society of Automation
Setting the Standard for Automation™

ISA CERTIFIED AUTOMATION PROFESSIONAL® (CAP®)

2012 Job Analysis Blueprint

Domain 1 Feasibility Study:

Identify, scope, and justify the automation project.

Task 1—Define the preliminary scope through currently established work practices in order to meet the business needs.

- 010101 Automating process and/or equipment
- 010102 Automation opportunity identification techniques (e.g., dynamic performance measures)
- 010103 Basic process and/or equipment
- 010104 Control and information technologies (e.g., MES, enterprise software) and equipment
- 010105 Developing value analyses
- 010106 Established work practices
- 010107 Project management methodology and work processes

Task 2—Perform and document cost/benefit analysis of automation alternatives that meet business needs.

- 010201 Automation systems technology
- 010202 Choosing the degree of automation
- 010203 Cost/benefit analysis tools
- 010204 Evaluating project viability
- 010205 Identifying and assessing business needs

Task 3—Conduct technical studies for the preliminary automation strategy by gathering data and conducting appropriate analyses relative to requirements in order to define development needs and risks.

- 010301 Conducting risk analyses
- 010302 Defining primary control strategies
- 010303 Machine control theories and mechatronics (electro-mechanical)
- 010304 Process control theories

Task 4—Perform justification analyses by generating cost estimates using accepted feasibility and financial models to determine project viability.

- 010401 Understanding business drivers
- 010402 Costs of control equipment
- 010403 Estimating techniques to establish cost of the system
- 010404 Evaluating the results of the financial analysis for the automation portion of the project
- 010405 Financial and feasibility models (e.g., ROI, NPV, Lean Six Sigma)

Task 5—Solicit stakeholder “buy-in” by creating a conceptual summary document that reports preliminary decisions, assumptions, feasibility results, and financial justifications in order to facilitate “go/no go” decision.

- 010501 Communicating effectively with varied audiences in written or oral form
- 010502 Compiling and summarizing information effectively for varied audiences
- 010503 Data presentation tools
- 010504 Presenting data and results in a logical and concise manner

Domain 2 Definition:

Identify customer requirements and complete high-level analysis of the best way to meet those requirements.

Task 1—Develop system and process operational strategies through discussion with key stakeholders and using appropriate documentation in order to create and communicate design requirements.

020101 Building consensus

020102 Compiling and summarizing information effectively for varied audiences 020103 Data analysis tools

020104 Effective team leadership 020105 Interpreting data

020106 Interview techniques

020107 Process and/or operations knowledge and experience

Task 2—Analyze alternative technical solutions in order to define the final automation strategy.

020201 Automation solutions and techniques

020202 Basic control elements (e.g., sensors, instruments, actuators, control systems, drive systems, HMI, batch control, machine control)

020203 Control systems theories and applications

020204 Process and/or equipment functionality and interoperability

Task 3—Establish detailed requirements and data including network architecture, communication concepts, safety, concepts, regulatory and industry codes and standards, preferences for instruments and equipment, reporting and information needs, and security architecture through established practices in order to form the basis of the design.

020301 Communication protocols, including field level 020302 Conducting safety analyses

020303 Control systems security practices and requirements 020304 Defining information needed for reports

020305 Determining which data is important to capture

020306 Network architecture

020307 Regulatory and industry standards and codes

020308 Safety concepts and standards (e.g., ISA, ISAM, ANSI, NFPA, OSHA, ISO, ABNT, SAC, STQC).

Task 4—Generate focused project cost estimates by gathering cost information from internal and external sources in order to support project financing.

020401 Available templates and tools

020402 Estimating the cost of control equipment and software 020403 Evaluating project viability

Task 5—Summarize project requirements by creating basis-of-design and user-requirements documents in order to launch the design phase.

020501 Basis-of-design outlines

020502 Communicating effectively with varied audiences in written or oral form 020503 Compiling and summarizing information

020504 User-requirements outlines and bid documents

Domain 3 System Design:

Prepare the complete conceptual design of the control and information systems including specifications of the hardware and software to be used in the system and complete the “detail design” and procurement of the hardware systems including preparation of construction work packages.

Task 1—Perform safety and/or hazard analyses, security analyses, and regulatory compliance assessments by identifying key issues and risks in order to comply with applicable standards, policies, and regulations.

- 030101 Analyzing hazards
- 030102 Analyzing safety integrity levels
- 030103 Applicable electrical, mechanical, safety, environmental standards (e.g., EPA, ASME, ISA S84, IEC 61508, 21 CFR Part 11, NFPA, OSHA, UL/FM, NEMA, ISO14000, CSA, ABNT)
- 030104 Applying regulations to design
- 030105 Assessing relationships between jurisdictional standards
- 030106 Assessing security requirements or relevant security issues
- 030107 Participating in a Hazard Operability Review
- 030108 Understanding differences between standards, regulations, codes and guidance documents

Task 2—Analyze customer design criteria and preferences using the information gathered in the definition stage and considering human-factors effects in order to establish standards, templates, and guidelines.

- 030201 Designing electrical and control systems
- 030202 Developing programming standards
- 030203 Drawing requirements (e.g., ISA 5.x)
- 030204 Electrical standards (e.g., NEC, DIN, JIS, CENELEC)
- 030205 Final control elements and other field devices
- 030206 IEC 61131 programming languages
- 030207 Instrument selection and sizing 030208 ISA standards (e.g., ISA88, ISA95)

Task 3—Create detailed equipment specifications and instrument data sheets in order to purchase equipment and support system design and development, based on vendor selection criteria, characteristics, and conditions of the physical environment, regulations, and performance requirements.

- 030301 Data sheets (ISA S20.x)
- 030302 Designing electrical and control systems
- 030303 Electrical standards (e.g., NEC, IEC, SAC, STQC, CENELEC) 030304 Evaluating equipment alternatives
- 030305 Final control elements and other field devices 030306 Instrument selection and sizing
- 030307 Motor and drive selection and sizing
- 030307 Selecting and sizing control system equipment
- 030309 Selecting and sizing input/output signal devices and/or conditioners

Task 4—Analyze the quantity, type, and flow of data involved with automation systems in order to provide specifications for hardware selection and software development.

- 030401 Data flow in control systems
- 030402 Data requirements of system to be automated
- 030403 Data structures of control systems
- 030404 Optimizing, tuning, and normalizing databases

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.

- 030501 Archiving practices
- 030502 Designing networks based on chosen protocols (e.g., Ethernet, Device net, Fieldbus)
- 030503 Grounding and bonding practices
- 030504 Physical and logical security requirements
- 030505 Physical requirements for networks/media (e.g., copper, fiber, RF, IR)
- 030506 Physical topology rules/limitations
- 030507 Redundancy and availability requirements

Task 6–Develop a functional description of the automation solution using rules established in the definition stage in order to guide development and programming.

- 030601 Alarm management and Human Machine Interface (HMI) philosophy
- 030602 Communicating the functional description to stakeholders
- 030603 Control strategies
- 030604 Documentation standards
- 030605 Interpreting design specifications and user requirements
- 030606 Process/equipment to be automated
- 030607 Use of operation philosophy
- 030608 Visualization, alarming, database/reporting techniques (e.g., control scheme, alarms, HMI, reports)

Task 7–Design the test plan using chosen methodologies in order to execute appropriate testing relative to functional requirements.

- 030701 Developing tests that validate that the system works as specified
- 030702 Functional description of the system/equipment to be automated
- 030703 General software testing procedures
- 030704 Relevant test standards and regulatory requirements (e.g., FDA, CENELEC, STQC, JIS)
- 030705 Simulation tools
- 030706 Writing test plans

Task 8–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 of construction work packages.

- 030801 Applicable construction codes
- 030802 Document and drawing standards
- 030803 Electrical and wiring practices
- 030804 Field devices, control devices, visualization devices, computers, and networks
- 030805 Installation standards and practices (e.g., field devices, computer hardware, cabling)
- 030806 Understanding customer preferences
- 030807 Using functional requirements and specifications of the system/equipment to be automated

Domain 4 Development:

Identify, develop, and implement requirements for packed software configuration and development.

Task 1—Develop Human Machine Interface (HMI) in accordance with the design documents in order to meet the functional requirements.

- 040101 Alarm and security schemes and features
- 040102 Capture, analysis, and display of trending and historical data
- 040103 Computer operating systems
- 040104 Database fundamentals
- 040105 Documenting the configuration and programs
- 040106 Human factors design (e.g., navigation menus, logical and effective data presentation)
- 040107 Implementing network connections and interface systems
- 040108 Programming structure techniques and configurations
- 040109 Report configurations
- 040110 Tag definition schemes

Task 2—Develop database and reporting functions in accordance with the design documents in order to meet the functional requirements. 040200 Develop database and reporting functions in accordance with the design documents in order to meet the functional requirements.

- 040201 Computer operating systems
- 040202 Creating reports and formatting/printing specifications for report output
- 040203 Data mapping
- 040204 Designing logical and effective reports
- 040205 Documenting database configuration
- 040206 Implementing network connections and interface systems
- 040207 Interpreting functional descriptions
- 040208 Programming structure techniques and configurations
- 040209 Relational database design, theory, and administration
- 040210 Writing database queries

Task 3—Develop control configuration or programming in accordance with the design documents in order to meet the functional requirements.

- 040301 Alarm and security schemes and features
- 040302 Computer operating systems
- 040303 Documenting the configuration and programs
- 040304 Hardware configuration and I/O structure (e.g., DCS, PLC Rack)
- 040305 Implementing network connections and interface systems
- 040306 Interpreting drawings and functional descriptions, including control strategies, logic drawings, P&IDs, and PFDs
- 040307 Memory addressing and tag definition schemes
- 040308 Process and/or equipment to be automated
- 040309 Programming, configuration and processor capabilities
- 040310 Standard nomenclature (e.g., ISA) 040311 Structured programming techniques

Task 4–Implement data transfer methodology using communications and network protocols in accordance with design documents in order to meet functional requirements.

- 040401 Analyzing throughput
- 040402 Computer operating systems
- 040403 Configure network products
- 040404 Data mapping
- 040405 Documenting the configuration and programs
- 040406 Ensuring data integrity
- 040407 Interfacing and systems and gateways
- 040408 Network protocols and topology

Task 5–Implement automation system security in accordance with the design documents in order to meet the functional requirements.

- 040501 Configuring/programming of security system
- 040502 Documenting the security configuration and programs
- 040503 Industry and regulatory standards (e.g., ISA 99 , 21 CFR Part 11, IEEE-802)
- 040504 System/network security techniques

Task 6–Conduct peer reviews of configuration and programming in order to establish compliance with functional requirements.

- 040601 Alarming schemes
- 040602 Computer operating systems
- 040603 Documenting the configuration and programs
- 040604 Functional requirements of system/equipment to be automated
- 040605 Hardware configuration and I/O structure (e.g., DCS, PLC Rack)
- 040606 I/O structure
- 040607 Memory addressing schemes
- 040608 Networking and data communications
- 040609 Programming and/or configuration capabilities
- 040610 Programming structure techniques and configurations
- 040611 Reviewing programming/configuration for compliance with design requirements

Task 7–Conduct offline or FAT (Factory/Functional Acceptance Testing) testing of automation systems using the test plan in order to determine compliance with functional requirements.

- 040701 Alarm and security schemes and features
- 040702 Computer operating systems
- 040703 Documenting test results and deviations
- 040704 Executing test plans
- 040705 Functional requirements of system/equipment to be automated
- 040706 Hardware configuration and I/O structure (e.g., DCS, PLC Rack)
- 040707 I/O structure
- 040708 Implementing connections to remote devices
- 040709 Interpreting functional requirements of system/equipment to be automated

040710 Interpreting P&IDs
040711 Memory addressing schemes
040712 Networking and data communications
040713 Programming and/or configuration capabilities
040714 Testing techniques
040715 Writing FAT procedure

Task 8—Assemble all required documentation and user manuals created during the development process in order to transfer essential knowledge to customers and end users.

040801 Documenting equipment information and procedures for end users
040802 Documentation practices
040803 Functional requirements of system/equipment to be automated
040804 General understanding of automation systems
040805 Operations procedures

Domain 5 Deployment:

Develop, review, and execute all phases of project field installation, testing, and start-up.

Task 1 Review and/or perform the physical inspection process of installed equipment against construction drawings in order to ensure installation in accordance with design drawings and specifications

050101 Applicable codes and regulations (e.g., NEC, building codes, OSHA, CENELEC EN codes, applicable IEC regulations)
050102 Comparing physical implementation to drawings
050103 Construction documentation
050104 Development of discrepancy reporting process (e.g., punch lists)
050105 Installation standards and practices (e.g., field devices, computer hardware, cabling)
050106 Reconciling and reporting of redlines and other discrepancies

Task 2 Conduct site acceptance testing of communication systems and field devices in accordance with design specifications in order to ensure proper device operation.

050201 Applicable standards, regulations, and procedures relative to testing
050202 Communication networks and protocols
050203 Comparing test results to design specifications
050204 Conducting and documenting field device tests
050205 Field devices and their performance requirements
050206 Management of change procedures
050207 Test plan and methodology (e.g., loop checks, point-to-point) for the system/equipment to be automated
050208 Verifying control system installation (e.g., PLC, DCS, PC)
050209 Versioning techniques and revision control

Task 3 Test safety elements and systems by executing test plans in order to ensure that safety functions operate as designed.

- 050301 Applicable safety standards, regulations, and procedures
- 050302 Executing and documenting test plans
- 050303 Safety system design

Task 4 Test security features by executing test plans in order to ensure that security functions operate as designed.

- 050401 Applicable security standards, regulations, and procedures
- 050402 Executing and documenting test plans
- 050403 Security system design
- 050404 Vulnerability assessments

Task 5 Execute operational tests in accordance with the test plan; make necessary adjustments in order to ensure the entire system, including safety and security systems, functions as designed.

- 050501 Adjusting final control elements
- 050502 Applicable standards, regulations, and procedures relative to testing
- 050503 Communicating final results to facility personnel
- 050504 Computer system performance tuning
- 050505 Control system hardware
- 050506 Executing and documenting test plans
- 050507 Loop tuning methods/control theory
- 050508 Network and data communications
- 050509 Optimizing software performance

Task 6 Troubleshoot and resolve problems identified during installation and testing using a structured methodology in order to correct system deficiencies and turn the system over to stakeholder.

- 050601 Communicating effectively with varied audiences in written or oral form
- 050602 Equipment history documentation
- 050603 Implementing problem solutions within system limitations
- 050604 Processes, equipment, configurations, and programming
- 050605 Structure troubleshooting techniques (e.g., Isolation, Trial and Error, "Circle the Wagon," Trends, Root Cause Analysis)

Domain 6 Operation and Maintenance:

Prepare and implement a long-term support strategy for a project.

Task 1 Develop and conduct periodic systems and component inspection protocols to verify the operation of systems to pre-determined standards and requirements.

- 060101 Analyzing test results
- 060102 Applicable standards, regulations, and procedures relative to testing
- 060103 Inspection and testing methods
- 060104 Using software and hardware diagnostic tools

Task 2 Provide technical support for facility personnel by applying system expertise in order to maximize system availability.

- 060201 Analytical troubleshooting and root-cause analyses
- 060202 Automation system functionality
- 060203 Communication tools and techniques for working with end-user audiences
- 060204 Control systems theories and applications
- 060205 Investigating and listening
- 060206 Operation maintenance procedures
- 060207 Processes and equipment
- 060208 Programming and configuring automation system components using appropriate tools

Task 3 Work with training professionals to perform training needs analysis, establish training goals and measurable outcomes, and participate in training development and delivery for customers and personnel on the safe operation of automated systems.

- 060301 Applicable standards, regulations, and procedures
- 060302 Assessing personnel training requirements
- 060303 Instructional techniques and methods
- 060304 Training program development

Task 4 Monitor performance using software and hardware diagnostic tools in order to support early detection of potential problems.

- 060401 Acceptable performance limits
- 060402 Analyzing data
- 060403 Automation systems
- 060404 Baseline/normal system performance
- 060405 Potential problem indicators
- 060406 System monitoring techniques (e.g., tracking and trending, asset management, alarming)

Task 5 Perform continuous improvement by working with facility personnel in order to increase capacity, reliability and/or efficiency.

- 060501 Analyzing data
- 060502 Understanding business needs
- 060503 Communicating effectively with varied audiences in written or oral form
- 060504 Continuous improvement techniques and procedures
- 060505 Control systems theories and applications