TRINE CENTER FOR TECHNICAL TRAINING

SMART AUTOMATION CERTIFICATION ALLIANCE

C-209 Pneumatic Systems

Skill Standards

Abstract

Defines the knowledge, skills, and abilities required to succeed in positions (e.g. controls engineer or maintenance technician) that install, troubleshoot, program, and maintain factory automation in a modern environment that uses Industry 4.0 technologies.

Version 1.3

Introduction to SACA

The Smart Automation Certification Alliance (SACA) is a non-profit foundation whose mission is to develop and deploy modular Industry 4.0 certifications for a wide range of industries. The vision is to provide highly affordable, accessible certifications that significantly increase the number of individuals who possess the skills represented by these credentials, thereby ensuring that companies have the highly skilled workers they need, and individuals are prepared to be successful in a "connected enterprise" world.

Industry-Driven Quality

SACA certifications are industry-driven, developed by industry for industry. They use a rigorous process that starts with the development of truly international skill standards, developed and endorsed by leading experts in Industry 4.0 technology throughout the world. Certifications examinations are created based on these standards, pilot-tested and statistically analyzed to ensure quality. Each certification includes a proctored hands-on evaluation (Gold) and an online, multiple choice test (Silver) to confirm that candidates have a knowledgeable foundation for certification success. SACA uses an annual standards and examination review process for all certifications to ensure that the certifications continue to remain highly up-to-date.

Certifying Individuals

Individuals can receive certifications through Trine University, an authorized SACA certification center. SACA ensures any certification center maintains high standards with proctored exams, certified evaluators, and approved equipment for consistent hands-on evaluation.

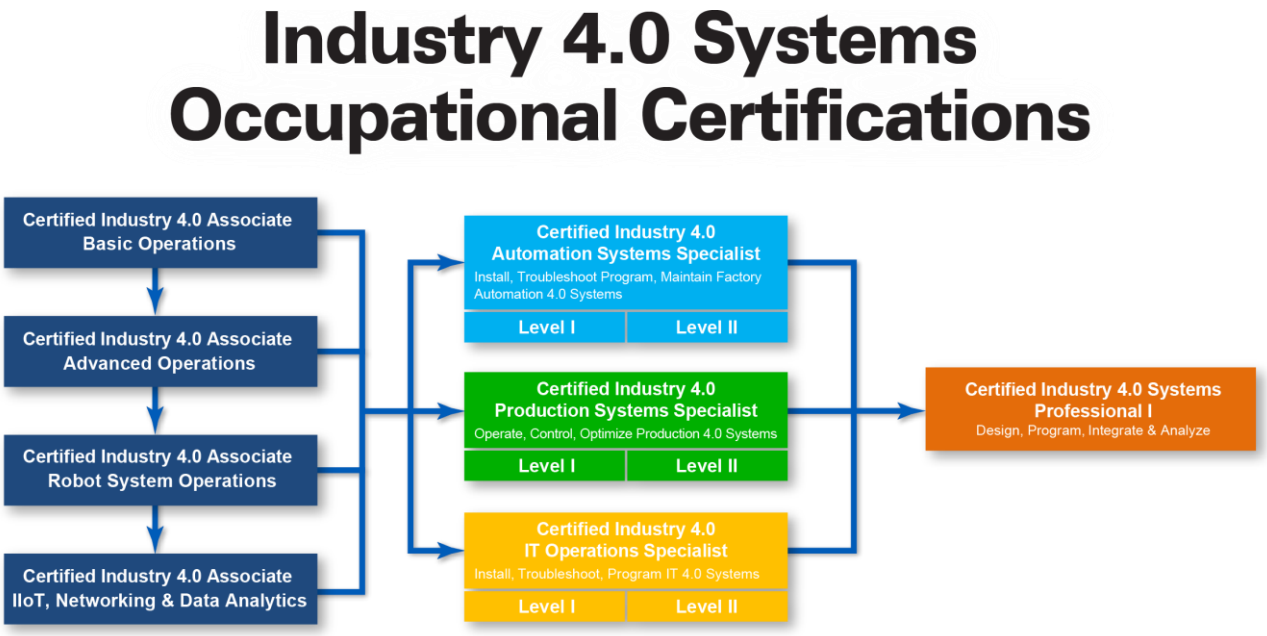
Certification Structure

SACA certifications use a modular structure to enable them to fit into wide range of individual needs and industries and educational environments. The three SACA certification categories include:

- Associate
- Specialist
- Professional

SACA Certification Structure

Each certification is stackable. Individuals can start with one certification and add other certifications to customize their documented skills. Certifications are occupationally focused so they prepare individuals for specific occupations.



Associate Certifications

The Associate certifications include the following four (4) credentials:

- C-101 Certified Industry 4.0 Associate-Basic Operations
- C-102 Certified Industry 4.0 Associate-Advanced Operations
- C-103 Certified Industry 4.0 Associate-Robot System Operations
- C-104 Certified Industry 4.0 Associate-IIoT, Networking and Data Analytics

The Associate certifications are introductory certifications for those individuals working in an Industry 4.0 environment. These certifications are ideal for production technicians, IT professionals, and industrial maintenance technicians seeking to acquire Industry 4.0 skills.

Specialist Certifications

Specialist certifications are modular certifications, consisting of a series of core and elective micro-credentials, each with its own hands-on practical assessment and a written (online) knowledge assessment. Core micro-credentials certify skills that are applicable to all companies, while elective micro-credentials can be added to match with regional or specific company needs.

- Automation Systems Specialist
- IT Systems Specialist
- Operations Specialist
- Electrical Systems Specialist
- Control Systems Specialist
- Robotics Specialist
- Network Systems Specialist
- Instrumentation Specialist
- Mechanical Systems Specialist
- Electro-Fluid Power Systems Specialist

Certified Industry 4.0 Electrical Systems Specialist

SACA's Certified Industry 4.0 Electrical Systems Specialist certification prepares individuals to succeed as an industrial electrician in modern production environments that use Industry 4.0 technologies. In this role, individuals will install, troubleshoot, repair, and maintain industrial electrical circuits and electric motor systems.

Core Micro-Credentials:
C-101 Associate-Basic Operations
C-201 Electrical Systems 1
C-202 Electric Motor Control Systems 1
C-204 Motor Control Troubleshooting 1
C-206 Electrical System Installation 1

Certified Industry 4.0 Automation Systems Specialist

SACA's Certified Industry 4.0 Automation Systems Specialist certification prepares individuals to succeed in multi-skill maintenance technician positions in modern production environments that use Industry 4.0 technologies. This certification also features a variety of elective micro-credentials that are ideal for individuals seeking to become versed in Industry 4.0 automation or those pursuing SACA Professional Certification.

Core Micro-Credentials:

C-101 Associate-Basic Operations
C-201 Electrical Systems 1
C-202 Electric Motor Control Systems 1
C-203 Variable Frequency Drive Systems 1
C-204 Motor Control Troubleshooting 1
C-205 Sensor Logic Systems 1 (*)
C-206 Electrical System Installation 1
C-207 Programmable Controller Systems 1 (**)
C-208 Programmable Controller Troubleshooting 1
C-209 Pneumatic Systems 1
C-210 Mechanical Power Systems I
C-211 Industry 4.0 Total Productive Maintenance Management
C-212 Ethernet Communications 1
C-213 Smart Sensor and Identification Sys. 1
C-214 Smart Factory Systems 1
C-215 Robot System Operations 1 (***)
C-216 Robot Systems Integration 1

Elective Micro-Credentials:

C-255 Hydraulic Systems 1
C-256 Hydraulic Maintenance
C-257 Process Control Systems 1
C-258 Process Control Troubleshooting 1
C-259 Rigging Systems 1
C-260 Rigging Systems 2

(*) - or SACA C101 Associate-Basic Operations and C-102 Associate-Advanced Operations Certifications

(**) - or SACA C-102 Associate-Advanced Operations and C-104 Associate-IIoT and Data Analytics Certifications

(***) - or SACA C-103 Associate-Robot Systems Certification

Professional Certifications

SACA's Certified Industry 4.0 Professional certification is an engineering certification that focuses on analysis, design, and optimization of Industry 4.0 systems. It prepares engineers to succeed in positions in modern production environments that use Industry 4.0 technologies. The Certified Industry 4.0 Professional certification is designed in a modular format.

- Robot Systems Applications Design 1
- Smart Factory Systems Optimization 1
- Smart Factory Systems Optimization 2
- Smart Factory Systems Architecture Design 1
- Manufacturing Execution Systems 2
- Flexible Manufacturing Systems Optimization
- Process Simulation and Design 1

SACA

SMART AUTOMATION CERTIFICATION ALLIANCE

SILVER & GOLD CERTIFICATIONS

All SACA Certifications can be attained on two levels: Silver and Gold.

SACA Silver Certifications are awarded to candidates who successfully pass the written knowledge exam delivered online through the SACA testing portal. Silver Certifications are ideal for individuals seeking to validate online core achievement or when hands-on testing is not available.

SACA Gold Certifications are awarded to candidates that successfully pass the written knowledge exam and successfully complete a hands-on performance assessment on SACA-approved equipment. Gold Certifications are ideal for individuals seeking to show they possess job-ready, hands-on Industry 4.0 skills.

C-209 Pneumatic Systems

E-Learning Content

1. Pneumatic Power Systems
2. Basic Pneumatic Circuits
3. Principles of Pneumatic Pressure and Flow
4. Pneumatic Speed Control Circuits
5. Pneumatic DCV Applications
6. Air Logic
7. Pneumatic Maintenance
8. SACA Test / Study Guide

Prepares individuals to connect, adjust, operate, and analyze pneumatic circuits using these components: quick connect fittings, tee and cross fittings, air compressors, filters, regulators, lubricators, gauges, rotameters, directional control valves, flow control valves, check valves, cylinders, and motors. Other key skills include: adhering to pneumatic safety rules, reading pneumatic circuit symbols and diagrams, applying the Force-Pressure-Area formula, converting absolute/gauge pressure units, performing reciprocating compressor startup/shutdown, applying Pascal's Law, setting pressure switch, filter draining, setting lubricator rate, lubricator refilling, and measuring delta P.

990-PAB53AF Technical Trainer for Gold Certification

Amatrol's Basic Pneumatics training system (85-BP) introduces pneumatic principles through a combination of Amatrol's top-flight multimedia curriculum with hands-on industrial pneumatic skill-building. The basic pneumatics expandable training system teaches learners basic pneumatic concepts and skills, such as pneumatic leverage; air flow control and measurement; and how to operate, install, design, and troubleshoot basic pneumatic circuits for various applications. The system features standard industrial-grade components that give learners real-world experience with equipment they'll encounter on the job. This combination of basic pneumatic knowledge and practice with hands-on equipment helps learners build the pneumatic skills they will need to succeed in the workplace.

SACA FAQ's

Who and What is SACA?

Smart Automation and Certification Alliance is a third-party certification body whose purpose is to validate technical knowledge and ability and prepare the next generation of skilled workers.

Each SACA certification is stackable, allowing individuals to start with one certification and add other certifications to customize their documented skills. Certifications are occupationally focused so they prepare individuals for specific occupations in the world of Industry 4.0.

How will SACA contribute to Student Success in the Workforce?

SACA credentials provide students industry driven competencies in an applied learning (hands on lab) format. These skills translate directly to jobs that are in high demand, great paying, and leading to exciting lifelong career paths.

What's the difference between Silver and Gold SACA certifications?

Silver is a theory only, multiple choice, proctored exam. Exams are 1 - 2 hour in length and varies from 40 to 100 questions depending on the subject.

Gold is a combination of theory in addition to hands on skills. This is the lab portion of the certification and vastly ranges from 15 minutes to 4 hours till completion depending on the subject.

Are Instructors required to be SACA certified?

Yes! Instructors must earn the SACA certification for the courses they teach to be credentialed.

How do Instructors earn SACA Silver certifications?

Instructors can take the theory exam before or at the same time as the exam is being taken with the students. Trine University will help you with this process.

How do Instructors earn SACA Gold certifications?

Instructors will work with Trine University to complete and validate the hands-on skills required.

What resources are students allowed to use while taking the certification exams?

Formulas are available within the testing environment as well as a calculator, and blank piece of paper.
Note: All resources are pending SACA approval and may be modified.

How long do students or instructors wait before re-attempting a failed attempt?

Re-attempts can be proctored again after 24 hours.

Is Trine University an Authorized Certification Assessment Center for SACA?

Yes! Trine University partnered with SACA in 2021 and Trine University has several Amatrol Industrial trainers that are SACA Gold certification approved.

What do Employers have to say about SACA?

"Technology disruption is widening the gap between student learning and industry relevance of learning. At the same time, it is also shortening the shelf life of degrees and opening up variable pathways of learning. To narrow this gap, we are actively participating with the Smart Automation Certification Alliance and other industry stakeholders working alongside education to create relevant standards around Industry 4.0 and more importantly access to relevant stackable learning."

- Michael Cook, Director Global Academic Partnerships, Rockwell Automation

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C-209 Pneumatic Systems Skill Standards

- **Pneumatic Power Systems**
    - Do you know the basic components of a pneumatic system?
    - Can you define pneumatic pressure and state its units of measurement?
    - Do you know how to read a pressure gauge?
    - Can you read a pneumatic schematic?
    - Can you state six pneumatic safety rules?
    - Can you explain the function of a pressure regulator valve?
    - Do you know how to drain a pneumatic filter?
    - Can you interpret schematic symbols?
    - Do you know how to use a pneumatic quick-connect fitting?
    - Can you state the basic operation of a double-acting cylinder?
    - Can you explain the operation of a 5-port, 3-position pneumatic DCV?
    - Do you know how DCVs are classified?
    - Can you interpret a multiple cylinder pneumatic circuit?

- **Basic Pneumatic Circuits**
    - Do you know the basic operation of a single-acting, spring-return cylinder?
    - Can you operate a single-acting pneumatic cylinder using a 3/2 manually-operated DCV?
    - Can you operate a uni-directional pneumatic motor using a 3-way, manually-operated DCV?
    - Do you know the function of a muffler?
    - Do you know three common pneumatic motor designs?
    - Can you interpret line symbols used with fluid power circuits?
    - Do you know seven basic rules for drawing pneumatic schematics?
    - Can you connect a pneumatic circuit given a schematic?
    - Can you interpret a multiple actuator pneumatic circuit?
    - Do you know the basic types of pneumatic conductors?

- **Principles of Pneumatic Pressure and Flow**
    - Do you know how to calculate the force output of a cylinder (extending and retracting)?
    - Do you know how to measure the force output of a cylinder (extending and retracting)?
    - Can you state two types of pneumatic cylinder loads?
    - Can you name four forces that act against cylinder movement?
    - Do you know how force is multiplied using Pascal's Law?
    - Can you state two methods of representing pressure?
    - Do you know how air pressure is created in a pneumatic system?
    - Can you state Boyle's Law and its significance?
    - Do you know how a pneumatic system creates air flow?
    - Can you state two types of resistance in a pneumatic system?
    - Can you measure Delta P across pneumatic components?
    - Do you know what determines the speed of a pneumatic actuator?

- **Pneumatic Speed Control Circuits**
    - Do you know the main function of a pneumatic needle valve?
    - Can you define air flow rate and state its units of measurement?
    - Do you know the function of a flow meter?
    - Can you explain the operation of a rotameter?
    - Do you know how to connect and read a flow meter?
    - Can you name two types of pneumatic check valves?
    - Do you know how to connect and operate a flow control valve to control actuator speed?
    - Can you explain the effect of actuator load changes have on flow control operation?

- **Pneumatic DCV Applications**
    - Can you explain the operation of a pneumatic CAM-operated DCV?
    - Can you explain the operation of a 2-speed pneumatic circuit using a CAM valve?
    - Do you know three methods of decelerating a pneumatic cylinder?
    - Do you know the function of two-way valves?
    - Can you explain the operation of five types of two-way valves?

- **Air Logic**
    - Can you describe four types of pneumatic DCV construction?
    - Can you state four advantages and four disadvantages of air logic?
    - Can you explain the operation of a shuttle valve?

- **Pneumatic Maintenance**
    - Do you know four sources of compressed air contamination and their effect?
    - Can you name three common filter elements?
    - Do you know how air filter elements are rated?
    - Do you know how to select a filter for an application?
    - Can you explain how water condenses in a pneumatic system and its effect?
    - Can you state two methods of removing water vapor from a pneumatic system?
    - Do you know three types of dryers and an advantage of each?
    - Can you name two types of pneumatic traps?
    - Do you know three lubrication methods?
    - Do you know the types of oils used in lubricators?
    - Do you know how pressure gauges are calibrated?
    - Do you know the procedure to clean an acrylic flow meter?
    - Do you know how to locate air leaks?
    - Can you state four common pneumatic component failures and explain their probable causes?
    - Can you adjust a pressure switch?
    - Do you know how to inspect, clean, and replace an air filter element?