TRINE CENTER FOR TECHNICAL TRAINING

SACA
SMART AUTOMATION CERTIFICATION ALLIANCE

INDUSTRY 4.0

C-205 Sensor Logic 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:
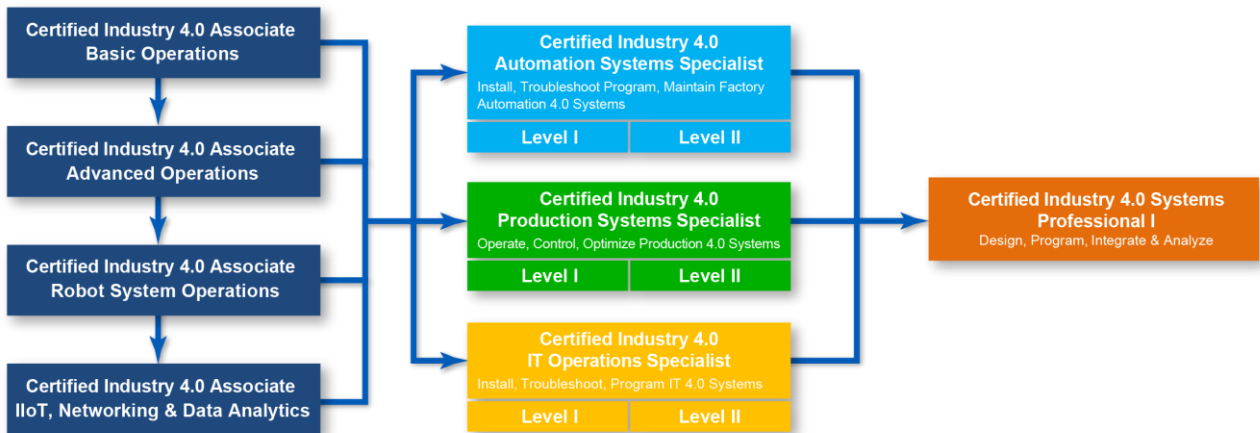
- Associate
- Specialist
- Professional

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.

Industry 4.0 Systems Occupational Certifications

Certified Industry 4.0 Associate Basic Operations		
Certified Industry 4.0 Associate Advanced Operations		
Certified Industry 4.0 Associate Robot System Operations		
Certified Industry 4.0 Associate IIoT, Networking & Data Analytics		

Certified Industry 4.0 Automation Systems Specialist
Install, Troubleshoot Program, Maintain Factory Automation 4.0 Systems

| Level I | Level II |

Certified Industry 4.0 Production Systems Specialist
Operate, Control, Optimize Production 4.0 Systems

| Level I | Level II |

Certified Industry 4.0 IT Operations Specialist
Install, Troubleshoot, Program IT 4.0 Systems

| Level I | Level II |

Certified Industry 4.0 Systems Professional I
Design, Program, Integrate & Analyze

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

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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

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SMART AUTOMATION CERTIFICATION ALLIANCE

SILVER & GOLD CERTIFICATIONS

SACA
SMART AUTOMATION CERTIFICATION ALLIANCE
INDUSTRY 4.0 CERTIFICATION

has successfully completed all requirements for SACA's Silver Certification

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

SACA
SMART AUTOMATION CERTIFICATION ALLIANCE
INDUSTRY 4.0 CERTIFICATION

has successfully completed all requirements for SACA's Gold Certification

SACA
SMART AUTOMATION CERTIFICATION ALLIANCE
CERTIFIED
SILVER

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
SMART AUTOMATION CERTIFICATION ALLIANCE
CERTIFIED
GOLD

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-205 Sensor Logic Systems

E-Learning Content

1. Control Logic
2. Valves and Relays
3. Limit Switches
4. Timers
5. Advanced Systems
6. Introduction to Electronic Sensors
7. Electronic Sensor Applications
8. SACA Test / Study Guide

Prepares individuals to connect, adjust, and operate discrete (on/off) electronic sensors and relay control sequence circuits using these components: inductive sensors, capacitive sensors, magnetic reed sensors, photoelectric sensors, hall effect sensors, limit switches, control relays, timer relays, manual switches, DC motors, indicators, electro-pneumatic solenoid directional control valves, and pneumatic actuators. Other key skills include: selecting sensor type for an application, reading ladder logic circuit diagrams, and interpreting common relay-control sequence applications circuits.

85-SN1 Technical Trainer for Gold Certification

Amatrol's Electronic Sensors Learning System (85-SN1) is a stand-alone training system that teaches the operation of electronic non-contact sensors and their applications in industry, such as sensing movement, detecting metal versus non-metal, and determining speed. The sensors training system includes the following components: capacitive proximity sensor, inductive proximity sensor, magnetic reed sensor, and hall-effect sensor. These sensors are used with a variety of test materials to show how each sensor completes industrial tasks.

SACA FAQ's

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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-205 Sensor Logic Systems Skill Standards

- **Control Logic**
  - Can you explain the function of OR logic and give an application?
  - Can you describe the function of NOT logic and give an application?
  - Can you explain the function of MEMORY logic and give an application?
  - Do you know the function of a ladder diagram?
  - Can you explain five rules of drawing a ladder diagram?

- **Valves and Relays**
  - Can you describe the function of a solenoid-operated fluid power valve?
  - Do you know how to describe the function of a power diagram?
  - Can you explain the function of an electromechanical relay and give an application?
  - Can you read and interpret a basic ladder diagram with detached symbology?
  - Do you know the operation of a relay used to energize a fluid power valve solenoid?
  - Can you interpret the operation of a relay performing control logic?
  - Can you describe the function and operation of a seal-in circuit?

- **Limit Switches**
  - Can you explain the operation of a limit switch and give its schematic symbol?
  - Do you know how the operation of a limit switch in an event sequencing circuit?
  - Can you describe the operation of a safety interlock circuit?

- **Timers**
  - Can you explain the function of a time-delay relay and give an application?
  - Can you describe the operation of a timer relay in an unloaded motor start circuit?
  - Do you know how to describe the operation of a timer relay in a cylinder dwell circuit?

- **Advanced Systems**
  - Can you describe the function of multiple cylinders in a machine?
  - Can you explain how multiple cylinders are controlled using one limit switch in an application?
  - Do you know the function of manual and automatic modes in machine operation?

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- **Introduction to Electronic Sensors**
  - Do you know five advantages of electronic sensors and two disadvantages?
  - Can you list five types of electronic sensors?
  - Can you explain the operation of two types of transistors used in electronic sensors?
  - Can you describe the operation of an inductive proximity sensor and give an application?
  - Do you know the five characteristics that affect inductive proximity sensor operation?
  - Can you name five characteristics that affect capacitive proximity sensor operation?

- **Electronic Sensor Applications**
  - Can you explain the operation of a magnetic reed switch and give an application?
  - Do you know six characteristics that affect magnetic reed switch operation?
  - Can you describe the operation of a hall effect sensor and give an application?