



INTERNET OF THINGS AND SMART HOME



SkillsUSA Championships Technical Standards

PURPOSE

To evaluate each competitor's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of home technology integration.

First, download and review the General Regulations at: <http://updates.skillsusa.org>.

ELIGIBILITY

Open to active SkillsUSA members enrolled in programs with computer networking, telecommunications cabling, home theater installation, electronics applications and/or electronics technology as the occupational objectives.

CLOTHING REQUIREMENT

Class E: Competition Specific — Business Casual

- Official SkillsUSA white polo shirt
- Black dress slacks or black dress skirt (knee-length minimum)
- Black closed-toe dress shoes

Note: Wearing socks or hose is no longer required. If worn, socks must be black dress socks and hose must be either black or skin-tone and seamless/nonpattern.

These regulations refer to clothing items that are pictured and described at www.skillsusastore.org. If you have questions about clothing or other logo items, call 1-888-501-2183.

Note: Competitors must wear their official competition clothing to the competition orientation meeting.

EQUIPMENT AND MATERIALS

1. Supplied by the technical committee:
 - a. All necessary information for the judges and technical committee
2. Supplied by the competitor:
 - a. Phillips and Flat Screwdrivers (#1 & #2)
 - b. Precision (small) screwdriver set
 - c. Drill Motor/Wood Drill Bit index
 - d. Multimeter
 - e. Cable tester (Network / Coax)
 - f. Laptop computer
 - g. Measuring Tape (18' +)
 - h. RJ11/RJ45 crimpers
 - i. Coax compression tool (BNC, F, RCA)
 - j. Coax strippers
 - k. High gauge wire strippers (20-25 AWG)
 - l. Diagonal cutters (small)
 - m. Needle-nose pliers (small)
 - n. 12" Level
 - o. Drywall Saw
 - p. Zip Ties
 - q. Fish Tape/Glow Rods
 - r. Stud Finder
 - s. Safety Glasses
 - t. Socket Set (SAE/Metric)
 - u. Wrench set (SAE/Metric)
 - v. One 6' multiple-outlet surge protector
 - w. All competitors must create a one-page resume. See "Resume Requirement" below for guidelines.

RESUME REQUIREMENT

Competitors must create a one-page resume to submit online. SkillsUSA national competitors should submit their resume by June 1. The link for resume submission will be published on <http://updates.skillsusa.org> on May 1. Failure to submit a resume will result in a 10-point penalty.

Your resume must be saved as a PDF file type using file name format of "Last Name_First Name." For example, "Amanda Smith" would save her resume as **Smith_Amanda**. If you need assistance with saving your file as a PDF, visit [the Adobe website](http://www.adobe.com) for more information.

Note: Check the Competition Guidelines and/or the updates page on the SkillsUSA website at <http://updates.skillsusa.org>.

PROHIBITED DEVICES

Cell phones or other electronic devices not approved by a competition's national technical committee are **NOT** allowed in the competition area. Please follow the guidelines in each technical standard for approved exceptions. Technical committee members may also approve exceptions onsite during the SkillsUSA Championships if deemed appropriate.

Penalties for Prohibited Devices

If a competitor's electronic device makes noise or if the competitor is seen using it at any time during the competition, an official report will be documented for review by the SkillsUSA Championships director. If confirmed that the competitor used the device in a manner which compromised the integrity of the competition, the competitor's scores may be canceled.

SCOPE OF THE COMPETITION

The competition is defined by industry standards as set by the current industry technical committee. The competition will be divided into two parts: general knowledge test and a skilled performance.

KNOWLEDGE PERFORMANCE

The competition will include a written exam assessing general knowledge of installation, configuration, troubleshooting, and maintenance of various smart home devices. Written portions may also exist during the skills portion of the competition.

SKILL PERFORMANCE

The skills performance event assesses the ability of the competitor to install, configure, troubleshoot, and maintain a variety of smart home devices encountered in a residential setting. A practical problem(s) will be given to evaluate the competitor's ability to function on a basic entry level.

COMPETITION GUIDELINES

1. The competitions will have several hands-on skill scenarios that demonstrate one's ability to perform jobs or skills selected from the list of competencies as determined by the SkillsUSA Championships technical committee. Scenarios may include any or several of the following:
 - a. Diagnose and service personal residential smart home systems.
 - b. Diagnose and resolve operational and startup problems.
 - c. Locate and identify defective modules within residential smart home equipment.
 - d. Demonstrate ability to use diagnostic utility software and equipment.
 - e. Install, configure and demonstrate proper operations of devices within the residence.
2. The hardware problems will relate to any residential networked smart home systems.
3. Competitors will be awarded points based on their ability to solve the provided problems within the allotted time. Partial points can be awarded for solving partial problems.
4. Competence in the provided tasks is considered when a competitor acquires 75% of the available points.

5. Competitors will be provided, as required, manufacturers' documentation of the devices to be installed and/or serviced.
6. Winners will be determined on the basis of their total scores (regardless of result on certification test), which includes diagnostic procedures, speed, standard industry procedures, accuracy of adjustments and correct component replacements.
7. Specific penalties will be assessed for the failure to properly use anti-static straps at all times when in contact with the computers and for the introduction of computer viruses into the competition computers. Penalties will be assessed at one point per occurrence, and notice of infractions will be communicated to the competitor when they occur.

STANDARDS AND COMPETENCIES

Networking

RSIM 1.0 — Identify basic networking protocols and their uses and know when/how to apply them

- 1.1. DHCP
- 1.2. UDP
- 1.3. DNS
- 1.4. TCP/IP
- 1.5. Subnet masks

RSIM 2.0 — Recognize and implement methods of network security

- 2.1. Personal computer (PC) security
- 2.2. Antivirus
- 2.3. Home networking security
- 2.4. Firewall knowledge

RSIM 3.0 — Configure setup and maintain a residential LAN (Local Area Network)

- 3.1. Client configuration
 - 3.1.1. Resource sharing
 - 3.1.2. Peer-to-peer
- 3.2. Remote access setup
- 3.3. Network device setup and integration
 - 3.3.1. Broadband configuration (e.g., DSL, cable and satellite)
 - 3.3.2. Routers
 - 3.3.3. Hubs
 - 3.3.4. Switches
 - 3.3.5. PoE (power over ethernet)

RSIM 4.0 — Configure setup and maintain a secure wireless network

- 4.1. Differentiate applications of hardwired vs. wireless networks
- 4.2. Assess networking security and encryption standards
 - 4.2.1. WEP
 - 4.2.2. WPA
 - 4.2.3. MAC filtering
 - 4.2.4. SSID

- 4.2.5. WPA2
- 4.3. Wireless networking integration and troubleshooting
 - 4.3.1. Frequency management
- 4.4. Wireless protocol standards
 - 4.4.1. 802.11 a/b/g/n

RSIM 5.0 — Identify and define network cabling characteristics and performance

- 5.1. Cable types
 - 5.1.1. CAT5
 - 5.1.2. CAT5e
 - 5.1.3. CAT6
 - 5.1.4. Fiber
 - 5.1.5. COAX
- 5.2. Cable length limitations
- 5.3. Protocols
 - 5.3.1. 10BaseT
 - 5.3.2. 100BaseT
 - 5.3.3. 1000BaseT
- 5.4. Shielded (STP) vs. unshielded (UTP)
- 5.5. Plenum vs. non-plenum
- 5.6. Importance of conductor colors

Audio/Video

RSIM 6.0 — Implement, maintain and troubleshoot multi-room audio systems. Identify common interference sources

- 6.1. Control devices
 - 6.1.1. Keypads
 - 6.1.2. Rotary volume controls
 - 6.1.3. Sliders
 - 6.1.4. Push button controls
 - 6.1.5. Touch screen
 - 6.1.6. Wireless keypads
 - 6.1.7. Handheld devices
- 6.2. Differentiate and define single source, multi-source and local source.
 - 6.2.1. Analog audio system
 - 6.2.2. Analog CAT5 audio system
 - 6.2.3. Digital CAT5 audio system
- 6.3. Proper cable use
 - 6.3.1. Line level vs. speaker level
- 6.4. Amplification
 - 6.4.1. Ohm's Law (e.g., impedance matched, or non-impedance matched)
 - 6.4.2. Watts vs. dB
 - 6.4.3. Local amplification
 - 6.4.4. Centralized amplification
- 6.5. Speaker types
 - 6.5.1. In wall

- 6.5.2. Surface mounted
- 6.5.3. Ceiling mounted
- 6.5.4. Freestanding
- 6.5.5. Fixed
- 6.5.6. Animated
- 6.6. Speaker specifications
 - 6.6.1. Frequency response
 - 6.6.2. Efficiency
 - 6.6.3. Power handling

RSIM 7.0 — Install, configure and maintain a residential home theater system

- 7.1. Audio components
 - 7.1.1. Define basics of acoustics (e.g., sound reflection, speaker placement, sound cancellation, sound balance)
 - 7.1.2. Audio/Video components setup and integration (e.g., digital signal cables and lengths, legacy devices)
 - 7.1.3. Multichannel surround (e.g., SACD, DVDA, DTS, DTSES, DDEX, DD, etc.) (e.g., crossovers and speaker setup)
- 7.2. Video components
 - 7.2.1. Display types (e.g., plasma, DLP, LCD, LCOS, CRT, rear projection, front projection, direct view)
 - 7.2.2. High-definition resolutions options (e.g., 720p, 1080i, 1080p, etc.)
 - 7.2.3. Tuner types (e.g., NTSC, PAL, ATSC, QAM, cable card, VSB, DVB-T, DVB-S)
 - 7.2.4. Video processing (e.g., scalers, processors, up-conversion)
 - 7.2.5. Aspect ratios
 - 7.2.6. Video setup (calibration e.g., color balance, contrast, brightness, etc.)
 - 7.2.7. Digital video cable and connector types (e.g., DVI and HDMI — compatibility and interoperability issues)
- 7.3. Use MRAV (Multi-Room Audio/Video) standards if/when applicable

RSIM 8.0 — Assess, install and configure content management systems and describe their applications in a residential environment

- 8.1. Describe typical applications and physical connections of sources
 - 8.1.1. Media servers
 - 8.1.2. Media PC
 - 8.1.3. MP3 players
 - 8.1.4. DVD players
 - 8.1.5. Satellite
 - 8.1.6. Cable
 - 8.1.7. DVR
 - 8.1.8. Gaming systems
 - 8.1.9. Satellite radio
 - 8.1.10. Legacy devices
 - 8.1.11. Streaming media
- 8.2. Summarize types of media storage, methods to transfer and backup data
 - 8.2.1. Memory cards

- 8.2.2. NAS devices (Network Attached Devices)
- 8.2.3. Remote storage
- 8.2.4. Local storage
- 8.2.5. Frequency of backup
- 8.3. Other connection considerations
 - 8.3.1. Digital rights management

RSIM 9.0 — Implement, maintain and troubleshoot multi-room video systems.

- 9.1. Define signal types and their applications
 - 9.1.1. Digital distribution (e.g., analog to IP converters, IP to analog converters, wireless distribution, IEEE 1394)
 - 9.1.2. RF distribution characteristics. Identify and troubleshoot noise and interference. (e.g., splitters and taps, active and passive, attenuators, bidirectional, modulation and filtration, amplification, IR over COAX)
 - 9.1.3. Analog Distribution (e.g., Composite, Component, and S-Video, Balun.)
- 9.2. Identify cable types and their applications
 - 9.2.1. COAX (e.g., RG-59, RG-6, RG-6 QS, DV, Serial data, CCS, BC)
 - 9.2.2. CAT5/5e/6
- 9.3. Termination (e.g., RCA, BNC, and F)
- 9.4. Satellite
 - 9.4.1. Multi-switches
 - 9.4.2. Diplexer
 - 9.4.3. LNB (Low Noise Block Down Converter)

Security and Surveillance Systems

RSIM 10.0 — Maintain, configure and troubleshoot basic security systems and applications

- 10.1. Define monitored and notification methods
 - 10.1.1. Phone line
 - 10.1.2. Cellphone
 - 10.1.3. Radio frequency
 - 10.1.4. IP based
 - 10.1.5. IoT based / Smart speaker controlled

RSIM 11.0 — Describe basic security terminology and apply installation procedures and methodologies

- 11.1. Installation and configuration of security panel
 - 11.1.1. Zone types
 - 11.1.2. Delays
 - 11.1.3. Battery backup and power supply requirements
- 11.2. Monitoring formats
 - 11.2.1. SIA and Contact ID
 - 11.2.2. 4/2 and 3/1
- 11.3. Define types of peripherals and accessories
 - 11.3.1. Motion sensors
 - 11.3.2. Glass-break detectors
 - 11.3.3. Magnetic contacts

- 11.3.4. Smoke fire (e.g., smoke detection, heat detection)
- 11.3.5. Environmental sensors (e.g., carbon monoxide, gas, water, temperature)
- 11.3.6. Vehicle detection
- 11.3.7. Photoelectric beam devices
- 11.3.8. Microwave beam devices
- 11.3.9. Pressure sensors
- 11.3.10. Sirens, strobes
- 11.3.11. Security keypads
- 11.3.12. Key fobs
- 11.3.13. Panic buttons
- 11.4. Describe security infrastructure types
 - 11.4.1. Wired, 22/4- standard power devices, 22/2- Magnetic contacts, 2 and 4 conductor fire wire (e.g., keypads, sounders, power supplies, smoke and fire detectors), Power supervision relays, Polarity reversal relays, Line seizure, End of line resistors)
 - 11.4.2. Wireless
- 11.5. Identify access control devices and protocols
 - 11.5.1. Devices (e.g., keypads, card readers, biometric readers, proximity readers, door strikes, electronic deadbolts, magnetic locks)
 - 11.5.2. Protocols (e.g., Weigand)

RSIM 12.0 — Identify, configure, install, maintain and troubleshoot security and surveillance cameras

- 12.1. Camera types
 - 12.1.1. IP
 - 12.1.2. Analog
 - 12.1.3. Hybrid
 - 12.1.4. IoT / Plug and play
- 12.2. Camera specifications
 - 12.2.1. Lens type
 - 12.2.2. Lux rating
 - 12.2.3. Resolution
 - 12.2.4. B&W vs. color
 - 12.2.5. IR illumination
 - 12.2.6. Power consumption
- 12.3. Camera applications
 - 12.3.1. Indoor/outdoor
 - 12.3.2. Day/night
 - 12.3.3. Fixed vs. animated
 - 12.3.4. Surveillance (e.g., door cams, nanny cams)
 - 12.3.5. Recording (e.g., DVR, triggers –internal vs. external detection)
 - 12.3.6. Sequencing vs. multiplexing

Home Control and Management

RSIM 13.0 — Identify user interfaces and their appropriate applications

- 13.1. Device types
 - 13.1.1. Remote controls
 - 13.1.2. Keypads
 - 13.1.3. Touchscreens
 - 13.1.4. Key fobs
 - 13.1.5. Telephones
 - 13.1.6. Smartphones
 - 13.1.7. Cellphones
 - 13.1.8. PDAs
 - 13.1.9. Web tablets
 - 13.1.10. Personal computers
 - 13.1.11. Laptops
- 13.2. Describe the importance of simplicity and ease of use as it pertains to the end user

RSIM 14.0 — Define and recognize control systems that integrate subsystems in the home. Describe their functionality, characteristics and purpose

- 14.1. Embedded control systems and personal computer (PC) based control systems
 - 14.1.1. Compatibility and interoperability issues

RSIM 15.0 — Identify commonly used communication protocols and their application

- 15.1. IR
- 15.2. Serial
- 15.3. IP
- 15.4. RF
- 15.5. Bluetooth
- 15.6. Contact closure
- 15.7. Inputs (zones)
- 15.8. Z-wave and Zigbee
- 15.9. ASCII
- 15.10. Proprietary protocols

RSIM 16.0 — Describe basic HVAC (Heating, Ventilation and Air Conditioning) terminology and install peripheral control devices

- 16.1. Control layer
 - 16.1.1. Compatibility
- 16.2. Communication layer
 - 16.2.1. Compatibility
 - 16.2.2. IP based, wireless, serial and proprietary
- 16.3. Zones HVAC
 - 16.3.1. Master slave configuration
 - 16.3.2. Microprocessor controlled configuration
- 16.4. Programmable thermostats
- 16.5. Importance of referencing manufacturer specification and compatibility

RSIM 17.0 — Describe basic lighting terminology and install peripheral control devices

- 17.1. Identify lighting control applications
 - 17.1.1. Indoor and outdoor
 - 17.1.2. Centralized and distributed
 - 17.1.3. Dimming
 - 17.1.4. Scenes
 - 17.1.5. Relay/switching
 - 17.1.6. Occupancy/motion sensing
 - 17.1.7. Time- and event-driven
 - 17.1.8. Window treatments
 - 17.1.9. Energy management
 - 17.1.10. Security interface
 - 17.1.11. Lighting connectivity
 - 17.1.12. Motor speed control
- 17.2. Communication interface/bridge
 - 17.2.1. Power line phase couplers
- 17.3. Identify lighting control protocols (Open standards)
 - 17.3.1. Z-wave
 - 17.3.2. ZigBee
 - 17.3.3. Powerline carrier (X10 protocol/PLC)
 - 17.3.4. UPB (Universal Powerline Bus)
- 17.4. Proprietary RF and proprietary low voltage
 - 17.4.1. Recognize compatibility issues

RSIM 18.0 — Identify and install component power protection devices

- 18.1. Identify whole house protection options
 - 18.1.1. Surge suppression
 - 18.1.2. Power conditioning
- 18.2. Identify and install point protection
 - 18.2.1. Surge protectors (high voltage and ancillary low voltage devices: e.g., satellite, CATV, etc.)
 - 18.2.2. UPS (uninterruptible power supply)
 - 18.2.3. Power conditioning

Troubleshooting Methodology and Documentation

RSIM 19.0 — Identify and apply the fundamentals of troubleshooting and diagnostics

- 19.1. Use of testing equipment
 - 19.1.1. Multimeter
 - 19.1.2. Telephone butt set
 - 19.1.3. Toner
 - 19.1.4. Signal generation
 - 19.1.5. Cable tester
- 19.2. Refer to prior documentation
- 19.3. Demonstrate when to communicate with technical support and what information is relevant

- 19.4. Troubleshoot common wireless interference issues: infrared, radio frequency, etc.
- 19.5. Identify demarcation and responsibilities of associated trades and/or utilities

RSIM 20.0 — Given a scenario, demonstrate how to apply troubleshooting skills to integrate subsystems

- 20.1. Networking
- 20.2. Audio/video
- 20.3. Telephony
- 20.4. Security
- 20.5. Home control

RSIM 21.0 —List and describe the benefits of verification of installation

- 21.1. Properly label wires
- 21.2. Wire mapping
- 21.3. Importance of documenting work upon completion
 - 21.3.1. Input/output verification for all systems
 - 21.3.2. Document wire placement
- 21.4. Certification of cable installation

RSIM 22.0 —Deliver appropriate manuals and documentation to the end user upon completion of installation.

- 22.1. Select, archive and appropriately distribute critical system information: Passwords, access codes, user IDs, credentials, etc.

RSIM 23.0 — Ability to safely measure AC and DC voltages

- 23.1. Measure AC and DC voltages using a digital multimeter (DMM)
- 23.2. Measure AC and DC current using a digital multimeter (DMM)
- 23.3. Measure the resistance of a circuit consisting of resistors using a digital multimeter (DMM)

RSIM 24.0 — Ability to test basic analog and digital circuits and repair them

- 24.1. Setup and operate test equipment for analog circuits
- 24.2. Troubleshoot switching power supplies
- 24.3. Analyze motor and phase control circuits
- 24.4. Apply logical and systematic approach to troubleshooting analog circuit devices

RSIM 25.0 — Ability to use multimeters and interpret results

- 25.1. Solve basic trigonometric problems as applicable to electronics (prerequisite to AC)
- 25.2. Identify properties of an AC signal
- 25.3. Identify AC sources
- 25.4. Analyze, construct and troubleshoot AC capacitive circuits, AC inductive circuits, RLC circuits (series, parallel, complex) series and parallel resonant circuits, filter circuits and polyphase circuits
- 25.5. Analyze and apply principles of transformers to AC circuits

COMMITTEE IDENTIFIED ACADEMIC SKILLS

The technical committee has identified that the following academic skills are embedded in this competition.

Math Skills

- Solve practical problems involving percentages.
- Solve single variable algebraic expressions.
- Solve multiple variable algebraic expressions.
- Make comparisons, predictions and inferences using graphs and charts.

Science Skills

- Plan and conduct a scientific investigation.
- Use knowledge of the particle theory of matter.
- Describe characteristics of types of matter based on physical and chemical properties.
- Use knowledge of physical properties (shape, density, solubility, odor, melting point, boiling point, color).
- Use knowledge of classification of elements as metals, metalloids and nonmetals.
- Understand Law of Conservation of Matter and Energy.
- Describe phases of matter.
- Describe and identify physical changes to matter.
- Use knowledge of potential and kinetic energy.
- Use knowledge of mechanical, chemical, and electrical energy.
- Use knowledge of heat, light and sound energy.
- Use knowledge of temperature scales, heat and heat transfer.
- Use knowledge of work, force, mechanical advantage, efficiency and power.
- Use knowledge of simple machines, compound machines, powered vehicles, rockets and restraining devices.
- Use knowledge of principles of electricity and magnetism.
- Use knowledge of static electricity, current electricity and circuits.
- Use knowledge of magnetic fields and electromagnets.
- Use knowledge of motors and generators.

Language Arts Skills

- Demonstrate comprehension of a variety of informational texts.
- Use text structures to aid comprehension.
- Demonstrate knowledge of appropriate reference materials.
- Use print, electronic databases and online resources to access information in books and articles.

CONNECTIONS TO NATIONAL STANDARDS

State-level academic curriculum specialists identified the following connections to national academic standards.

Math Standards

- Numbers and operations
- Algebra
- Geometry
- Measurement
- Data analysis and probability
- Problem solving
- Reasoning and proof

Source: NCTM Principles and Standards for School Mathematics. For more information, visit:
<http://www.nctm.org>.

Science Standards

- Understands the structure and properties of matter.
- Understands the sources and properties of energy.
- Understands forces and motion.
- Understands the nature of scientific knowledge.
- Understands the nature of scientific inquiry.

Source: McREL compendium of national science standards. To view and search the compendium, visit:
<http://www2.mcrel.org/compendium/browse.asp>.

Language Arts Standards

- Students read a wide range of print and nonprint texts to build an understanding of texts, of themselves and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works.
- Students apply a wide range of strategies to comprehend, interpret, evaluate and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics).
- Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
- Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.
- Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language and genre to create, critique and discuss print and nonprint texts.
- Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate and synthesize data from a variety of sources (e.g., print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.

- Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge
- Students use spoken, written and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion and the exchange of information).

Source: *IRA/NCTE Standards for the English Language Arts. To view the standards, visit: www.ncte.org/standards.*