

RESIDENTIAL SYSTEMS INSTALLATION AND MAINTENANCE NYS



PURPOSE

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

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

Men: Black dress slacks; white dress shirt; plain black tie with no pattern or a SkillsUSA black tie. Black socks and black shoes.

Women: Black dress slacks or skirt, with businesslike white, collarless blouse or white blouse with small, plain collar that may not extend onto the lapels of the blazer; black sheer or skin-tone hose and black shoes, that are not backless or open toe.

Note: Contestants must wear their official contest clothing to the contest 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 contestant:
 - a. Multimeter
 - b. Telephone buttset
 - c. Toner
 - d. Signal generation
 - e. Cable tester
 - f. Laptop computer
 - g. Coax (Hex) Crimpers
 - h. RJ11/RG 45 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. Safety glasses
- o. Pen and Pencil
- p. All competitors must create a one-page résumé and submit a hard copy to the technical committee chair at orientation. Failure to do so will result in a 10-point penalty.

Note: Your contest may also require a hard copy of your résumé as part of the actual contest. Check the Contest Guidelines and/or the updates page on the NYS SkillsUSA Web site:

<http://www.nysskillsusa.org/>

SCOPE OF THE CONTEST

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

Knowledge Performance

The contest will include a written exam assessing general knowledge of residential electronics installation and maintenance including smart house technologies. Written portions may also exist during the skills portion of the contest.

Skill Performance

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

Contest Guidelines

1. The contests will have hands-on skill scenarios that demonstrate one's ability to perform jobs or skills selected from the list of competencies as determined by the NY chair/committee. Scenarios may include

- any or several of the following:
- a. Diagnose and service personal residential electronic systems
 - b. Diagnose and resolve operational and startup problems
 - c. Locate and identify defective modules within residential electronic 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 systems.
 3. Contestants 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. Contestants will be provided, as required, manufacturers' documentation of the devices to be installed and/or serviced.
 5. 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.
 6. 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 contest computers. Penalties will be assessed at one point per occurrence, and notice of infractions will be communicated to the contestant when they occur.

Standards and Competencies

Networking

EIMT 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

EIMT 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

EIMT 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)

EIMT 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

EIMT 5.0 — 1.5 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

EIMT 6.0 — Implement, maintain and troubleshoot multiroom 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

EIMT 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, NDVBT, DVBS)
 - 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

EIMT 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

EIMT 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 SVideo, 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)

Telephony/VoIP

EIMT 10.0 — Differentiate and describe POTS vs. VoIP delivery. Identify and troubleshoot common issues

- 10.1 VoIP
 - 10.1.1 Compatibility issues
 - 10.1.2 Whole house distribution of VoIP
 - 10.1.3 Performance and Quality of Service (QoS)
- 10.2 POTS
 - 10.2.1 Cross talk
 - 10.2.2 Radio interference
 - 10.2.3 Dead ports
 - 10.2.4 REN (Ringer Equivalence Number)

EIMT 11.0 — Describe and define fundamentals of telephone systems.

- 11.1 Multi-line
- 11.2 Paging
- 11.3 Intercom
- 11.4 Voice messaging/Unified messaging
- 11.5 Door entry/gate entry
- 11.6 PBX
- 11.7 Key systems
- 11.8 Telecommunication services (e.g., caller

ID, voice mail, rollover)

Security and Surveillance Systems

EIMT 12.0 — Maintain, configure and troubleshoot basic security systems and applications

- 12.1 Define monitored and notification methods
 - 12.1.1 Phone line
 - 12.1.2 Cell phone
 - 12.1.3 Radio frequency
 - 12.1.4 IP based

EIMT 13.0 — Describe basic security terminology and apply installation procedures and methodologies

- 13.1 Installation and configuration of security panel
 - 13.1.1 Zone types
 - 13.1.2 Delays
 - 13.1.3 Battery backup and power supply requirements
- 13.2. Monitoring formats
 - 13.2.1 SIA and Contact ID
 - 13.2.2 4/2 and 3/1
- 13.3 Define types of peripherals and accessories
 - 13.3.1 Motion sensors
 - 13.3.2 Glass-break detectors
 - 13.3.3 Magnetic contacts
 - 13.3.4 Smoke fire (e.g., smoke detection, heat detection)
 - 13.3.5 Environmental sensors (e.g., carbon monoxide, gas, water, temperature)
 - 13.3.6 Vehicle detection
 - 13.3.7 Photoelectric beam devices
 - 13.3.8 Microwave beam devices
 - 13.3.9 Pressure sensors
 - 13.3.10 Sirens, strobes
 - 13.3.11 Security keypads
 - 13.3.12 Key fobs
 - 13.3.13 Panic buttons
- 13.4 Describe security infrastructure types
 - 13.4.1 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.)
 - 13.4.2 Wireless
- 13.5 Identify access control devices and

protocols

13.5.1 Devices (e.g., keypads, card readers, biometric readers, proximity readers, door strikes, electronic deadbolts, magnetic locks.)

13.5.2 Protocols (e.g., Weigand)

EIMT 14.0 — Identify, configure, install, maintain and troubleshoot security and surveillance cameras

14.1 Camera types

14.1.1 IP

14.1.2 Analog

14.1.3 Hybrid

14.2 Camera specifications

14.2.1 Lens type

14.2.2 Lux rating

14.2.3 Resolution

14.2.4 B&W vs. color

14.2.5 IR illumination

14.2.6 Power consumption

14.3 Camera applications

14.3.1 Indoor/outdoor

14.3.2 Day/night

14.3.3 Fixed vs. animated

14.3.4 Surveillance (e.g., door cams, nanny cams)

14.3.5 Recording (e.g., DVR, triggers – internal vs. external detection)

14.3.6 Sequencing vs. multiplexing

Home Control and Management

EIMT 15.0 — Identify user interfaces and their appropriate applications

15.1 Device types

15.1.1 Remote controls

15.1.2 Keypads

15.1.3 Touchscreens

15.1.4 Key fobs

15.1.5 Telephones

15.1.6 Smartphones

15.1.7 Cell phones

15.1.8 PDAs

15.1.9 Web tablets

15.1.10 Personal computers

15.1.11 Laptops

15.2 Describe the importance of simplicity and ease of use as it pertains to the end user

EIMT 16.0 — Define and recognize control systems that integrate subsystems in the home. Describe their functionality, characteristics and purpose

16.1 Embedded control systems and personal computer (PC) based control systems

16.1.1 Compatibility and interoperability issues

EIMT 17.0 — Identify commonly used communication protocols and their application

17.1 I R

17.2

Serial 17.3

IP

17.4 RF

17.5 Bluetooth

17.6 Contact closure

17.7 Inputs (zones)

17.8 Z-wave and Zigbee

17.9 ASCII

17.10 Proprietary protocols

EIMT 18.0 — Describe basic HVAC (Heating, Ventilation and Air Conditioning) terminology and install peripheral control devices

18.1 Control layer

18.1.1 Compatibility

18.2 Communication layer

18.2.1 Compatibility

18.2.2 IP based, wireless, serial and proprietary

18.3 Zones HVAC

18.3.1 Master slave configuration

18.3.2 Microprocessor controlled configuration

18.4 Programmable thermostats

18.5 Importance of referencing

Manufacturer specification and compatibility

EIMT 19.0 — Describe basic lighting terminology and install peripheral control devices

19.1 Identify lighting control applications

19.1.1 Indoor and outdoor

19.1.2 Centralized and distributed

19.1.3 Dimming

19.1.4 Scenes

19.1.5 Relay/switching

19.1.6 Occupancy/motion sensing

19.1.7 Time- and event-driven

19.1.8 Window treatments

19.1.9 Energy management

19.1.10 Security interface

- 19.1.11 Lighting connectivity
- 19.1.12 Motor speed control

- 19.2 Communication interface/bridge
 - 19.2.1 Power line phase couplers
- 19.3 Identify lighting control protocols (Open standards)
 - 19.3.1 Z-wave
 - 19.3.2 ZigBee
 - 19.3.3 Powerline carrier (X10 protocol/PLC)
- 19.3.4 UPB (Universal Powerline Bus) 19.4 Proprietary RF and proprietary low voltage
 - 19.4.1 Recognize compatibility issues

EIMT 20.0 — Identify and install component power protection devices

- 20.1 Identify whole house protection options
 - 20.1.1 Surge suppression
 - 20.1.2 Power conditioning
- 20.2 Identify and install point protection
 - 20.2.1 Surge protectors (high voltage and ancillary low voltage devices: e.g., satellite, CATV, etc.)
 - 20.2.2 UPS (uninterruptible power supply)
 - 20.2.3 Power conditioning

Troubleshooting Methodology and Documentation

EIMT 21.0 — Identify and apply the fundamentals of troubleshooting and diagnostics

- 21.1 Use of testing equipment
 - 21.1.1 Multimeter
 - 21.1.2 Telephone buttset
 - 21.1.3 Toner
 - 21.1.4 Signal generation
 - 21.1.5 Cable tester
- 21.2 Refer to prior documentation
- 21.3 Demonstrate when to communicate with technical support and what information is relevant
- 21.4 Troubleshoot common wireless interference issues: infrared, radio frequency, etc.
- 21.5 Identify demarcation and responsibilities of associated trades and/or utilities

EIMT 22.0 — Given a scenario, demonstrate how to apply troubleshooting skills to integrate subsystems

- 22.1 Networking
- 22.2 Audio/video
- 22.3 Telephony
- 22.4 Security
- 22.5 Home control

EIMT 23.0 —List and describe the benefits of verification of installation

- 23.1 Properly label wires
- 23.2 Wire mapping
- 23.3 Importance of documenting work upon completion
 - 23.3.1 Input/output verification for all systems
 - 23.3.2 Document wire placement
- 23.4 Certification of cable installation

EIMT 24.0 —Deliver appropriate manuals and documentation to the end user upon completion of installation.

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

EIMT 25.0 — Ability to safely measure AC and DC voltages

- 25.1 Measure AC and DC voltages using a digital multimeter (DMM)
- 25.2 Measure AC and DC current using a digital multimeter (DMM)
- 25.3 Measure the resistance of a circuit consisting of resistors using a digital multimeter (DMM)

EIMT 26.0 — Ability to test basic analog and digital circuits and repair them

- 26.1 Setup and operate test equipment for analog circuits
- 26.2 Troubleshoot switching power supplies
- 26.3 Analyze motor and phase control circuits
- 26.4 Apply logical and systematic approach to troubleshooting analog circuit devices

EIMT 27.0 — Ability to use multimeters and oscilloscopes and interpret results

- 27.1 Solve basic trigonometric problems as applicable to electronics (prerequisite to AC)
- 27.2 Identify properties of an AC signal
- 27.3 Identify AC sources
- 27.4 Analyze and measure AC signals using oscilloscope, frequency meters and generators
- 27.5 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
- 27.6 Analyze basic motor theory and operation
- 27.7 Analyze basic generator theory and operation
- 27.8 Set up and operate oscilloscopes frequency counters, signal generators, capacitor-inductor analyzers and impedance bridges for AC circuits.
- 27.9 Analyze and apply principles of transformers to AC circuit