

Appendix A: CTS-I Exam Content Outline

The CTS-I exam specifications were developed by combining the importance, criticality, and frequency data obtained from the Job Task Analysis study. The resulting data were converted to percentages and the percentages were used to determine the number of questions related to each domain and task that should appear on the multiple-choice CTS-I examination. The test specifications in the table below list how many questions are included in each Domain and Task and the percentage of the test included in each domain. The Job Task Analysis Final Report can be downloaded at www.AVIXA.org/ctsi under “CTS-I Resources.”

| CTS-I Domains/Tasks | % of Exam | # of Items |
|---|------------|------------|
| Domain A: Conducting Pre-Installation Activities | 22% | 22 |
| Task 1: Review Audiovisual Project Documentation | 4% | 4 |
| Task 2: Conduct Technical Site Survey | 4% | 4 |
| Task 3: Prepare for Audiovisual Installation | 4% | 4 |
| Task 4: Evaluate Overall Facility Conditions | 3% | 3 |
| Task 5: Maintain Tools and Equipment | 3% | 3 |
| Task 6: Prepare Site for Installation | 4% | 4 |
| Domain B: Conducting Site Rough-In/First-Fix | 11% | 11 |
| Task 1: Deinstallation of Existing Equipment/cabling | 3% | 3 |
| Task 2: Pull Cable | 4% | 4 |
| Task 3: Mount Substructure | 4% | 4 |
| Domain C: Installing Audiovisual Systems | 37% | 37 |
| Task 1: Conduct Off-site Fabrication | 3% | 3 |
| Task 2: Prepare Audiovisual Rack | 4% | 4 |
| Task 3: Wire the Audiovisual Equipment Rack | 4% | 4 |
| Task 4: Distribute Audiovisual Equipment | 3% | 3 |
| Task 5: Mount Audiovisual Equipment | 4% | 4 |
| Task 6: Terminate Cables | 4% | 4 |
| Task 7: Configure Network Attached Components (ISDN, IP, POTS, etc.) | 4% | 4 |
| Task 8: Load Control Programs | 3% | 3 |
| Task 9: Test the Audiovisual Equipment | 4% | 4 |
| Task 10: Calibrate Audiovisual Equipment | 4% | 4 |
| Domain D: Perform Systems Close Out | 11% | 11 |
| Task 1: Demonstrate to Client or Client's Representative that System Performs to Specifications | 4% | 4 |
| Task 2: Obtain Project Completion Sign-Off from Client or Client's Representative | 3% | 3 |
| Task 3: Provide Training on Equipment Operation | 4% | 4 |

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| | | |
|--|-------------|------------|
| Domain E: Conducting Ongoing Project Responsibilities | 19% | 19 |
| Task 1: Perform Site Clean-up | 3% | 3 |
| Task 2: Complete Daily Progress Reports | 3% | 3 |
| Task 3: Coordinate with Other Contractors | 3% | 3 |
| Task 4: Conduct Field Engineering | 4% | 4 |
| Task 5: Repair Audiovisual Systems | 3% | 3 |
| Task 6: Maintain AV Systems | 3% | 3 |
| Total | 100% | 100 |

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CTS-I Examination: Job Task Analysis

A detailed job task analysis is available on the CTS-D Exam Resource page of AVIXA's website. Visit www.AVIXA.org/cts

Domain A: Conducting Pre-Installation Activities

Task 1: Review Audiovisual Project Documentation

Knowledge of:

- Converting scales
- Local language
- Reading and interpreting drawings
- Interpreting measurements and symbols

Skill in:

- Interpreting measurements
- Interpreting symbols
- Reading blueprints
- Reading written documentation
- Utilizing the Internet
- Basic computer operations
- Basic math
- Listening
- Verbal communication
- Written communication
- Typing
- Writing legibly

Domain A: Conducting Pre-Installation Activities

Task 2: Conduct Technical Site Survey

Knowledge of:

- Arranging site access and access limitations
- Site obstacles (i.e., ceilings, flooring, walls)
- Infrastructure (i.e., conduit, floor boxes, power location, data points, grounding)
- Mounting/rigging points for substructures
- Documenting observations (i.e., photographs, sketches, layouts)
- Special requirements (i.e., local code requirements, regulations, special cable requirements, cable management)
- Scaffolding
- Communicating site observations to project management
- Chain of command procedures
- Conduit capacities
- Electrical components (cable trays, pathways, backboxes, etc.)
- Employer policies
- General construction principles

Skill in:

- Calculation of conduit capacities
- Calculation of throw distances
- Measuring distances
- Basic computer operations
- Basic math
- Interpersonal communication
- Technical writing
- Climbing ladders
- Taking documentary photographs of site conditions
- Using a manlift

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- Installation options and alternatives
- Installation process
- Local codes
- Calculating throw distances
- Measuring distances
- Products
- System functionality
- Tool limitations and capabilities
- Basic first aid
- Lock out/tag out standards
- Safety standards (OSHA, health and safety, etc.,)
- Hazard awareness

Domain A: Conducting Pre-Installation Activities

Task 3: Prepare for Audiovisual Installation

Knowledge of:

- Audiovisual tools, materials and equipment
- Identifying connectors and cable requirements (quantity and type)
- Specialty tools (lifts, transportation, etc.)
- Network provisioning information
- Cable pull lists and hardware lists
- Special fabrication
- Permitting
- Calculating cable take offs
- Calculating load capacities
- Determining dimensions of custom parts
- Estimating project and task durations
- Reading and Interpreting schedules
- Selecting tools and sizes
- Safety meetings
- Cable specifications/limits/application
- Access limitations
- Basic first aid
- Chain of command procedures
- Conduit capacities
- Electrical components (cable trays, pathways, backboxes, etc.)
- Employer policies
- General construction principles
- Creating schedules
- Installation options and alternatives
- Installation processes
- LAN/WAN topology
- Local codes
- Network terminology

Skill in:

- Calculation of cable take offs (estimate cable quantities)
- Calculation of load capacities
- Determining dimensions of custom parts
- Estimating project and task durations
- Following instructions
- Reading and interpreting schedules
- Selecting correct tools and sizes
- Basic computer operations
- Basic math
- Interpersonal communication

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- Permitting requirements
- Products
- Project budgets
- Project timelines
- Proper tool use
- Resource allocation
- RoHS compliance requirements
- Security requirements
- Signal types transmitted by different cables
- Structural components and capacities
- Supply management
- System functionality
- Types of connectors and appropriate cable types
- Tool limitations and capabilities
- Activities performed by other construction trades

Domain A: Conducting Pre-Installation Activities

Task 4: Evaluate Overall Facility Conditions

Knowledge of:

- Site logistics (parking, loading docks, elevators, lifts, etc.)
- Building access obstacles
- Required infrastructures
- Appropriate site conditions (i.e., dust free, HVAC operational, power, lighting)
- Calculating weight capacities
- Measuring distances
- Activities performed by other construction trades
- Building timelines
- General construction principles
- Security requirements
- Visual-spatial relationships
- Construction hazards
- General hazards
- Facility specific hazards

Skill in:

- Calculation of weight capacities
- Measuring distances
- Written communication
- Verbal communication

Domain A: Conducting Pre-Installation Activities

Task 5: Maintain Tools and Equipment

Knowledge of:

Skill in:

- Rechargeable meters
- Drilling and cutting tools (bits, wire strippers, wire cutters, saw blades, etc.)
- Calibrating test equipment
- Labeling kits
- Electrical safety testing
- Tagging of electrical tools and equipment
- First aid kits and fire extinguishers
- Testing and tagging of safety and access equipment
- Equipment testing protocols
- Grounding
- Electrical power and electrical current
- Pre-use equipment checks
- Tagging requirements to verify inspection
- Tool and equipment calibration requirements
- Voltage
- Basic math
- Recognizing defective equipment
- Using a voltmeter

Domain A: Conducting Pre-Installation Activities

Task 6: Prepare Site for Installation

Knowledge of:

- Marking installation locations for equipment and services
- Assembling scaffolding
- Identifying hazards and taking safety measures
- Calculating throw distances
- Measuring distances
- Asbestos
- Ceiling systems
- Construction terminology
- General construction principles
- Hazards
- Responsibilities of other trades
- Scaffolding assembly
- System functionality
- Ladder safety
- Fall protection
- Confined spaces
- Customer safety
- Safety zones
- OSHA/HSE

Skill in:

- Interpersonal communication
- Basic math

Domain B: Conducting Site Rough-In/First Fix

Task 1: Deinstallation of Existing Equipment/Cabling

Knowledge of:

- Selecting equipment/cabling that should be removed
- Removing equipment/cabling
- Disposing of removed equipment/cabling
- Storing equipment/cabling per customer instructions or scope of work.
- Preparing equipment for reinstallation (testing, cleaning, labeling, etc.)
- Calculating weights and loads
- Electrical power
- Local disposal regulations
- Manual handling techniques
- System functionality
- OSHA/HSE
- Cadmium hazard
- Asbestos
- CRT

Skill in:

- Interpersonal Communication
- Drilling holes
- Painting
- Cutting drywall/plaster board

Domain B: Conducting Site Rough-In/First Fix

Task 2: Pulling Cable

Knowledge of:

- Identifying cable paths by signal types
- Cable pull lists and drawings
- Cable groupings
- Cable routes/paths for non-conduit cables
- Cutting in mud rings, low voltage rings, electrical boxes (or pattresses), backboxes, etc.
- Installing cable supports/containment
- Preparing cables for pulling
- Marking cables
- Marking spools and drums
- Pulling cable
- Securing cable
- Securing cable ends
- Calculating areas
- Calculating lengths
- Interpreting drawings
- Measuring diameters
- Measuring lengths
- Measuring volumes
- Measuring with an architect's scale
- Cable pulling techniques
- Cable terminology

Skill in:

- Calculating areas
- Calculating lengths
- Interpreting drawings
- Measuring diameters
- Measuring lengths
- Measuring volumes
- Basic math
- Applying firestop materials
- Climbing ladders
- Cutting cable
- Making a snout (wire pull cable harness)
- Pulling cable
- Marking cable

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- Cable types and applications
- Conduit capacities
- Fiber optic cables
- Fiber optic cable handling techniques
- Firestop requirements
- OSHA/HSE/COSHH and related standards
- Project requirements
- Tensile and shear strengths
- Fiber optic disposal
- Asbestos
- Power tool certifications
- Confined spaces
- COSHH - Control of hazardous substances

Domain B: Conducting Site Rough-In/First Fix

Task 3: Mount Substructure

Knowledge of:

- Locations for mountings
- Methods/materials for mountings
- Prefabricated structures
- Installing anchors
- Attaching substructures
- Testing mountings of substructures
- Measuring distances
- Calculating weight capacities
- Adequacy of substructures
- Blocking (or noggin)
- Concrete construction methods and materials
- Correct locations for placing fasteners
- Engineering lumber
- Fasteners (capabilities, limitations, options, etc.)
- Glue laminated construction methods
- Pipes
- Powder actuated tools
- Rigging
- Safe working loads (weights and safety margins)
- Seismic restraints
- Slotted channel and accessories (unistruts)
- Steel construction methods and materials
- Tensile and shear strengths
- Threaded rods
- Throw distances
- Wood frame construction methods and materials
- OSHA/HSE
- Powder actuated tool certification

Skill in:

- Measuring distances
- Basic math
- Cutting
- Drilling
- Calculating weight capacities
- Interpersonal communication

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- Safety zones
- General work site conditions

Domain C: Installing Audiovisual Systems

Task 1: Conduct Off-Site Fabrication

Knowledge of:

- Creating material lists for off-site fabricated items
- Assembling off-site fabricated items
- AC theory
- Basic electronic components (resistors, diodes, transformers)
- Basic metalworking techniques: types of metal, gage, drilling, tapping, punching, layout, bend radius
- Basic woodworking techniques: types of wood and finishes, drilling, cutting, layout, laminates
- DC theory
- Lead time and schedule restrictions
- Materials
- Outsourcing and fabrication options
- Punch tools
- Tap and die use
- Tool selection
- OSHA and health and safety Requirements

Skill in:

- Cutting
- Drilling
- Marking out items

Domain C: Installing Audiovisual Systems

Task 2: Prepare Audiovisual Rack

Knowledge of:

- Drawings and project documentation
- Assembling audiovisual equipment racks from kits
- Populating audiovisual equipment racks
- Installing rack infrastructures (lacing, power, fans, peripherals, etc.)
- Documenting serial numbers of equipment
- Interpreting rack elevations
- Measuring rack units
- ADA requirements
- Electrical power and grounding
- Rack accessories and components
- Rack elevation design
- Screw gun settings, torque settings
- Standard rack unit and width
- System functionality and components
- Ventilation requirements
- Weight distribution

Skill in:

- Reading comprehension
- Assembling a rack

Domain C: Installing Audiovisual Systems

Task 3: Wire the Audiovisual Equipment Rack

Knowledge of:

- Setting up workstations (terminating supplies, heat shrink guns, etc.)
- Selecting cables for applications
- Determining cable dressing strategies
- Measuring cable lengths
- Terminating cables (audiovisual, network, power, etc.)
- Installing cables and cable management techniques
- Cable labeling
- Testing cable
- Testing rack loaded components
- Documenting changes (mark ups)
- Selecting die sets
- Measuring cable lengths
- Crimping techniques (BNC, spade lugs, bell caps, ferrules)
- Adjusting torque on screw gun
- Balanced and unbalanced audio
- Cable types
- Client requirements (e.g., military, government)
- Compression connections
- Compression techniques
- Connector types
- Cable preparation for connector types
- Crimp connections
- Dressing techniques for racks
- Fiber optic terminations
- Insulation displacement
- Labeling systems
- Lacing components
- Linear compression techniques
- Plenum rated tie wraps
- Tie wrap applications and selection
- Service loops
- Signal separation
- Signal types
- System functionality
- The project specifications
- OSHA/HSE
- Spacing of components for access to connections

Skill in:

- Applying heat shrink
- Basic computers
- Creating service loops
- Dressing wire
- Soldering
- Cutting wire
- Applying barrier strips

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Domain C: Installing Audiovisual Systems

Task 4: Distribute Audiovisual

Knowledge of:

- Equipment manifests and delivery schedules
- What to do in the event of equipment damage
- Obtaining delivery confirmations
- Documenting serial numbers of equipment
- Client and company policies and procedures
- Reading and using floor plans
- Hazards
- Projects
- Proper loading techniques to avoid equipment damage
- Site restrictions
- Timelines
- Wrapping, banding, palleting equipment
- Safe bending and lifting techniques
- OSHA/HSE
- Loading techniques

Skill in:

- Basic math
- Interpersonal communication
- Reading and writing
- Written communication

Domain C: Installing Audiovisual Systems

Task 5: Mount Audiovisual Equipment

Knowledge of:

- Acceptable substructures for specific purposes
- Installing mounting brackets and mounting hardware
- Customized millwork/joinery for audiovisual installations
- Installing equipment
- Preparing cables for termination
- Terminating cables
- Connecting power to equipment
- Dressing cables
- Measuring distances
- Calculating weight capacities
- Blocking (or noggin)
- Cleaning supplies and techniques
- Concrete construction methods and materials
- Correct locations for placing fasteners
- Correct mountings for components
- Engineered lumber
- Fasteners (capabilities, limitations, options, etc.)
- Glue laminated construction methods

Skill in:

- Measuring distances
- Basic math
- Calculating weights
- Interpersonal communication
- Cutting
- Drilling

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- Metal frame construction methods and materials
- Pipes
- Powder actuated tools
- Rigging
- Safe working loads (weights) and safety margins
- Seismic restraints
- Slotted channel and accessories (unistrut)
- Steel construction methods and materials
- Tensile and shear strengths
- Threaded rods
- Throw distances
- Wood frame construction methods and materials
- OSHA/HSE
- Safety zones
- Work site safety

Domain C: Installing Audiovisual Systems

Task 6: Terminate Cables

Knowledge of:

- Preparing cable ends
- Connectors
- Applying insulation (heat shrink, sleeving, etc.)
- Attaching connectors
- Labeling cables
- Identifying fiber optic terminations (sc/st/fc/mt-rj)
- Crimping techniques (BNC, spade lugs, bell caps, ferrules)
- Compression techniques
- Fiber optic cable types (single mode, multi-mode) and sizes
- Fiber optic technology (transceivers)
- Fiber optic terminology
- Handling techniques for fiber optic cable
- Insulation displacement
- Interduct (conduit type for fiber optic)
- Cable types
- Limitations of fiber optic cables and connectors
- Linear compression techniques
- Stripping techniques
- RoHS compliance requirements
- Signal types
- Testing fiber optic cable for signal continuity and attenuation
- OSHA/ESE

Skill in:

- Applying heat shrink
- Soldering
- Cutting wire

- Eye protection
- Fiber optic technology safety protocols
- RoHS

Domain C: Installing Audiovisual Systems

Task 7: Configure Network Attached Components (ISDN, IP, POTS, etc.)

Knowledge of:

- Network topologies
- Loading network configurations into equipment
- Preparing AV Internet protocol tables
- Broadband service (cable, satellite, etc.) and service protocols
- Network connectivity
- Basic router configuration (e.g., Linksys WRT54G)
- Cable types/specifications
- Classifications of IP addresses (routable, unroutable)
- Testing network connectivity (ping)
- Testing terminations
- Network equipment
- Network systems
- Network terminology
- Projects
- Wireless connectivity (Wi-Fi, RF, IR)

Skill in:

- Communicating with subcontractors
- Basic computers
- Interpersonal communication

Domain C: Installing Audiovisual Systems

Task 8: Load Control Programs

Knowledge of:

- Establishing communications with devices
- Obtaining correct versions of uploadables
- Loading audiovisual programming
- Verifying codes are loaded and saved
- Testing communications to ancillary devices
- Selecting cables
- Downloading firmware updates
- Audiovisual equipment configurations
- Baud rates
- Company policies and procedures for archiving and saving code
- DSP programs
- Firmware (verification, updates, compatibility)
- Obtaining manufacturer updates
- Signal types

Skill in:

- Basic computers

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Domain C: Installing Audiovisual Systems

Task 9: Test the Audiovisual Equipment

Knowledge of:

- Operational procedures for audiovisual equipment
- Correct cable connectivity
- Selecting appropriate test equipment and supplies
- Proper test methods and requirements
- Performing audiovisual tests
- Comparing tests results with specifications
- Troubleshooting AV equipment
- Performing corrective actions to systems
- Calculating anticipated impedance
- Calculating Ohm's Law
- Measuring impedance
- Testing audio DSP
- Testing audio signal paths
- Testing device communications
- Testing limits
- Testing RF signal paths
- Testing speakers
- Testing video signal paths
- Adjusting audio gain
- Anti-static techniques
- Audio gain structures
- Signal processing components (EQ, limiter)
- System functionality
- Vendor policies, phone numbers
- Video system timing
- Wave form monitors and vectorscopes
- Electrical safety

Skill in:

- Basic computers
- Adjusting basic color balance display

Domain C: Installing Audiovisual Systems

Task 10: Calibrate Audiovisual Equipment

Knowledge of:

- Calibration standards
- Component adjustments
- Aligning display equipment to system configurations for optimal performance
- Adjusting gain structure for audio
- Adjusting gain structure for video
- Setting user preferences for equipment (power management, signal type, etc.)
- Aiming loud speakers

Skill in:

- Basic computers
- Interpersonal communication
- Reading and writing
- Adjusting audio DSP
- Adjusting audio gain
- Adjusting basic color balance displays
- Adjusting video system timing
- Setting speaker taps
- Setting and locking limits
- Setting RF Channels
- Aiming and positioning microphones

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- Adjusting camera configurations
- Setting limits for equipment (cameras, screens, etc.)
- Setting up lighting (presets, fixture positions, zoning, etc.)
- Setting up assisted listening devices
- Adjusting gain and channel on RF frequencies
- Adjusting microphones for optimal performance
- Timing video and audio systems
- Adjusting equalization of rooms (sound systems, etc.)
- Setting data baud rates
- Calculating anticipated impedance
- Calculating Ohm's Law
- Determining speaker taps
- Measuring impedance
- Measuring signal levels
- Reading schematics
- Anti-static techniques
- Audio gain structure
- Distributed audio systems
- Equalization of a room
- Project requirements and specifications
- Signal processing components (EQ, limiter)
- Signal to noise ratio
- System functionality
- Video system timing
- Wave form monitor and vectorscope
- Electrical safety
- Reading and setup of EDID
- HDCP

Domain D: Perform Systems Close Out

Task 1: Demonstrate to Client or Client's Representative that System Performs to Specifications

Knowledge of:

- Generating punch lists/deficiency lists
- Resolving punch lists and deficiency lists
- Substantial completion sign-offs
- Project timelines
- System functionality
- Troubleshooting techniques
- Test equipment

Skill in

- Basic computers
- Interpersonal communication
- Reading and writing

Domain D: Perform Systems Close Out

Task 2: Obtain Project Completion Sign Off from Client or Client's Representative

Knowledge of:

- Deliverables (inventory lists/assets register, manuals, remotes, as-builts, etc.)
- Warranty coverages
- Maintenance schedules
- Project timelines
- System functionality

Skill in

- Basic computers
- Interpersonal communication
- Reading and writing

Domain D: Perform Systems Close Out

Task 3: Provide Training on Equipment Operation

Knowledge of:

- Training techniques
- Training attendance logs
- Company policies and procedures
- Customer expectations
- System functionality

Skill in

- Basic computers
- Verbal Communication

Domain E: Conducting Ongoing Project Responsibilities

Task 1: Perform Site Clean-up

Knowledge of

- Debris removal
- Cleaning protocols and methods
- Appropriate cleaning products for equipment
- Site protocols (dumpsters, rules, etc.)

Domain E: Conducting Ongoing Project Responsibilities

Task 2: Complete Daily Progress Reports

Knowledge of:

- Reporting procedures for damaged, defective or missing equipment
- Reporting procedures for man-hours
- Reporting procedures for additional expenses
- Estimating time to project completion
- Reporting procedures for project delays, design deficiencies, changes in scope of work and requests for additional resources
- Company policies and procedures
- Project tasks
- Vendor policies and phone numbers

Skill in

- Basic computers
- Interpersonal communication
- Planning
- Observation
- Reading and writing

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Domain E: Conducting Ongoing Project Responsibilities

Task 3: Coordinate with Other Contractors

Knowledge of:

- Construction progress meetings
- Reporting procedures for discrepancies and coordination issues
- Responsibilities of various contractors
- Scheduling practices

Skill in

- Communicating with other contractors
- Interpersonal communication

Domain E: Conducting Ongoing Project Responsibilities

Task 4: Conduct Field Engineering

Knowledge of:

- Creating field mark-ups (design changes, site conditions, etc.)
- Making design modifications to accommodate site issues
- Making installation decisions in response to assessments of sites
- Communicate changes to engineering, project managers and others
- Adequacy of substructures
- Blocking (or noggin)
- Cleaning supplies and techniques
- Company policy and procedures
- Concrete construction methods and materials
- Correct locations for placing fasteners
- Correct mountings for components
- Engineered lumber
- Equipment capabilities
- Fasteners (capabilities, limitations, options)
- Glue laminated construction methods
- Completing markups
- Metal frame construction methods and materials
- Pipes
- Powder actuated tools
- Rigging
- Safe working loads (weights) and safety margins
- Seismic restraints
- Slotted channel and accessories (unistrut)
- Steel construction methods and materials
- Tensile and shear strengths
- Threaded rods

Skill in:

- Communicating with other contractors
- Interpersonal communication
- Basic math

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- Wood frame construction methods and materials

Domain E: Conducting Ongoing Project Responsibilities

Task 5: Repair Audiovisual Systems

Knowledge of:

- Troubleshooting system problems
- Making recommendations for problem resolution
- Implementing problem resolutions
- Calculating signal levels
- Measuring impedance
- Testing audio DSP
- Testing audio signal paths
- Testing device communications
- Testing limits
- Testing RF signal paths
- Test speakers
- Testing video signal paths
- Company policy and procedures
- Conferencing products
- Control systems
- Customer expectations
- DSP
- Individual system component capabilities
- Service agreements and warranties
- Signal to noise ratios
- System functionality
- Troubleshooting techniques
- Vendor policies

Skill in:

- Interpersonal communication
- Adjusting audio gain
- Adjusting basic color balance displays

Domain E: Conducting Ongoing Project Responsibilities

Task 6: Maintain AV Systems

Knowledge of:

- Maintenance requirements for systems
- Maintenance schedules
- Obtaining parts and supplies for maintenance
- Performing maintenance activities
- Performing system/component functionality tests
- Submitting maintenance documentation
- Cleaning procedures and products
- Manufacturer's recommended maintenance schedules
- Service agreements and warranties
- Testing practices

Skill in:

- Interpersonal communication

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