Module Overview

This module prepares the trainee to identify equipment and components, support the installation and troubleshooting of audio systems, and commission a system. It provides a basic understanding of audio system theory.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify and describe the primary components of an audio system, including:
   - Input devices
   - Output devices
   - Amplifiers
   - Mixers
   - Equalizers
2. Identify typical audio system applications for sound reinforcement.
3. Identify various audio input devices and describe their effects on audio signaling.
4. Identify and describe various processing options for audio signals.
5. Specify proper cabling selection criteria for a given audio system.
6. Identify and use various measurement devices, meters, and other electronic tools used for audio systems.
7. Describe typical audio system troubleshooting techniques.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Mount a speaker.
2. Properly terminate equipment and speakers.
3. Identify audio cable types and applications.
4. Locate a cable within a bundle.
5. Use test equipment to set up a gain structure.
6. Read and interpret specifications and shop drawings.
7. Perform acceptance testing.

Materials and Equipment

Multimedia projector and screen
Electronic Systems Technician Level Four
PowerPoint® Presentation Slides
Computer
Whiteboard/chalkboard
Markers/chalk
Pencils and paper
Appropriate personal protective equipment
Sample frequency response diagrams from speaker systems
Speaker cones
Microphones
Mixers
Distribution amplifiers
Compressors
Gates
Expanders
Transformers
Bulk microphone and speaker cabling
Audio equipment with a VU meter, a PPM, and an LED meter
Real-time analyzer
Spectrum analyzer
Tone generator
Sound pressure level meter
Oscilloscope
XLR connectors
RCA connectors
Phone jack connectors
Module Examinations*
Performance Profile Sheets*

* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.
Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on electrical and electronic systems and with rigging. Emphasize the importance of proper housekeeping.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.


Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 30 hours are suggested to cover Audio Systems. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

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<tr>
<th>Topic</th>
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<td>A. Introduction</td>
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<td>B. Elements of a Sound Reinforcement System</td>
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<tr>
<td>C. PT/Laboratory</td>
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<tr>
<td>1. Have the trainees mount a speaker. This laboratory corresponds to Performance Task 1.</td>
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<tr>
<td>2. Have the trainees read and interpret specifications and shop drawings. This laboratory corresponds to Performance Task 6.</td>
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</table>
Session IV. Applications of Sound Reinforcement Systems

A. Applications of Sound Reinforcement Systems
   1. Auditorium Sound Systems
   2. School and Talkback Intercom Systems
   3. Paging Systems
   4. Background Music
   5. Noise Masking
   6. Room Combining Systems
   7. Distributed Residential Audio Systems

Sessions V and VI. Audio Cabling Options

A. Audio Cabling Options
   1. Impedance Versus Resistance
   2. Balanced Versus Unbalanced
   3. Cabling and Wire
   4. Connectors

B. PT/Laboratory
   1. Have the trainees identify audio cable types and applications. This laboratory corresponds to Performance Task 3.
   2. Have the trainees locate a cable within a bundle. This laboratory corresponds to Performance Task 4.
   3. Have the trainees properly terminate equipment and speakers. This laboratory corresponds with Performance Task 2.

Sessions VII–IX. Instrumentation and Test Equipment

A. Instrumentation and Test Equipment
   1. Understanding Console Instruments
   2. Audio Test Instruments
   3. Real-Time Analyzer
   4. Impedance Bridges
   5. Spectrum Analyzers
   6. Sound Pressure Level Meters

B. PT/Laboratory
   1. Have the trainees use test equipment to set up a gain structure. This laboratory corresponds to Performance Task 5.

Session X. Installing Audio Systems

A. Installing Audio Systems
   1. Overview of Installation Activities
   2. Speaker Rigging
   3. Troubleshooting an Audio Installation
Session XI. System Commissioning
A. System Commissioning
   1. General Commissioning Activities
B. PT/Laboratory
   1. Have the trainees perform acceptance testing. This laboratory corresponds to
      Performance Task 7.
C. Commissioning a PA or Intercom System
D. Commissioning an Audio System

Session XII. Review and Testing
A. Review
B. Module Examination
   1. Trainees must score 70% or higher to receive recognition from NCCER.
   2. Record the testing results on Training Report Form 200 and submit the
      results to the Training Program Sponsor.
C. Performance Testing
   1. Trainees must perform each task to the satisfaction of the instructor to receive
      recognition from NCCER. If applicable, proficiency noted during laboratory
      exercises can be used to satisfy the Performance Testing requirements.
   2. Record the testing results on Training Report Form 200 and submit the
      results to the Training Program Sponsor.
Module Overview

This module introduces the trainee to video technology as it applies to the presentation of public, educational, and business information.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Describe what video is and the various ways in which it is produced and delivered.
2. Describe the characteristics of analog and digital video signals.
3. Describe video display technologies and video monitoring equipment.
4. Explain video processing methods and equipment.
5. Describe cabling and connectors used in video systems.
6. Identify the components of a video system.
7. Calculate the bandwidth of a video system.
8. Perform basic video system installation procedures, including:
   • Connect the components of a video system
   • Terminate an HD-15 connector
9. Isolate a fault in a video system.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Terminate a video connector.
2. Identify the components of a video system.
3. Connect a video system.
4. Calculate the bandwidth of a video system.
5. Set up a video display and verify proper operation.
6. Isolate a fault in a video system.

Materials and Equipment

- Multimedia projector and screen
- Computer
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- Video presentation system
- System with separate video and audio
  - If possible, an older TV video display and one in high definition; a movie in the older format and the same movie in high definition
- Computer and printer and the same digital photograph in high resolution and in low resolution
- Video display equipment with different aspect ratios; a movie on DVD
  - If possible, access to a store that shows the same picture on a variety of TV and computer monitor displays
  - If possible, video system with a front projection screen and video system with a rear projection screen
  - Length of Cat 5 cable and a piece of UTP cabling
  - Length of fiber optic cabling; a DVI connector; and a digital optical audio cable
  - Selection of video cables and connectors
  - Soldering equipment and appropriate flux
  - DVI-I and DVI-D connectors
  - Module Examinations*
  - Performance Profile Sheets*

* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.
**Safety Considerations**

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on electrical and electronic systems. Emphasize the importance of proper housekeeping.

**Additional Resources**

This module presents thorough resources for task training. The following resource material is suggested for further study.

- www.extron.com (video control equipment)
- www.da-lite.com (projection devices)
- www.draperinc.com (home theater systems)

**Teaching Time for This Module**

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 40 hours are suggested to cover *Video Systems*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

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<td>B. Overview of Video Technology</td>
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<td>2. A Real-World Video System</td>
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<td>6. RGB</td>
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<td>9. RGBHV</td>
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<td>10. Other Video Standards</td>
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Sessions III and IV. Digital Video Signaling

A. Digital Video Signaling
   1. Video Compression
   2. Benefits of High Definition TV
   3. HDTV Signaling
   4. The Digital Color Space
   5. Digital Visual Interface
   6. High Definition Multimedia Interface (HDMI)
   7. 3D TV

B. PT/Laboratory
   Have the trainees calculate the bandwidth of a video system. This laboratory corresponds to Performance Task 4.

Sessions V–VII. Video Displays

A. Video Displays
   1. Overview of Display Technology
   2. Display Types
   3. Projection Systems as Displays
   4. Projection Screens

Sessions VIII–X. Video Processing and Distribution

A. Video Processing and Distribution
   1. Video Processing Equipment
   2. Video Distribution and Cabling

B. PT/Laboratory
   Have the trainees terminate a video connector. This laboratory corresponds to Performance Task 1.

Sessions XI–XIII. Laboratory

A. PT/Laboratory
   1. Have trainees identify the components of a video system. This laboratory corresponds to Performance Task 2.
   2. Have the trainees connect a video system. This laboratory corresponds to Performance Task 3.

Sessions XIV and XV. Laboratory

A. PT/Laboratory
   1. Have the trainees set up a video system display and verify proper operation. This laboratory corresponds to Performance Task 5.
   2. Have the trainees isolate a fault in a video system. This laboratory corresponds to Performance Task 6.
Session XVI. Review and Testing

A. Review

B. Module Examination
   1. Trainees must score 70% or higher to receive recognition from NCCER.
   2. Record the testing results on Training Report Form 200 and submit the results
to the Training Program Sponsor.

C. Performance Testing
   1. Trainees must perform each task to the satisfaction of the instructor to receive
recognition from NCCER. If applicable, proficiency noted during laboratory
exercises can be used to satisfy the Performance Testing requirements.
   2. Record the testing results on Training Report Form 200 and submit the results
to the Training Program Sponsor.
Module Overview

This module introduces the trainee to the operation, maintenance, and troubleshooting procedures pertaining to broadband systems. The broadband systems covered include cable television (CATV) systems, satellite master antenna television (SMATV) systems, and master antenna television (MATV) systems.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Draw a block diagram of a selected CATV/SMATV/MATV system headend.
2. Describe the signal flow for selected processing paths in the headend of a CATV/SMATV/MATV system.
3. Identify the different assemblies and components used in CATV/SMATV/MATV systems and describe their function.
4. Select and terminate coaxial cables used for specific applications.
5. Calculate CATV/SMATV/MATV distribution system gains and losses.
6. Use selected test equipment to make measurements and checks in CATV/SMATV/MATV systems in order to evaluate system operation.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Install a video distribution system.
2. Use a signal level meter (SLM) to measure signal strength and slope of a signal.

Materials and Equipment

- Multimedia projector and screen
- Computer
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- Assortment of broadband equipment manufacturers’ catalogs
- Service manuals for various CATV/SMATV components
- Copies of operational CATV/SMATV system as-built drawings and documentation
- Copy of the latest edition of the National Electrical Code®
- Assortment (or photos) of headend components including:
  - Television broadcast receiving antennas and preamps
  - Broadband VHF and UHF preamplifiers
  - Satellite-receiving antennas and downconverters
  - Strip amplifiers
  - Single-channel converters
  - Agile heterodyne processors
  - Demodulators and modulators
  - Satellite receivers
  - Stereo encoders
  - Combiners and splitters
  - Filters
- Assortment (or photos) of distribution system components including:
  - Distribution amplifiers and line extenders
  - Splitters
  - Directional couplers and taps
  - Attenuators and terminators
  - Multimeter
  - Signal generator

continued
Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on electrical and electronic systems. Emphasize the importance of proper housekeeping.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

- Manufacturer or distributor product literature, available from various cable equipment manufacturers and/or distributors.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 30 hours are suggested to cover Broadband Systems. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

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<tr>
<td>A. Introduction</td>
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<td>B. Evolution of CATV Systems</td>
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<td>C. Architecture of Cable Systems</td>
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<td>2. MATV and SMATV Architecture</td>
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<td>D. Broadband System Basics</td>
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<td>2. Scientific Notation</td>
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<td>3. Frequency Spectrum</td>
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<td>6. Common CATV Symbols</td>
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* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.
E. Satellite Technology
   1. Classification of Satellites
   2. Television Satellite Frequency Spectrum Bands
   3. Orbital Positions of Satellites
   4. Downlink Signal Parameters
   5. Areas of Service

Sessions III and IV. Headend Signal Processing; Headend Components
   A. Headend Signal Processing
      1. VHF/UHF Off-Air Signal Processing
      2. Satellite Signal Processing
      3. Locally Originated Channel Signal Processing
   B. Headend Components
      1. Television Broadcast Receiving Antennas and Preamps
      2. Satellite-Receiving Antennas and Downconverters
      3. Off-Air Processors
      4. Demodulators and Modulators
      5. Satellite Receivers
      6. Stereo Encoders
      7. Combiners and Splitters
      8. Filters

Sessions V and VI. Distribution System Components; Distribution System Topologies
   A. Distribution System Components
      1. Distribution Amplifiers and Line Extenders
      2. Splitters
      3. Directional Couplers and Taps
      4. Attenuators and Terminators
      5. Coaxial Cables
   B. PT/Laboratory
      Have trainees install a video distribution system. This laboratory corresponds to Performance Task 1.
   C. Distribution System Topologies
      1. Home-Run Cable Distribution Systems
      2. Loop-Through Cable Distribution Systems
      3. Trunk-and-Branch Cable Distribution Systems

Sessions VII and VIII. Distribution System Gains and Losses
   A. Distribution System Gains and Losses
      1. Cable Losses
      2. Splitter Losses
      3. Directional Coupler/Tap Losses
      4. Calculating Distribution System Gains and Losses

Sessions IX and X. Test Equipment
A. Test Equipment
   1. Signal Level Meter
   2. Spectrum Analyzer
   3. Cable Tone Test Set
   4. Satellite Signal Level Meter
   5. Portable Color TV Receiver
   6. Handling and Using Test Equipment
B. PT/Laboratory
   Have trainees use a signal level meter (SLM) to measure the strength and slope of a selected signal. This laboratory corresponds to Performance Task 2.

Session XI. Headend Alignment; Troubleshooting
A. Headend Alignment
B. Troubleshooting
   1. Customer Interface
   2. Physical Examination of the System
   3. Basic System Analysis
   4. The Use of Manufacturers' Troubleshooting Aids
   5. Guidelines for Troubleshooting the Distribution System
   6. Guidelines for Troubleshooting the Headend

Session XII. Two-Way Transmission; Review and Testing
A. Two-Way Transmission
B. Review
C. Module Examination
   1. Trainees must score 70% or higher to receive recognition from NCCER.
   2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.
D. Performance Testing
   1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
   2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.
Module Overview

This module introduces the trainee to the centralized storage and retrieval system called a media management system (MMS). This module also covers the concepts and principles of an MMS as it applies to educational institutions.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Explain the functions of a media management system.
2. Identify the major components of a media management system and explain their functions in the system.
3. Describe the database and operating software used to control a media management system.
4. Describe the various devices used to store media in a media management system.
5. Describe the types of playback and display devices used in media management systems.

Performance Tasks

This is a knowledge-based module; there are no performance tasks.

Materials and Equipment

Multimedia projector and screen
Computer
Whiteboard/chalkboard
Markers/chalk
Pencils and paper
If possible, provide an MMS setup with several monitors
If possible, access to a store with different types of large screen TVs on display

Access to a large room
Laptop computer and compatible digital projector and screen, free-standing speakers
TV, DVD player, and audio and video material with appropriate coaxial cable
Cables and RCA connectors
Access to a LAN-based system
If possible, a video network, computer monitor, processor, scan converter, and a video file
Module Examinations*

* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on electrical and electronic systems. Emphasize the importance of proper housekeeping.
Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 20 hours are suggested to cover Media Management Systems. You will need to adjust the time required for hands-on activity and testing based on your class size and resources.

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<td>A. Video Display Equipment</td>
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<td>A. Storage, Retrieval, and Playback Equipment</td>
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<td>2. Content Scheduling Issues</td>
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Session VIII. Review and Testing

A. Review

B. Module Examination
   1. Trainees must score 70% or higher to receive recognition from NCCER.
   2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.
Module Overview

This module introduces the trainee to the terms, components, and history of telecommunications systems. The trainee will acquire an understanding of both analog and digital systems.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Explain common trade terms relating to telephone systems.
2. Briefly describe the history of telephones and the operation of the plain old telephone service (POTS).
3. Describe the operation of analog telephones.
4. Identify the main types of business telephone systems and describe their differences.
5. Identify the components used in key systems and traditional private branch exchange (PBX) systems.
6. Describe the differences between analog and digital telephone systems.
7. Describe the commonly used optional features for key systems and traditional PBX systems.
8. Describe emerging technologies.

Performance Task

Under the supervision of the instructor, the trainee should be able to do the following:

1. Install a fully operational phone system.

Materials and Equipment

- Multimedia projector and screen
- Computer
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- Typical POTS telephone
- Two- and four-wire samples
- Touch-Tone® phone
- Access to a working phone system

- Modem
- Components and tools for installing an operating phone system:
  - Control unit
  - Compatible phones
  - Power converter
  - Punch-down block
  - Punch-down tool
  - Phone jacks
  - 24-gauge phone wire
  - Module Examinations*
  - Performance Profile Sheets*

* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on electrical and electronic systems. Emphasize the importance of proper housekeeping.
Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.


*Voice Over DSL.* New York, NY: CMP Books of CMP Media LLC.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 20 hours are suggested to cover *Telecommunications Systems.* You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Planned Time</th>
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<tbody>
<tr>
<td><strong>Session I. Telephone History; Plain Old Telephone Service (POTS)</strong></td>
<td></td>
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<tr>
<td>A. Telephone History</td>
<td></td>
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<tr>
<td>B. Plain Old Telephone Service (POTS)</td>
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<tr>
<td>1. Local Subscriber Loop</td>
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<tr>
<td>2. Local Exchange Switch</td>
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<tr>
<td>3. Central Office Services</td>
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<tr>
<td><strong>Session II. Telephone Switching Systems</strong></td>
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</tr>
<tr>
<td>A. Telephone Switching Systems</td>
<td></td>
</tr>
<tr>
<td>1. PBX Systems</td>
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<tr>
<td>2. Key Telephone Systems</td>
<td></td>
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<tr>
<td>3. Electronic Key Service Units</td>
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<tr>
<td>4. Hybrid Systems</td>
<td></td>
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<tr>
<td><strong>Session III. Multiplexing; Other Telecommunications Technologies</strong></td>
<td></td>
</tr>
<tr>
<td>A. Multiplexing</td>
<td></td>
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<tr>
<td>1. Analog Voice to Digital Voice Conversion</td>
<td></td>
</tr>
<tr>
<td>2. Pulse Code Modulation (PCM)</td>
<td></td>
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<tr>
<td>3. Digital Transmission Level 1 Signals (T-1)</td>
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<tr>
<td>4. Digital Transmission Level 3 Signals (T-3)</td>
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<tr>
<td>B. Other Telecommunications Technologies</td>
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</tr>
<tr>
<td>1. Digital Services</td>
<td></td>
</tr>
<tr>
<td>2. Digital Subscriber Line (DSL)</td>
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</tbody>
</table>
Sessions IV–VII. Digital Voice Services

A. Digital Voice Services
   1. Subscriber Line Carrier Pair Gain System
   2. Channel Banks
   3. Integrated Services Digital Network (ISDN)
   4. Voice over Internet Protocol (VoIP)

B. PT/Laboratory
   Have trainees install a fully operational phone system. This laboratory
   corresponds to Performance Task 1.

Session VIII. Review and Testing

A. Review

B. Module Examination
   1. Trainees must score 70% or higher to receive recognition from NCCER.
   2. Record the testing results on Training Report Form 200 and submit the results
to the Training Program Sponsor.

C. Performance Testing
   1. Trainees must perform each task to the satisfaction of the instructor to receive
recognition from NCCER. If applicable, proficiency noted during laboratory
exercises can be used to satisfy the Performance Testing requirements.
   2. Record the testing results on Training Report Form 200 and submit the
results to the Training Program Sponsor.
Module Overview

This module introduces the trainee to networks used to control fire, security, entertainment, environmental, lighting, and other building systems in residential and commercial structures. The focus of the module is on the use of systems controllers to link diverse building systems and on the applications of the OSI Reference Model to system integration.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Describe the various configurations of residential and commercial networked systems.
2. Explain the various connection options and protocols commonly used for integration.
3. Describe network configurations.
4. Describe the various user interfaces used for integrated systems monitoring and control.
5. Explain the methods of communication between devices and controllers.
6. Explain how integrated systems can be remotely accessed and controlled.
7. Set up components on an Ethernet-based network that can be controlled remotely.

Performance Task

Under the supervision of the instructor, the trainee should be able to do the following:

1. Set up components on an Ethernet-based network that can be controlled remotely.

Materials and Equipment

<table>
<thead>
<tr>
<th>Multimedia projector and screen</th>
<th>Selection of fiber-optic connectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Copies of NEC® requirements for communications wiring</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Examples of touch panels</td>
</tr>
<tr>
<td>Pencils and paper</td>
<td>If possible, a simple touch panel and manufacturer’s design tools</td>
</tr>
<tr>
<td>Interchangeable plug-in circuit card</td>
<td>If possible, an alarm system</td>
</tr>
<tr>
<td>Laptop computer</td>
<td>An Ethernet network</td>
</tr>
<tr>
<td>Two or three PCs with monitors and keyboards</td>
<td>Module Examinations*</td>
</tr>
<tr>
<td>Printer and other peripheral device such as a scanner</td>
<td>Performance Profile Sheets*</td>
</tr>
</tbody>
</table>

* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on electrical and electronic systems. Emphasize the importance of proper housekeeping.
Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.


Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 25 hours are suggested to cover Residential and Commercial Building Networks. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Planned Time</th>
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<tbody>
<tr>
<td>Sessions I-III. Introduction; Reasons for System Integration; The OSI Reference Model</td>
<td></td>
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<tr>
<td>A. Introduction</td>
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<td>B. Reasons for System Integration</td>
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<tr>
<td>1. Convergence</td>
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<tr>
<td>C. The OSI Reference Model</td>
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<tr>
<td>1. The Physical Layer</td>
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<tr>
<td>2. Layer 2 – The Data Link Layer</td>
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<td>3. Layer 3—The Network Layer</td>
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<td>4. Layer 4 – The Transport Layer</td>
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<td>5. Layer 5 – The Session Layer</td>
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<td>6. Layer 6 – The Presentation Layer</td>
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<td>7. Layer 7 – The Application Layer</td>
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<tr>
<td>Session IV. Communication Between Subsystems</td>
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<tr>
<td>A. Communication Between Subsystems</td>
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<tr>
<td>1. Basic Topology</td>
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<tr>
<td>2. Protocols</td>
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<tr>
<td>3. Network Configurations in Complex Systems</td>
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<tr>
<td>4. Intersystem Connections</td>
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<tr>
<td>5. Network Device Addresses</td>
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<tr>
<td>6. Networks, Hubs, Switches, and Routers</td>
<td></td>
</tr>
</tbody>
</table>
Session VI. System Programming; User Interfaces

A. System Programming
   1. Program Development Tools for Systems Controllers
   2. Graphical User Interface (GUI) Development Tools
   3. Other Specialized Development Tools
   4. Advanced Systems Controllers
   5. External Computer as Systems Controller

B. User Interfaces
   1. Feedback
   2. User Interface Types

Session VII. Fault Tolerance Procedures; Residential Applications

A. Fault Tolerance Procedures
   1. Individual Components
   2. Subsystems
   3. Integrated Systems

B. Residential Applications
   1. Integration of Other Home Systems

Sessions VIII and IX. Commercial Building Applications

A. Natural Combinations
   1. Fire Alarms Combined with Security, Sound, and Communications
   2. Video Combined with Access Control
   3. Fire Alarms Combined with HVAC, Elevators, and Lighting
   4. Traffic Control Combined with Video
   5. HVAC Combined with Lighting

B. PT/Laboratory
   Have trainees set up components on an Ethernet-based network that can be controlled remotely. This laboratory corresponds to Performance Task 1.

Session X. Review and Testing

A. Review

B. Module Examination
   1. Trainees must score 70% or higher to receive recognition from NCCER.
   2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.

C. Performance Testing
   1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
   2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.
Module Overview

This module introduces the trainee to intrusion detection systems and notification devices. The trainee will learn how to install and wire these systems, program the control panels, and test and troubleshoot.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify and describe intrusion detection system sensing and notification devices.
2. Describe the control equipment and methods used with intrusion detection systems.
3. Configure an intrusion detection system to meet a specified need.
4. Describe system and equipment installation practices.
5. Describe the inspection, testing, maintenance, and troubleshooting practices associated with intrusion detection systems.
6. Install and wire an intrusion detection system consisting of sensors, notification devices, and a control panel.
7. Program a control panel and describe the different components, inputs, and programming options used in controlling intrusion detection systems.
8. Test and troubleshoot an intrusion detection system.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Identify types of security sensors, notification devices, and control panels.
2. Select the correct sensors, notification devices, and control panels for various applications.
3. Install, wire, and program an intrusion detection system.
4. Troubleshoot an intrusion detection system.

Materials and Equipment

Multimedia projector and screen

Electronic Systems Technician Level Four PowerPoint® Presentation Slides

Computer

Whiteboard/chalkboard

Markers/chalk

Pencils and paper

Different types of security sensors

Magnetic switch sensors

Glass-break detectors

Burglar alarm screens

Shock (vibration) detectors

Photoelectric detectors

Seismic sensors

Proximity sensors

Different types of glass

Different types of notification devices:

Bells

Buzzers

Horns

Chimes

Sirens

Different types of control panels

Copies of NFPA codes and standards

Copies of UL Commercial Extent Number 1

Copies of ANSI/SIA CP-01, Control Panel Standard

– Features for False Alarm Reduction

Blank copies of the Intrusion System Standby Battery Calculation Form found in Appendix A

Copies of the latest edition of the National Fire
Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on electrical and electronic systems. Emphasize the importance of proper housekeeping.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.


Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 30 hours are suggested to cover *Intrusion Detection Systems*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Planned Time</th>
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<tbody>
<tr>
<td><strong>Session I. Introduction; Intrusion System Overview; Types of Intrusion System Sensors</strong></td>
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<tr>
<td>A. Introduction</td>
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<tr>
<td>B. Intrusion System Overview</td>
<td></td>
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<tr>
<td>1. Local</td>
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<td>2. Monitored</td>
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<td>3. Types</td>
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<tr>
<td>C. Types of Intrusion System Sensors</td>
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<tr>
<td>1. Perimeter</td>
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<td>2. Interior</td>
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<tr>
<td><strong>Sessions II and III. Annunciation (Notification) Devices; Control Panels</strong></td>
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<tr>
<td>A. Annunciation (Notification) Devices</td>
<td></td>
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<tr>
<td>1. Strobes</td>
<td></td>
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<tr>
<td>2. Bells, Buzzers, Horns, Chimes, and Sirens</td>
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</tr>
</tbody>
</table>
3. Voice Messages

B. Control Panels
   1. Control Units and Combination Systems
   2. Operating Panels (Control Points)
   3. Control Unit/Panel Circuit Labeling
   4. Types of Control Unit Outputs

C. PT/Laboratory
   Have trainees identify types of security sensors, notification devices, and control panels. This laboratory corresponds to Performance Task 1.

Sessions IV and V. Communication and Monitoring; System Design

A. Communication and Monitoring
   1. Communications Options
   2. Monitoring Options
   3. Communication Methods and Systems

B. System Design
   1. Applications
   2. Methods for Connection
   3. UL Certificated Requirements
   4. False Alarm Prevention and False Alarm Control Teams (FACT)

C. PT/Laboratory
   Have trainees select the correct sensors, notification devices, and control panels for various applications. This laboratory corresponds to Performance Task 2.

Session VI. General Installation Guidelines

A. General Installation Guidelines
   1. General Wiring Requirements
   2. Workmanship
   3. Access
   4. Circuit Identification
   5. Power-Limited Circuits in Raceways
   6. Mounting of Detector Assemblies
   7. Outdoor Wiring
   8. Fire-Stopping
   9. Air-Handling Spaces
   10. Hazardous Locations
   11. Wet or Corrosive Environments
   12. Underground
   13. Remote Control Signaling Circuits
   14. Wiring Protection
   15. Floor to Floor Cables
   16. Cables in Raceways
   17. Raceways-Cable Support
   18. Cable Spacing
   19. Elevator Shafts
   20. Wiring Methods
   21. Primary Power
   22. Secondary Power
   23. Grounding
Sessions VII through IX. System and Equipment Installation Guidelines; Programming Options

A. System and Equipment Installation Guidelines
   1. Minimum Secondary Power
   2. Control Units
   3. Perimeter Sensors
   4. Perimeter Fence or Exterior Detection Systems
   5. Interior Intrusion Systems

B. Programming Options
   1. Controlled and 24-Hour Zones
   2. Entry and Exit Delays
   3. Delayed and Instant Zones
   4. Perimeter and Interior Zones
   5. Home and Away Feature
   6. Interior and Perimeter Follower Zones
   7. Panic, Duress, Medical, and Fire Zones

C. PT/Laboratory
   Have trainees install, wire, and program an intrusion detection system. This laboratory corresponds to Performance Task 3.

Sessions X and XI. Inspection, Testing, and Maintenance; Intrusion System Troubleshooting Guidelines

A. Inspection, Testing, and Maintenance
   1. Purpose of Testing
   2. Before Testing
   3. Precautions for Occupied Buildings
   4. Definitions
   5. General Requirements
   6. Testing Methodology
   7. After Testing

B. PT/Laboratory
   Have trainees troubleshoot an intrusion detection system. This laboratory corresponds to Performance Task 4.

Session XII. Review and Testing

A. Review

B. Module Examination
   1. Trainees must score 70% or higher to receive recognition from NCCER.
   2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor

C. Performance Testing
   1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
   2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.
Module Overview

This module covers the basics of fire alarm systems, including devices, circuits, control panels, system design, installation, power requirements, testing, commissioning, and troubleshooting.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Explain the terminology associated with fire alarm systems.
2. Describe the relationship between fire alarm systems and life safety.
3. Identify and explain the role that various codes and standards play in both commercial and residential fire alarm applications.
4. Describe the characteristics and functions of various fire alarm system components.
5. Explain and describe the different types of circuitry that connect fire alarm system components.
6. Describe the operation of conventional, addressable, and analog fire alarm systems.
7. Draw a two-wire and four-wire initiating circuit showing proper supervision.
8. Install and troubleshoot a four-wire initiating device circuit.
9. Wire either a conventional zone or a fire alarm system pull station.
10. Troubleshoot an instructor-induced ground fault of a fire alarm system.
11. Isolate a short circuit on a fire alarm system.
12. Isolate an open circuit on a fire alarm circuit.
13. Program a system.
14. Commission a system.
15. Correctly wire an RJ-31X telephone jack.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Draw a two-wire and four-wire initiating circuit.
2. Install a fire alarm system.
3. Commission a system.
5. Complete an NFPA record of completion.
6. Troubleshoot a fire alarm system.

Materials and Equipment

- Multimedia projector and screen
- Computer
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- Appropriate personal protective equipment
- Copies of NFPA codes and standards
- Different types of detectors (sensors), including:
  - Heat detectors
  - Smoke detectors
  - Ionization detectors
  - Photoelectric smoke detectors
  - Flame detectors
  - Carbon monoxide detectors
  - Initiating devices, wiring, and tools necessary to complete a four-wire initiating circuit
  - RJ-31X telephone jacks, wiring, and tools necessary to wire an RJ-31X telephone jack

continued
**Safety Considerations**

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Emphasize basic electrical system safety.

**Additional Resources**

This module presents thorough resources for task training. The following resource material is suggested for further study.


**Teaching Time for This Module**

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 40 hours are suggested to cover *Fire Alarm Systems*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

### Topic Planned Time

**Sessions I and II. Introduction; Codes and Standards; Fire Alarm Systems Overview**

A. Introduction

B. Codes and Standards
   1. The National Fire Protection Association (NFPA)
   2. Other Codes
   3. Labeled and Listed Equipment

C. Fire Alarm Systems Overview
   1. Fire Alarm Circuit Designations
   2. Types of Fire Alarm Systems

D. PT/Laboratory
   Have trainees practice drawing two-wire and four-wire initiating device circuits. This laboratory corresponds to Performance Task 1.

**Copy of the latest edition of the National Electrical Code®**
**Copies of the latest edition of the National Fire Alarm and Signaling Code**
Fire alarm system, pull stations, and tools necessary to wire, program, commission, and troubleshoot a conventional zone fire alarm or simulator

* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.
Session III. Fire Alarm System Equipment; Fire Alarm Initiating Devices

A. Fire Alarm System Equipment
B. Fire Alarm Initiating Devices
   1. Conventional versus Addressable Commercial Detectors
   2. Automatic Detectors
   3. Heat Detectors
   4. Smoke Detectors
   5. Other Types of Detectors
   7. Sprinkler System Fire Alarm and Supervision Equipment

Sessions IV and V. Fire Alarm Control Units; FACU Primary and Secondary Power; Notification Appliances; Communications and Monitoring

A. Control Units
   1. User Control Points
   2. FACU Initiating Devices
   3. Types of FACU Alarm Options
   4. FACU Listings
B. FACU Primary and Secondary Power
C. Notification Appliances
   1. Visual Notification Devices
   2. Audible Notification Devices
   3. Voice Evacuation Systems
   4. Signal Considerations
D. Communications and Monitoring
   1. Monitoring Options
   2. Communications Methods
E. PT/Laboratory
   Have trainees practice correctly wiring an RJ-31X telephone jack. This laboratory corresponds to Performance Task 4.

Session VI. General Installation Guidelines

A. General Installation Guidelines
   1. General Wiring Requirements
   2. Workmanship
   3. Access to Equipment
   4. Fire Alarm Circuit Identification
   5. Power-Limited Circuits in Raceways
   6. Mounting of Detectors
   7. Outdoor Wiring
   8. Fire Stopping
   9. Wiring in Air Handling Spaces
   10. Wiring in Hazardous Locations
   11. Wet or Corrosive Environments
   12. Wiring Protection
   13. Fire Pumps
   14. Remote Control Signaling Circuits
   15. Cables Running Floor to Floor

continued
16. Cables Running in Raceways
17. Cable Spacing
18. Elevator Shafts
19. Terminal Wiring Methods
20. Conventional Initiation Device Circuits
21. Signaling Line Circuits (SLCs)
22. Notification Appliance Circuits
23. Primary Power Requirements
24. Secondary Power Requirements
25. Grounding

Session VII. Total Premises Fire Alarm System Installation Guidelines
A. Total Premises Fire Alarm System Installation Guidelines
   1. Manual Fire Alarm Box (Pull Box) Installation
   2. Flame Detector Installation
   3. Smoke Chamber Definition, Smoke Spread Phenomena, and Stratification Phenomena
   4. General Precautions for Detector Installation
   5. Spot Detector Installations on Flat, Smooth Ceilings
   6. Photoelectric Beam Smoke Detector Installations on Flat, Smooth Ceilings
   7. Spot Detector Installations on Irregular Ceilings
   8. Notification Appliance Installation
   9. FACU Installation Guidelines
  10. Trouble Signal Device Installation

Sessions VIII and IX. Fire Alarm-Related Systems and Installation Guidelines
A. Fire Alarm-Related Systems and Installation Guidelines
   1. Ancillary Control Relay Installation Guidelines
   2. Duct Smoke Detectors
   3. Door Hold-Open Releasing Service
   4. Elevator Recall and Shutdown
   5. Special Door Locking Arrangements
   6. Suppression System Fire Alarm Initiation
   7. Supervision of Suppression Systems
B. PT/Laboratory
   Have trainees practice installing a fire alarm system. This laboratory corresponds to Performance Task 2.

Session X. Household Fire Alarm Installation Guidelines
A. Household Fire Alarm Installation Guidelines
   1. Smoke Detectors
   2. Household Heat Detectors
   3. Household Audibility Considerations
   4. Extra Sounders for Greater Life Safety
   5. Household Visible Notification Appliances
   6. Primary Power
   7. Standby Power Requirements
   8. Combination Systems
   9. Monitoring/Supervising Station Systems
10. Supervising Station Verification of Signals
11. User Instructions
12. Wiring Methods
13. Residential Testing Requirements

Session XI–XII. Inspection, Testing, Commissioning, and Maintenance
A. Inspection, Testing, and Maintenance
   1. Before Testing
   2. Precautions for Occupied Buildings
   3. Definitions
   4. General Requirements
   5. Central Stations (Certificated Systems)
   6. All Systems
   7. Testing Methodology
   8. After Testing
B. Commissioning
C. Troubleshooting
   1. Alarm System Troubleshooting Guidelines
   2. Addressable System Troubleshooting Guidelines
D. PT/Laboratory
   Have trainees practice completing an NFPA record of completion. This laboratory corresponds to Performance Task 5.

Sessions XIII–XV. Laboratory
A. PT/Laboratory
   1. Have trainees practice commissioning a fire alarm system. This laboratory corresponds to Performance Task 3.
   2. Have trainees troubleshoot an instructor-induced ground fault of a fire alarm system. This laboratory corresponds to Performance Task 6.

Session XVI. Review and Testing
A. Review
B. Module Examination
   1. Trainees must score 70% or higher to receive recognition from NCCER.
   2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.
C. Performance Testing
   1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
   2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.
Overview of Nurse Call and Signaling Systems
Annotated Instructor’s Guide

Module Overview

This module introduces the trainee to the basic types and components of nurse call systems used in health care facilities. There are many variations on components but all are strictly controlled by authorities such as NFPA, UL, and NEMA. The trainee will learn some of the components and features and how the systems are used.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Explain key terms related to nurse call systems.
2. Identify the codes and standards that apply to the installation and operation of nurse call systems.
3. Describe the different types of nurse call systems and explain their differences.
4. Explain the limitations on connections between nurse call systems and other systems.
5. State the general installation guidelines that apply to nurse call systems.
6. Install and connect nurse call system components.

Performance Task

Under the supervision of the instructor, the trainee should be able to do the following:

1. Install and connect nurse call system components.

Materials and Equipment

Multimedia projector and screen
Computer
Whiteboard/chalkboard
Markers/chalk
Pencils and paper
Copies of NFPA 70®, NFPA 99, and UL Standard 1069 for reference
UPS

If possible, a microprocessor-based audiovisual nurse call system, a pager, or samples of system components
If possible, a three-wire and/or a five-wire pillow speaker
If possible, a pager from a nurse call system
Nurse call system components and a compatible annunciator or central microprocessor
Module Examinations*
Performance Profile Sheets*

* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.
Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on electrical and electronic systems. Emphasize the importance of proper housekeeping.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 15 hours are suggested to cover Overview of Nurse Call and Signaling Systems. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

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Sessions III and IV. Installation Practices
   A. Installation Practices
      1. Electrical Power Requirements
      2. Installation Guidelines
      3. Programming

Session V. System Checkout/Commissioning
   A. System Checkout/Commissioning
   B. PT/Laboratory
      Have trainees install and connect nurse call system components. This laboratory corresponds to Performance Task 1.

Session VI. Review and Testing
   A. Review
   B. Module Examination
      1. Trainees must score 70% or higher to receive recognition from NCCER.
      2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.
   C. Performance Testing
      1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
      2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.
Module Overview

This module introduces the trainee to the applications and operation of CCTV systems. The trainee will learn to select the correct components for an application and troubleshoot a CCTV system.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Describe the typical uses and configurations of CCTV systems.
2. Describe the operation of CCTV systems.
3. Identify and describe the components of a CCTV system, including:
   - Cameras
   - Lenses
   - Amplifiers
   - Recorders
   - Switchers/multiplexers
5. Define installation and test requirements for CCTV systems.
6. Select the correct lens for a given CCTV application.
7. Select the correct equipment for a CCTV installation.
8. Troubleshoot a CCTV system.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Select the correct lens for a given CCTV application.
2. Select the correct equipment for a CCTV installation.
3. Troubleshoot a CCTV system.

Materials and Equipment

- Multimedia projector and screen
- Computer
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- Appropriate personal protective equipment
- A working digital CCTV system with manufacturer’s instruction manual

* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on electrical and electronic systems. Emphasize the importance of proper housekeeping.
**Additional Resources**

This module presents thorough resources for task training. The following resource material is suggested for further study.


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**Teaching Time for This Module**

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 30 hours are suggested to cover CCTV Systems. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

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<td>4. Recording and Retrieving Network Video</td>
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<td>5. Factors that Affect Digital CCTV</td>
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<td>6. Monitoring Video in a Digital CCTV System</td>
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<td>7. Network and User Authentication</td>
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<td>8. Encryption and Decryption</td>
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<td>B. Laboratory</td>
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<tr>
<td>Have the trainees practice programming CCTV system options using the manufacturer’s instructions.</td>
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Sessions III–VI. CCTV System Components
A. CCTV System Components
   1. Cameras
   2. The Camera Lens
   3. Camera Mounts and Housings
   4. Date and Time Generators
   5. Controllers
   6. Alarm Interface Units
   7. Motion Detection
   8. CCTV Keyboards
   9. Recorder-Controllers
  10. Video Monitors
B. PT/Laboratory
   Have the trainees select the correct equipment for a CCTV installation.
   This laboratory corresponds to Performance Task 2.

Session VII. Signal Distribution; Power Sources
A. Signal Distribution
   1. CCTV Signal Amplifiers
   2. Distribution Amplifiers for CCTV
   3. Signal-to-Noise Ratio
   4. The Importance of Impedance Matching
   5. Ground Loops
   6. The Advantages of Fiber Optic Cable in CCTV Applications
B. Power Sources

Sessions VIII and IX. Lighting and Illumination
A. Lighting and Illumination
   1. Working with Light Conditions
   2. Measuring Light
   3. Measuring Reflectivity
   4. Light Sensitivity of Cameras
   5. Infrared Lighting and Cameras
   6. Illumination and Beam Angles
   7. Managing Backlighting
B. PT/Laboratory
   Have the trainees select the correct lens for a given application. This laboratory corresponds to Performance Task 1.
Sessions X and XI. Medium to Large CCTV Systems; Testing CCTV System Video

A. Medium to Large CCTV Systems
   1. Control Systems for Large CCTV Installations

B. Laboratory
   Have trainees practice programming options for a CCTV System.

C. Testing CCTV System Video
   1. Video Equipment Calibration
   2. Signal Synchronization

D. Laboratory
   1. Have trainees practice measuring and verifying video levels.
   2. Have trainees practice syncing and phasing multiple cameras.

E. PT/Laboratory
   Have the trainees troubleshoot a CCTV system. This laboratory corresponds to Performance Task 3.

Session XII. Review and Testing

A. Review

B. Module Examination
   1. Trainees must score 70% or higher to receive recognition from NCCER.
   2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.

C. Performance Testing
   1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
   2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.
Module Overview

This module introduces the trainee to access control systems, the systems that allow controlled entry or access to areas and resources within a facility. The trainee will learn to identify types of access control equipment and to install readers and access control systems.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Explain the application and operation of access control systems.
2. Identify and explain the uses of the following types of entry equipment:
   - Entry barriers
   - Locking devices, fail safe, and fail secure
   - Entry/exit readers
3. Explain the types of controller topologies.
4. Describe general installation guidelines for entry control system equipment.
5. Install a reader for an entry control system.
6. Install an access control system.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Select components for an access control system.
2. Install an access control system.
3. Troubleshoot an access control system.

Materials and Equipment

Multimedia projector and screen
Electronic Systems Technician Level Four
PowerPoint® Presentation Slides
Computer
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Coded credentials
   - Magnetic stripe cards
   - Proximity cards
   - Proximity key ring tags
   - Smart cards
Electric lock strikes and electric locksets
Electric bolt locks
Electromagnetic locks and push bars
Touch sense bars and cables
Exit switches and accessories
Electric locking device, exit touch bar, controller,
   key pad, and tools necessary to install, program,
   test, and troubleshoot an access control system
Copies of Quick Quiz*
Module Examinations**
Performance Profile Sheets**

* Located at the back of the module.
**Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.
Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on electrical and electronic systems. Emphasize the importance of proper housekeeping.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.


Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 35 hours are suggested to cover Access Control Systems. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

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<td>Sessions I and II. Introduction; Entry and Access Control Systems; Controllers and Power Supplies</td>
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A. Introduction  
B. Entry and Access Control Systems  
1. Non-Staffed Entry Control System  
2. Non-Staffed Entry Control System Considerations  
3. Access Control Systems  
4. Coded Credentials  
5. Protective Distribution Systems  
C. Controllers and Power Supplies |  
| Session III. Entry/Exit Readers |  
A. Entry/Exit Readers  
1. Swipe, Insert, and Proximity Readers  
2. Biometric Readers |  
| Sessions IV–VI. Locking Devices and Accessories |  
A. Locking Devices and Accessories  
1. Electric Strikes  
2. Electric Bolt Locks  
3. Electric Locksets (Latches)  
4. Electromagnetic Locks  
5. Exit Devices  
6. Cable Supervision  
7. Door Status Devices |
Sessions VII and VIII. Entry Control Barriers
A. Entry Control Barriers
   1. Gates
   2. Turnstiles and Rotary Security Doors
   3. Mantraps
   4. Doors

Sessions IX–XIII. Installation Guidelines
A. Installation Guidelines
   1. Installation Tips
   2. Installation Procedures
B. PT/Laboratory
   1. Have trainees select components for an access control system.
      This laboratory corresponds to Performance Task 1.
   2. Have trainees install an access control system. This laboratory corresponds to Performance Task 2.
   3. Have trainees troubleshoot an access control system. This laboratory corresponds to Performance Task 3.

Session XIV. Review and Testing
A. Review
B. Module Examination
   1. Trainees must score 70% or higher to receive recognition from NCCER.
   2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.
C. Performance Testing
   1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
   2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.