

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
(ISBN 978-0-13-266258-1)
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.

Audio Made Easy (OR How to be a Sound Engineer Without Really Trying). Ira White. Milwaukee, WI: Hal Leonard Corporation.

Audio Systems Design and Installation. Philip Giddings. Woburn, MA: Focal Press.

Guide to Sound Systems for Worship. Jon F. Eiche. Milwaukee, WI: Hal Leonard Corporation.

Live Sound Reinforcement. Scott Hunter Stark. Vallejo, CA: Mix Books.

Sound Reinforcement Handbook. Gary Davis and Ralph Jones. Milwaukee, WI: Hal Leonard Corporation.

The Audio Dictionary. Glenn D. White. Seattle, WA: University of Washington Press.

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.

Topic	Planned Time
Sessions I-III. Introduction; Elements of a Sound Reinforcement System, Part One	
A. Introduction	_____
1. What is Sound?	_____
2. Volume, Pressure, and Speed	_____
3. Audio Systems Applications	_____
B. Elements of a Sound Reinforcement System	_____
1. Microphone Basics	_____
2. Microphone Classifications	_____
3. Speakers	_____
4. Classification of Speaker Types	_____
5. Processing Equipment	_____
6. Signal Processing	_____
7. Amplifiers for Sound Reinforcement	_____
8. Constant-Voltage Audio Distribution	_____
9. Audio Transformers	_____
C. PT/Laboratory	_____
1. Have the trainees mount a speaker. This laboratory corresponds to Performance Task 1.	
2. Have the trainees read and interpret specifications and shop drawings. This laboratory corresponds to Performance Task 6.	

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
Electronic Systems Technician Level Four
PowerPoint® Presentation Slides
(ISBN 978-0-13-266258-1)
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 photo-
graph in high resolution and in low resolu-
tion

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 moni-
tor 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.

How Video Works, Second Edition: From Analog to High Definition. Marcus Weisse. Burlington, MA: Focal Press.

Maxim Application Note 750, Bandwidth Versus Video Resolution, www.maxim-ic.com.

Video Bandwidth, www.extron.com.

Video Demystified: A Handbook for Video Engineers, Fifth Edition. Keith Jack. Burlington, MA: Newnes.

www.extron.com (video control equipment)

www.da-lite.com (projection devices)

www.draprinc.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.

Topic	Planned Time
Session I. Introduction; Overview of Video Technology; Analog Video, Part One	
A. Introduction	_____
B. Overview of Video Technology	_____
1. A Simple Video System	_____
2. A Real-World Video System	_____
3. Video Connecting Equipment	_____
C. Analog Video	_____
1. National Television System Committee Analog Video	_____
2. Color Signaling for the Americas	_____
3. Blanking Intervals	_____
Session II. Analog Video, Part Two	
A. Analog Video	_____
1. Synchronizing Video Signals	_____
2. Composite Video	_____
3. S-Video	_____
4. Component Video YPrPb	_____
5. YIQ	_____
6. RGB	_____
7. RGB Sync-on-Green	_____
8. RGSB	_____
9. RGBHV	_____
10. Other Video Standards	_____

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
Electronic Systems Technician Level Four
PowerPoint® Presentation Slides
(ISBN 978-0-13-266258-1)
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*®
Compression connectors for RG-6 or RG-11 cable
Equal lengths of RG-6 and RG-11 coaxial cable for demonstration of cable attenuation loss
Sample lengths of RG-6 and RG-11 coaxial cable
Sample lengths of semiflex coaxial cable
Access to one or more operational CATV/SMATV systems

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

Signal level meter (SLM)
 Spectrum analyzer
 Cable tone test set
 Satellite tester
 Portable color TV receiver
 Assorted test cables and related connectors and adapters
 Cable cutter

Coaxial cable stripper
 Coaxial cable compression tool for the specific type of F-connector being used for practicing coaxial cable termination
 Torque wrench (25 to 30 inch-pound range)
 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.

National Electrical Code Handbook, Latest Edition. Quincy, MA: National Fire Protection Association.

Wireless Cable and SMATV. Steve Berkoff and Frank Baylin. Boulder, CO: Baylin Publications.

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.

Topic	Planned Time
Sessions I and II. Introduction; Evolution of CATV Systems; Architecture of Cable Systems; Broadband System Basics; Satellite Technology	
A. Introduction	_____
B. Evolution of CATV Systems	_____
C. Architecture of Cable Systems	_____
1. CATV Architecture	_____
2. MATV and SMATV Architecture	_____
D. Broadband System Basics	_____
1. Prefixes	_____
2. Scientific Notation	_____
3. Frequency Spectrum	_____
4. TV Channels	_____
5. Units of Measure	_____
6. Common CATV Symbols	_____

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
Electronic Systems Technician Level Four Power-Point[®] Presentation Slides
(ISBN 978-0-13-266258-1)

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.

Topic	Planned Time
Session I. Introduction; Overview of Media Management Systems; Types of Systems	
A. Introduction	_____
B. Overview of Media Management Systems	_____
C. Types of Systems	_____
1. Digital Library Systems	_____
2. Content-on-Demand Systems	_____
Session II. Video Display Equipment	
A. Video Display Equipment	_____
1. Local Control Units	_____
2. Television Monitors	_____
3. Speakers	_____
4. Video Projectors	_____
5. Computers	_____
6. Displays	_____
Sessions III and IV. Storage, Retrieval, and Playback Equipment	
A. Storage, Retrieval, and Playback Equipment	_____
1. Local Digital Data Sources	_____
2. Digital File Formats	_____
3. Local Digital Data Storage	_____
4. Internet Digital Data Sources	_____
5. Content Players	_____
6. Broadcast Sources	_____
Sessions V and VI. Network Infrastructure	
A. Network Infrastructure	_____
1. Broadband A/V	_____
2. Baseband A/V	_____
3. Data Network	_____
4. Video Transmission Equipment	_____
Session VII. MMS Software	
A. MMS Software	_____
1. User Interface	_____
2. Content Scheduling Issues	_____

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
Electronic Systems Technician Level Four
PowerPoint® Presentation Slides
(ISBN 978-0-13-266258-1)

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.

Business Telecom Systems: A Guide to Choosing the Best Technologies and Service. New York, NY: CMP Books.

Newton's Telecom Dictionary. San Francisco, CA: CMP Books of CMP Media LLC.

Next Generation Phone Systems: How to Choose a Voice and Data System for E-Business. New York, NY: CMP Books of CMP Media LLC.

The Telecom Handbook. New York, NY: CMP Books of CMP Media LLC.

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.

Topic	Planned Time
Session I. Telephone History; Plain Old Telephone Service (POTS)	
A. Telephone History	_____
B. Plain Old Telephone Service (POTS)	_____
1. Local Subscriber Loop	_____
2. Local Exchange Switch	_____
3. Central Office Services	_____
Session II. Telephone Switching Systems	
A. Telephone Switching Systems	_____
1. PBX Systems	_____
2. Key Telephone Systems	_____
3. Electronic Key Service Units	_____
4. Hybrid Systems	_____
Session III. Multiplexing; Other Telecommunications Technologies	
A. Multiplexing	_____
1. Analog Voice to Digital Voice Conversion	_____
2. Pulse Code Modulation (PCM)	_____
3. Digital Transmission Level 1 Signals (T-1)	_____
4. Digital Transmission Level 3 Signals (T-3)	_____
B. Other Telecommunications Technologies	_____
1. Digital Services	_____
2. Digital Subscriber Line (DSL)	_____

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

Multimedia projector and screen
Electronic Systems Technician Level Four
PowerPoint® Presentation Slides
(ISBN 978-0-13-266258-1)

Whiteboard/chalkboard

Markers/chalk

Pencils and paper

Interchangeable plug-in circuit card

Laptop computer

Two or three PCs with monitors and keyboards

Printer and other peripheral device such as a scanner

Selection of fiber-optic connectors

Internet connection

Copies of NEC® requirements for communications wiring

Examples of touch panels

If possible, a simple touch panel and manufacturer's design tools

If possible, an alarm system

An Ethernet network

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.

Network Architecture & Design: A Field Guide for IT Professionals. Jerome F. DiMarzio. Indianapolis, IN: Sams Publishing.

Smart Home Automation with Linux. Steven Goodwin. New York, NY: Apress.

Smart Home Hacks: Tips & Tools for Automating Your House. Gordon Meyer. Sebastopol, CA: O'Reilly Media.

Top-Down Network Design, 3rd Edition. Priscilla Oppenheimer. Indianapolis, IN: Cisco Press.

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.

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

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.
9. Wire an RJ-31X connector for line seizure.

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 Power-Point[®] Presentation Slides
(ISBN 978-0-13-266258-1)
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*
Sensors, notification devices, control panel, and tools necessary to install, program, and test a security system or simulator
Copies of the latest edition of the *National Fire*

continued

* 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.

Security for Building Occupants and Assets. The Whole Building Design Guide/National Institute of Building Sciences. www.wbdg.org.

The Design and Evaluation of Physical Protection Systems, 2007. Mary Lynn Garcia. Boston, MA: Butterworth-Heinemann.

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.

Topic	Planned Time
Session I. Introduction; Intrusion System Overview; Types of Intrusion System Sensors	
A. Introduction	_____
B. Intrusion System Overview	_____
1. Local	_____
2. Monitored	_____
3. Types	_____
C. Types of Intrusion System Sensors	_____
1. Perimeter	_____
2. Interior	_____
Sessions II and III. Annunciation (Notification) Devices; Control Panels	
A. Annunciation (Notification) Devices	_____
1. Strobes	_____
2. Bells, Buzzers, Horns, Chimes, and Sirens	_____

- 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
 - 5. 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. Explain 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.
16. Complete an NFPA record of completion.

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.
4. Correctly wire an RJ-31X telephone jack.
5. Complete an NFPA record of completion.
6. Troubleshoot a fire alarm system.

Materials and Equipment

Multimedia projector and screen
Electronic Systems Technician Level Four
PowerPoint® Presentation Slides
(ISBN 978-0-13-266258-1)
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

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

Blank copies of the NFPA record of completion 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. Emphasize basic electrical system safety.

Additional Resources

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

A Designer's Guide to Fire Alarm Systems, First Edition. Robert M. Gagnon, Ronald H. Kirby. Quincy, MA: National Fire Protection Association.

Electrical Installations in Hazardous Locations. Peter J. Schram, Robert Bendetti, Mark W. Earley. Sudbury, MA: Jones and Bartlett Learning.

Fire Alarm Signaling Systems. Richard W. Bukowski, Wayne D. Moore. Quincy, MA: National Fire Protection Association.

NFPA Pocket Guide to Fire Alarm and Signaling System Installation. Merton W. Bunker, Jr., Richard J. Roux. Quincy, MA: National Fire Protection Association.

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.	

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 _____
 - 6. Manual Fire Alarm Boxes _____
 - 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 33409-12

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
Electronic Systems Technician Level Four
PowerPoint® Presentation Slides
(ISBN 978-0-13-266258-1)
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.

Topic	Planned Time
Session I. Introduction; Important Terms; Codes and Standards; Types of Nurse Call Systems	
A. Introduction	_____
B. Important Terms	_____
C. Codes and Standards	_____
1. National Fire Protection Association (NFPA)	_____
2. Underwriters Laboratory (UL)	_____
3. Joint Commission on Accreditation of Health Care (JCAHO)	_____
4. National Electrical Manufacturers Association (NEMA)	_____
D. Types of Nurse Call Systems	_____
1. Visual Systems	_____
2. Audiovisual Systems	_____
3. Microprocessor-Based Audiovisual Systems	_____
Session II. Call Management; Skilled Living and Assisted Living Facilities; System Interfaces	
A. Call Management	_____
B. Skilled Living and Assisted Living Facilities	_____
C. System Interfaces	_____
1. Telephone Equipment	_____
2. Entertainment Equipment	_____
3. Paging Systems	_____
4. Fire Alarm Systems	_____
5. Security Systems	_____
6. Auxiliary Alarm Devices	_____
7. Computers and Printers	_____

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
4. Describe how light affects camera selection.
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
Electronic Systems Technician Level Four Power-Point® Presentation Slides
(ISBN 978-0-13-266258-1)

Computer

Whiteboard/chalkboard

Markers/chalk

Pencils and paper

Appropriate personal protective equipment

A working digital CCTV system with manufacturer's instruction manual

Video cameras and lenses

Waveform monitor

Vectorscope

Color bar generator

Test cables

Manufacturer catalogs or data sheets (or Internet access) to support equipment selection

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.video-surveillance-guide.com contains articles and links related to video surveillance.

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.

Topic	Planned Time
Session I. Introduction; CCTV System Overview	
A. Introduction	_____
B. CCTV System Overview	_____
1. Typical CCTV System	_____
2. Multiple Cameras with a Switcher	_____
3. Viewing Multiple Cameras with a Splitter	_____
4. Viewing Multiple Cameras with a Multiplexer	_____
5. A Video Recorder Used to Archive Video	_____
Session II. CCTV Technology	
A. CCTV Technology	_____
1. Digital vs. Analog	_____
2. Review of Internet Protocols	_____
3. Client-Server CCTV for the Internet Age	_____
4. Recording and Retrieving Network Video	_____
5. Factors that Affect Digital CCTV	_____
6. Monitoring Video in a Digital CCTV System	_____
7. Network and User Authentication	_____
8. Encryption and Decryption	_____
B. Laboratory	_____
Have the trainees practice programming CCTV system options using the manufacturer's instructions.	

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
(ISBN 978-0-13-266258-1)
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, pro-
gram, 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.

The Design and Evaluation of Physical Protection Systems, 2001. M.L. Garcia. Burlington, MA: Butterworth Heinemann.

Security, ID Systems, and Locks: The Book on Electronic Access Control, 1997. J. Konicek/K. Little. Burlington, MA: Butterworth-Heinemann.

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.

Topic	Planned Time
Sessions I and II. Introduction; Entry and Access Control Systems; Controllers and Power Supplies	
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.
