Tennessee
Network of Security Integrators

TN Security Certification Course

Student Manual

Tennessee Network of Security Integrators
TN Security Certification

WELCOME

to the Tennessee Network of Security Integrators
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Goals of this Course

- Compliance with the law
  - Successful completion of this course will meet the state requirements
- Expand your knowledge
  - We will cover a broad scope of the alarm industry offering insight into how to design, install and service alarm systems.
- Bring new industry members up to speed
  - Our goal will be to bring those new to the industry up to at least a minimal level of industry knowledge. We also hope to fill in areas of knowledge for experienced professionals.
- Brush you up on codes & standards
  - Industry codes and standards are revised every 3 years to reflect new best practices and the latest technology.

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Table of Contents

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Why you are here

- Improve your knowledge
- Enhance your value to your company
- Comply with state requirements

5

Basic Class Rules

- Locate your Emergency Exits
- Understand your Emergency Evacuation plan
- Silence ALL electronic devices
- You must attend the entire course and pass the exam to fully complete the program
- Be Interactive

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What TNSI does for you

- Provides networking opportunities
- Gives you information
- We monitor and influence the state and local legislative process
- We provide training at a discounted rate for members
- Belonging gives your company credibility & exposure

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We need your involvement!

- You only get back – what you put in
- This association is your voice to government
- Speak up!

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Disclaimers

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- All codes declare that all manufacturers instructions must also be followed to be in compliance

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Ethics, Standards and Codes

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Professionalism

- The standing, practice, or methods of a professional, as distinguished from an amateur

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Company Standards

- **Common sources**
  - –Employee handbook
  - –Company policy
  - –On the Job Training
- **Common Reasons to Set Standards**
  - –Meet Customer Expectations
  - –Makes Troubleshooting easier
  - –It is more efficient

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Company Obligations to Customer

- Meet customer need
- Comply with law
- Install full system as sold
- Test to verify operation
- Ensure user understanding
- Offer ongoing service and repair

4

Employee Obligations to Customer

- You only get one chance to make a first impression for YOU and YOUR COMPANY
- Look the part - dress to the level of professional that you want to be seen as
- Be Prepared - have everything you need ready to go

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Employee Obligations To Employer

- Do your best!
- Promote customer satisfaction
- Promote company growth
- Work as a PROFESSIONAL !

6

Courtesy

- Good customer service attracts & retains customers
- Treat the customer with respect - they are signing your check for that day!

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Customer Communications

- Read the job documentation
- Explain what you will be installing
- Verify job specifications with customer
- Document changes

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General Obligations

- Work WITH your local Police and Fire departments
- Promote the industry's integrity through your local and state associations
- Work within your local community and local association to promote ethics and integrity in our industry

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Do Your Best!

- Earn reputation as a professional
- Expand your opportunities
- Increase your value
- Gain satisfaction

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Ethics

Sales Ethics

Installer Ethics

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Ethics

- That branch of philosophy dealing with values relating to human conduct, with respect to the rightness and wrongness of certain actions and to the goodness and badness of the motives and ends of such actions

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Sales Ethics

- Educate yourself about what you are selling
- Inform your customer of ALL contract details
- Respect the competition - sell your strengths not others weaknesses

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Sales Ethics

- Listen to your customer's needs & desires
- Design to meet the customer's need
- Remember - One Size Does Not Fit All

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Sales Ethics

- Do not mislead a customer
- Do not use tricks to get in front of the customer
- Do not imply you are with the user's alarm company and need to test or upgrade the system

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Installer Ethics

- Educate yourself
- Be honest about system operation
- Comply with laws and standards
- Be safe
- Work as if it is your own home or business
- Make sure that the customer is comfortable with system operation after completion
- Make sure you leave each home or business cleaner than you found it

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Standards and Codes

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What is a Standard?

- A set of specifications or rules
- Sets a level of quality
- Specifies type of equipment
- Sets type of training
- Describes how the system should operate

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What is a Code?

- Codes tell us when a given type system is required
- Codes are easily and often incorporated into laws
- Codes usually incorporate standards into law

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Following Codes & Standards

- Results in fewer false alarms
- Lowers maintenance costs
- Means better system performance
- More credibility!
- YOUR responsibility to follow

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Liability

- Substandard work leads to faulty systems
- Faulty systems lead to losses or injuries for customers
- Legal action can result affecting the industry, company and employee
- Potential for loss of license for company or employee for code / law violations
- Potential monetary damages or fines

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Judge and Jury

- Courts take into consideration whether any recognized standard was followed
- The excuse: “Everyone is doing it this way” will not win a court case!

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Where Do Standards Come From Anyway?

- Experts in the field
- Interested public
- Events (crimes, fires)
- Industry (manufacturers, insurance, owners)
- Agencies (fire, police, EMS)

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Standards are updated periodically

- Most standards get updated every three years

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Types Of Standards

- International Standards
- National Standards
- State Standards
- Local Standards
- Company Standards
- Manufacturers Instructions

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Shall & Should…

- "**Shall"** means it is mandatory. You will do it this way
- **"Should"** means its recommended but not required. Be ready to explain to the judge and jury why you didn't

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Minimum Standards

Codes and standards contain the minimum requirements

We can exceed those minimums

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N.F.P.A. 70- NEC

The National Electrical Code

Significant Sections

- –Article 110 – (Requirements for Electrical installations
- –Article 250- (grounding)
- –Article 300- (plenums and raceways)
- –Article 725- (control circuits)
- –Article 760- (fire alarms)
- –Article 800- (communications)

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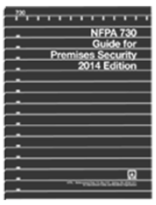
NFPA 730

- Guide that describes construction, protection, occupancy features, and practices intended to reduce security vulnerabilities to life and property
- NFPA Guides are recommendations not requirements



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NFPA 731

- Standard for application, location, installation, performance, testing, and maintenance
- Covers Burglar alarm, Video Surveillance and Access Control

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SIA

- Security Industry Association (SIA)
- SIA/IAPSC AG-01-1995.12 (R2000.03) Architectural Graphics Standard - CAD Symbols for Security System Layout

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Testing Agencies

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False Alarm Prevention Strategies

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False Alarm Prevention

- Preventing false alarms is a critical part of every job
- Several organizations, codes and standards can provide help

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Impact of False Alarms

- Can lead to fines and suspension of public safety response
- Can endanger responders
- Reduces effectiveness of system
- Adds to cost of system

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Know Your Dispatch Rate

- Measure your problem

Step	Example
1. Find Number of Alarm Dispatch Requests	1000
2. Subtract Cancellations	100
3. Equals Actual Dispatch Requests	900
4. Find total number of alarm sites	1500
5. Actual Dispatch requests divided by Number of Alarm sites	900/1500
6. Equals Dispatch Rate	.6

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False Alarm Prevention

- Proper Design
- Quality Equipment
- Proper Installation
- Proper User Education
- Verify Before Dispatch
- Follow-up on Each False Alarm

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Alarm Verification

- An attempt by a monitoring company or its representative to contact a burglar alarm location or a burglar alarm user by telephone or other electronic means to determine whether a burglar alarm signal is valid in an attempt to avoid unnecessary police response before requesting law enforcement to be dispatched to the location

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Enhanced Call Verification (ECV)

- ECV means that at least a second call shall be made to a different number if the first attempt fails to reach an alarm user.
- Alarm verification standards are defined in the latest version of ANSI / TMA (formally CSAA) CS-V-01, for all burglar alarm signals except for hold-up alarms.

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Associations

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Security Industry Alarm Coalition (SIAC)

- On behalf of four North American alarm associations, we are committed to:
  - Make every reasonable effort to reduce false alarms that result in false dispatches by law enforcement
  - Be diligent in educating alarm dealers, law enforcement, consumers and other interested parties
  - Provide assistance to law enforcement at no charge

www.siacinc.org

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False Alarm Reduction Assn (FARA)

- FARA is committed to reducing false alarms. Members are employed by government and public safety agencies, along with alarm industry and other professionals.
- They offer a wealth of information to help:
  - the alarm industry install, monitor and maintain their systems effectively while reducing false alarms
  - public safety and government officials tasked with running local false alarm reduction programs to do their jobs more effectively
  - public officials draft, enact and implement effective false alarm reduction programs
  - alarm users use their systems effectively while reducing false alarms

www.faraonline.org

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CP-01
Control Panel Standard

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SIA –CP01

- SIA –CP01- **Control Panel Standard - Features for False Alarm Reduction**
- In 1994 a meeting of industry professionals was held including alarm dealers and panel manufacturers
- Goal was to reduce false alarms due to user error

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SIA Study Concluded That

- Most User Errors - During Exit:
  - User Arms - Exits - Re-enters…
  - User Arms - Fails to Exit in time…
  - User Arms - Building still Occupied…
  - User Arms - Exits Through Wrong Door…
  - User Arms - Fails to exit at all...
- Most User Errors - During Entry:
  - User enters - forgets code…
  - User enters - fails to disarm within delay time…
  - User enters - unfamiliar with system...
  - User enters - through the wrong door…
    - non-delayed
    - no keypad - unable to hear prewarn

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Exit Time

- Default time set at 60 seconds (Min 45 sec)
- If system is armed silently then Exit Time shall be doubled for that arming period

SIA CP-01 4.2.2.1 ['19]

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Progress Annunciation

- Progress Annunciation added - different sound the last 10 seconds of delay – reminds the user that time is almost up

SIA CP-01 4.2.2.2 ['19]

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Exit Error

- If an error is made when exiting - the local alarm sounds right away and an Exit Error signal is sent to the central station at the end of the Entry Delay

SIA CP-01 4.2.2.4 ['19]

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Recent Closing

- If an alarm occurs within 2 minutes of exit time expiration a Recent Closing signal is sent

SIA CP-01 4.2.2.6 ['19]

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Unvacated Premises

- If the user fails to exit after arming the system the system puts all zones in stay mode
- This prevents the user from setting off motion sensors

SIA CP-01 4.2.2.5 ['19]

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System Acknowledgment

- The panel supports remote annunciation to allow you to annunciate entry exit sounds away from the keypad

SIA CP-01 4.2.4.3 ['19]

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Exit Time Restart

- If the alarm user reenters premise prior to the end of the exit delay time, the exit time shall restart
- Can be disabled however all panels should use this feature to allow the user time to reenter and reduce exit alarms

SIA CP-01 4.2.2.3 ['19]

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Entry Delay

- Entry Delay Time Default set at 30 seconds (Minimum 30 sec)
- Make sure the user has enough time to enter from any door they they use to enter

SIA CP-01 4.2.3.1 ['19]

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Progress Annunciation

- Progress Annunciation - different sound last ten seconds of entry delay time

SIA CP-01 4.2.3.2 ['19]

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Progress Annunciation Silenced

- Pre-Warning is Silenced after the 1st digit of the code is entered
- Allows user to focus on completing the code

SIA CP-01 4.2.3.3 ['19]

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Universal Disarming Sequence

- When the system is in an Entry Delay the system shall Disarm by a single step procedure
- Either single code entry or presenting a credential
- Panel can allow either one at the same time

SIA CP-01 4.2.3.3 ['19]

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Abort Window

- A period of time that allows the user additional time to disarm the system before an alarm is transmitted
- 0-45 second time allowed. Default is 30 seconds
- Life Safety Zones and Silent Alarms no Abort Window
- Entry Delay plus Abort Window should not exceed 1 minute

SIA CP-01 4.2.5.1 ['19]

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Cancel Window

- A period of time shall be provided, starting at the end of the Abort Window, during which a user can Cancel the alarm
- The minimum duration of the window shall be five (5) minutes
- The Cancel Window shall apply to all alarms that have been subjected to the Abort Window

SIA CP-01 4.2.5.4 ['19]

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Initiation of Manual Alarms

- Shall require double action
- Press two buttons simultaneously, lift cover then press single button, or tap one icon and then second after

SIA CP-01 4.2.7 ['19]

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Other Features

- Upon Power Restoral 60 second settling out period NO ALARM SIGNALS TRANSMITTED!
- Swinger shut-down - default - “2” (MAX-6)
  - –Will reset after 8 hours - with no trips
  - –OPTION - Swinger Trouble signal sent after 1st trip

SIA CP-01 4.3.2 & 4.4.3 ['19]

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Other Features

- Cross Zoning features available
  - SIA CP-01 4.3.1 ['19]
- 1+ duress Eliminated! Must be unique code
  - SIA CP-01 4.2.6.2 ['19]
- Quick Reference chart or card required. Can be in User Manual if separate section
  - SIA CP-01 4.6.1.1 ['19]

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Tennessee Law & Rules

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TN Fire Marshall Adopted Code

- NFPA 70 2011 - National Electrical Code
- NFPA 72 2010 - National Fire Alarm and Signaling Code
- NFPA 101 2012 - Life Safety Code (State Bldgs and Educational)
- IRC 2009 - International Residential Code
- IBC 2012 - International Building Code
- Information as of 1/2/2020. Local municipalities may differ from State Codes.

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Regulations for Security Systems Contractors

- Regulations for Security Systems Contractors are covered in:
  - –TN Code Title 62 Professions, Businesses and Trades
  - –Chapter 32 Fire Protection and Alarm System
  - –Part 3 Alarm Contractors Licensing Act of 1991

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Critical Sections

- **Topics to be covered in this section are:**
  - –62-32-304. Prohibited activities – Requirements
  - –62-32-312. Employee registration – Procedure
  - –62-32-313. Qualifying agents - Requirements & Renewal
  - –62-32-314. Alarm systems contractor – Company Requirements

TNESA always recommends reading the entire TN law before doing business as an Alarm Contractor in the state of TN

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62-32-304. Prohibited activities – Requirements

- (a) No person shall engage in or hold out as engaging in the business of an alarm systems contractor without first being certified in accordance with this part.
- (b) No person shall do business under this part unless the business entity has in its employ a qualifying agent who meets the requirements for licensing by the board and who is, in fact, licensed under this part. The qualifying agent who is licensed under this part shall be in a management position and be responsible for overseeing the quality of operations of the alarm systems contractor.

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62-32-304. Prohibited activities – Requirements

- (j) No person shall sell and install, service, monitor or respond to alarm signals, signal devices, fire alarms, burglar alarms, television or still cameras used to detect fire, burglary, breaking or entering, intrusion, shoplifting, pilferage or theft in violation of this part or the rules adopted under this part.

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62-32-312. Employee registration – Procedure

- a) All alarm systems contractor employees with access to records, diagrams, plans or other sensitive information pertaining to monitored, installed or proposed alarm systems shall be registered with the board.

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62-32-312. Employee registration – Procedure

- (b) In accordance with the Uniform Administrative Procedures Act, compiled in title 4, chapter 5, the board shall promulgate rules to establish an appropriate system of employee classifications and registration.

69

62-32-312. Employee registration – Procedure

- (c) An alarm systems contractor may not employ any employee required to be registered with the board unless the employee is properly registered with the board in compliance with subsection (d) and meets the training requirements of subsection (g).

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62-32-312. Employee registration – Procedure

- (d) All alarm systems contractors, within thirty (30) working days of the beginning of employment of any employee, shall furnish the board with the following:
  - (1) A set or sets of classifiable fingerprints on standard FBI/TBI applicant cards;
  - (2) A recent color photograph or photographs of acceptable quality for identification; and
  - (3) Statements of any criminal records in each area where the employee has resided within the immediately preceding forty-eight (48) months.

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62-32-312. Employee registration – Procedure

- (e) Upon receipt of an application, the board shall cause an FBI/TBI background investigation to be made, during which the applicant shall be required to show that the applicant meets all the following requirements and qualifications, prerequisite to registration or licensure:
  - (1) The applicant is at least eighteen (18) years of age;
  - (2) The applicant is of good moral character; and
  - (3) Registration of an employee shall be for two (2) years and shall be subject to renewal.

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62-32-312. Employee registration – Procedure

- (f) Employee registration pursuant to this section shall be renewed every two (2) years.
  - (g) (1) All alarm system contractor employees who sell, install or repair alarm systems, including closed circuit television systems, shall take and successfully complete the NBFAA Level 1 or equivalent training. The board may determine what constitutes equivalent training.
    (2) New employees after January 1, 2005, must successfully complete such training within one (1) year of employment.
    (3) Employees not in compliance with this subsection (g) shall not sell, install or repair alarm systems, including closed circuit television systems.

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62-32-312. Employee registration – Procedure

- (h) All alarm system contractors shall provide proof of employee training upon request by the board.
- (i) Any costs associated with the alarm system training required by this section shall be the responsibility of and paid by the alarm system contractor who employs the person being trained.

  Approved Training Providers may be found at: www.tn.gov

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62-32-313. Qualifying agents - Requirements

- (c) An applicant for qualifying agent shall meet the following combination of experience and educational requirements:
  (1) The applicant must hold a four-year baccalaureate degree in electrical engineering, industrial technology, computer engineering, or industrial engineering from an accredited university or college acceptable to the board with at least two (2) years actual experience in the alarm industry;
  (2) The applicant must hold an associates degree in engineering technology from an accredited two-year technical college acceptable to the board with at least four (4) years actual experience in the alarm industry; or
  (3) The applicant must hold current certification by a national training program approved by the board in the field of work to be installed, serviced or monitored and have at least five (5) years of working experience in the alarm industry covering the actual installation of alarms.

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62-32-313. Qualifying agents - Requirements

- (d) If the application is satisfactory to the board, the qualifying agent shall be entitled to an examination to determine the agent's qualifications. This examination may be written or oral, or both. The board shall be entitled to charge each applicant an examination fee as set by the board for each written or oral examination, or both.
- (e) If the results of the examination of any applicant are satisfactory to the board, then it shall issue to the applicant a license as a qualified agent in this state. The board shall state the classifications in which the applicant is qualified to engage

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62-32-313. Qualifying agents - Renewal

- (f) Licenses as a qualifying agent shall expire on the last day of the twenty-fourth month following its issuance or renewal and shall become invalid on that date unless renewed.
- (h) It is the duty of the board to notify every person registered under this part by mail to the last known address of the date of expiration of the person's certificate of license and the amount of fee required for its renewal for two (2) years. The notice shall be mailed in accordance with this section.

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62-32-313. Qualifying agents - Renewal

- (k) The board shall not grant renewal of a qualifying agent license until it has received satisfactory evidence of continuing education during the previous two (2) years. The board shall promulgate rules to establish minimum satisfactory standards of continuing education.
- RULE 0090-05-.01(1) – 16 Approved Credit Hours for QA
  (m) No qualifying agent may be the qualifying agent for more than one (1) business location.

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62-32-314. Alarm systems contractor

- a) Anyone desiring to be certified as an alarm systems contractor shall make written application to the board on forms prescribed by the board. The application shall be accompanied by an application fee as set by the board.

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62-32-314. Alarm systems contractor Continued

- –(1) Have a regular place of business at a permanent fixed location;
- –(2) Have a business license or licenses for the city and county in which the business is located;
- –(3) Provide proof of insurance as required;
- –(4) Submit an application for certification with the notarized signature of a qualified agent licensed by the board for the classifications of alarm systems being applied for;
- –(5) Submit applications for registration of all employees on forms provided by the board as required and accompanied by registration fees as required.

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Workplace Safety

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OSHA

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OSHA

- Occupational Safety and Health Administration
- OSHA enforces safety standards
- Visit www.osha.gov for more information
- Standards 1926 & 1910 apply to our industry

3

OSHA Citations

- The most common citations to OSHA for violations in SIC code 1731 the code for the electrical industry
  - 423 - Elec. Wiring Methods, Components & Equipment General Use
  - 220 - Electrical, General Requirements
  - 174 - Electrical, Wiring Design & Protection
  - 118 - Fall Protection
  - 96 - Manually Propelled Mobile Ladder Stands & Scaffolds

4

Causes of Electrical Injury/Death

According to OSHA the most frequent causes of electrical injury/death are:

- Contact with power lines
- Lack of ground-fault protection
- Path to ground missing or discontinuous
- Equipment not used in manner prescribed
- Improper use of extension and flexible cords

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Avoid Electrical Hazards

- Use ground-fault circuit interrupters (GFCIs) on all 120-volt, single-phase, 15 & 20-amp receptacles, or have an assured equipment grounding conductor program
- Follow manufacturers' recommended testing procedure to insure GFCI is working correctly

6

Avoid Electrical Hazards

- Use tools and equipment according to the instructions included in their listing, labeling or certification
- Visually inspect all electrical equipment before use. Remove from service any equipment with frayed cords, missing ground prongs, cracked tool casings, etc
- Use double-insulated tools & equipment, distinctively marked

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Safety Tips

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Job Site, Tools, Open Areas, Construction Rules, etc.

- Keep control of your tools
- Block off unsafe areas
- Clean up unsafe debris

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Take Care in Ceiling

- Do not rest on drop ceiling or supports

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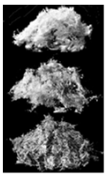
Watch Out For Asbestos

- Asbestos is a naturally occurring mineral fiber
- It was used in numerous building materials and vehicle products for its strength & ability to resist heat & corrosion before its dangerous health effects were discovered
- Individual asbestos fibers cannot be seen by the naked eye, which puts workers at increased risk.
- OSHA has regulations to protect workers from the hazards of asbestos



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Asbestos Hazard

- Asbestos fibers are released into the air during activities that disturb asbestos-containing materials
- Fibers can then be inhaled and trapped in the lungs
- If swallowed, they can become embedded into the digestive tract

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Asbestos Hazard

- Asbestos is a known human carcinogen and can cause chronic lung disease as well as lung and other cancers
- Symptoms and/or cancer may take many years to develop following exposure

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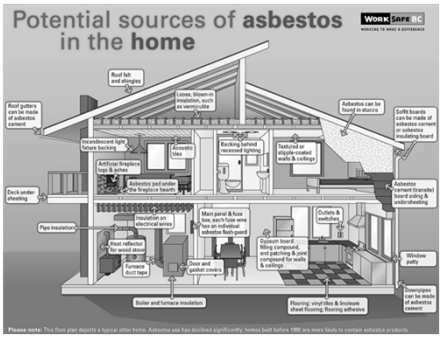
Potential Sources of Asbestos



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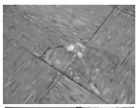
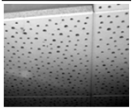
Common Sources of Asbestos

- Vinyl floor tiles
- Pipe wrapping
- Ceiling Tiles
- Items that contain asbestos cannot be recognized on sight
- It is always safer to assume material manufactured before 1980 contains asbestos





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Take Care in Crawl Spaces

- Assistant
  - Have an assistant to stand watch at the crawl space entrance. If for some reason you have to enter the crawl space alone, always have your cell phone with you
- Flashlight
  - You'll need a light source, & a battery operated flashlight with extra batteries will help you look for problem signs like crawl space mold or standing water
- Eye protection
  - Cover your eyes! Safety glasses or goggles will keep debris from entering your eyes

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Take Care in Crawl Spaces

- Respirator
  - A cheap paper mask will not protect you from chemicals, mold or other airborne hazards - Only a respirator with a filter will protect you
- Protective clothing
  - Gloves, knee pads & a tyvek suit or jump suit will protect you from nails, rodent droppings and other hazards
  - Helmet or padded hat
  - Protect your head from nails and sharp objects. It's not always practical to crawl around with a hard hat so a padded hat may help protect your head

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Take Care in Attics

- Get In, Get Out
  - The best advice for working in an overheated attic is to limit your exposure
  - Make sure you are drinking plenty of fluids before entering the attic, and are checking in regularly with either an onsite partner or over the radio
  - If you or a co-worker experience the signs of heat stress or heat exhaustion, get out of that environment and seek appropriate medical help

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Take Care in Attics

- Moving Around
  - Make sure you maintain three points of contact when moving a hand or foot
  - Consider putting a simple tread board system in place. 1×8 or 1×10 lumber is frequently used, or strips of ¾ plywood
  - A lesser known alternative is cheap Styrofoam 'boogie boards', available at most toy centers for around ten dollars

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Take Care in Attics

- Insulation Irritation
  - Long pants & shirtsleeves are the traditional uniform for working in insulation-heavy attics, but that extra clothing doesn't help control high temperatures
  - A light coat of Vaseline will keep the insulation away but will also interfere with your body's natural cooling process: sweating.
  - Instead, try dusting exposed arms and legs with baby powder
  - The talcum prevents insulation from sticking to your body without raising your temperature

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Take Care in Attics

- Insulation Irritation
  - While insulation itch can be annoying, wet insulation can be a greater hazard
  - Many modern buildings have a higher density of electric runs through the attic space
  - Wet insulation can act as a conductor, delivering a nasty shock. If you see discoloration on insulation or attic sheathing, stop and assess the situation before proceeding

21

EPA Lead Paint Rule

- EPA's Lead Renovation, Repair and Painting Rule (RRP Rule) requires that firms performing renovation, repair, and painting projects that disturb lead-based paint in homes, child care facilities and pre-schools built before 1978 have their firm certified by EPA (or an EPA authorized state), use certified renovators who are trained by EPA-approved training providers and follow lead-safe work practices

22

When Does the Lead Paint Rule Apply?

- If you're working in a pre-78 home or child occupied facility the rule wouldn't apply if"
  - You disturb less than 6 square feet of paint per room for an interior job, or less than 20 square feet of paint for an exterior job. AND
  - The project doesn't involve window replacement or demolition. AND
  - The project doesn't involve work practices prohibited by the rule. The practices prohibited for use on lead paint include open flame burning, the use of heat guns >1100 degrees, and power tools without HEPA exhaust.

23

Most Common Causes of Accidents

- Failure to communicate
  - Coordinate with fellow workers and others on each job
- Poor work habits
  - Pay attention, avoid horseplay , do not rush
- Drug or alcohol use
- Lack of skill
  - Unsure how it works – Ask for help

24

Use Personal Safety Devices

25

Clothing, Hair & Jewelry

- Wear proper clothing
- Keep long hair, ID badges and jewelry out of the path of drills
- Use care with metal watches, rings and jewelry around electricity

26

Driver, Vehicle, etc

- Pay attention
- Focus on driving not cell phone, radio, lunch, map, etc
- Wear seatbelt
- Obey traffic laws
- Keep vehicle maintained
- Drive Defensively

27

Driver Safety

- Motor vehicle crashes are the #1 cause of work-related injuries

28

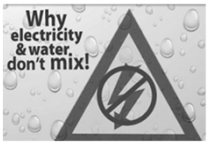
Healthcare Facilities

- Potential hazards include radiation, toxic chemicals, biological hazards, heat, noise & dust

29

Conductive Work Locations

- Use approved equipment in highly conductive work locations such as:
  - those inundated with water or other conductive liquids
  - or in a job location where employees are likely to contact water or conductive liquid



30

Report All Accidents

- Report all injuries and accidents to your supervisor
- If you do not you may not be properly covered by insurance if a minor injury proves to be serious later

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31

Prevention

- **Best Prevention for accidents** is to have a workplace safety policy for the company you own or work for

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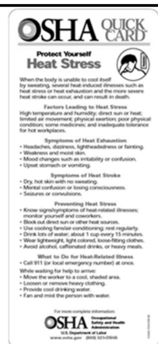
Heat Stress



OSHA QUICK CARD

Protect Yourself
Heat Stress

When the body is unable to cool itself by sweating, several heat-induced illnesses such as heat stress or heat exhaustion and the more severe heat stroke can occur, and can result in death.

Factors Leading to Heat Stress
High temperature and humidity; direct sun or heat; limited air movement; physical exertion; poor physical condition; some medicines; and inadequate tolerance for hot workplaces.

Symptoms of Heat Exhaustion
- Headaches, dizziness, lightheadedness or fainting.
- Weakness and moist skin.
- Mood changes such as irritability or confusion.
- Upset stomach or vomiting.

Symptoms of Heat Stroke
- Dry, hot skin with no sweating.
- Mental confusion or losing consciousness.
- Seizures or convulsions.

Preventing Heat Stress
- Know signs/symptoms of heat-related illnesses; monitor yourself and coworkers.
- Block out direct sun or other heat sources.
- Use cooling fans/air-conditioning; rest regularly.
- Drink lots of water; about 1 cup every 15 minutes.
- Wear lightweight, light colored, loose-fitting clothes.
- Avoid alcohol, caffeinated drinks, or heavy meals.

What to Do for Heat-Related Illness
- Call 911 (or local emergency number) at once.

While waiting for help to arrive:
- Move the worker to a cool, shaded area.
- Loosen or remove heavy clothing.
- Provide cool drinking water.
- Fan and mist the person with water.

For more complete information:
OSHA Occupational Safety and Health Administration
U.S. Department of Labor
www.osha.gov (800) 321-OSHA

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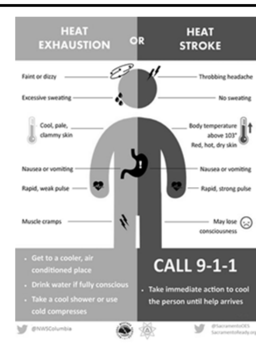
Heat Exhaustion OR Heat Stroke



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Ladders, Scaffolds & Lifts

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Ladder Safety

- Visit the OSHA Web site for extensive material on Ladder Safety
- http://www.osha.gov/SLTC/etools/construction/falls/4ladders.html

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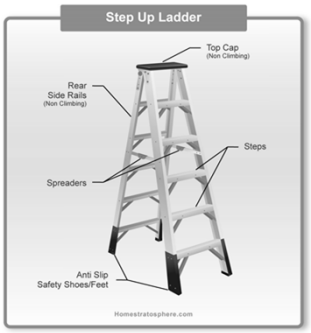
Step Ladder Parts



Slide 3-37

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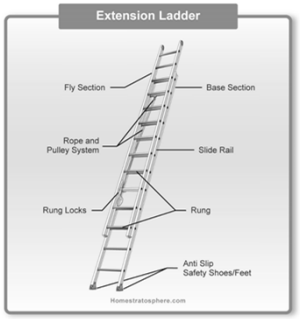
Extension Ladder Parts



Slide 3-38

38

Inspect Ladder Before Use

Slide 3-39

39

Ladder Inspection Checklist

- Feet and End Caps
  - When using a ladder, you need to make sure you're on steady footing – so make sure the ladder's feet and end caps are in good working order
  - Ensure there are none missing or loose
  - Make sure there are no loose/missing fixings or screws
  - Check for cracks and splits
  - Look out for excessive wear – e.g. the feet grooves worn away

Slide 3-40

40

Ladder Inspection Checklist

- Side Rail or Stiles
  - Strong stiles are a crucial part of a ladder – they stabilize the whole structure & support the rungs
  - Check for any contamination/dirt – e.g. paint, chemicals or glue spillages
  - Look for impact damage, such as bent rungs or dents in stiles from contact with excessively heavy or falling objects
  - Ensure the stiles have no holes, tears, splinters or cracks from heavy use
  - Make sure that the stiles are straight, with no bows, twists or bends.
  - Ensure there is no corrosion from rust, oxidization or rotting

Slide 3-41

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Ladder Inspection Checklist

- Treads and Rungs
  - You should perform a pre-use inspection every time you use your ladders – this should include a close look at the treads / rungs
  - Check that they are not corroded, rotten, damaged or loose
  - Ensure they are straight, tight, and not buckled or bent
  - Make sure they are kept clean and free of debris at all times

Slide 3-42

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Ladder Inspection Checklist

- Guide Brackets
  - Finally, take a close look at any guide brackets on your ladders before getting to work
  - Ensure they are not corroded, contaminated, rusted or distorted in any manner
  - Make sure that none are missing
  - Check that they are all secured fully
  - Verify that the sections pass through smoothly without sticking or jamming

Slide 3-43

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Select the Right Ladder

- Select the right ladder for the job
- Use only Class II & III fiberglass ladders around electricity

Slide 3-44

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Secure the Area

- Secure the ladder or use barricades if ladder can be displaced by workplace activities or traffic, such as in doorways, passageways or driveways

Slide 3-45

45

Ladder Setup

- Place ladder on a clean, slip free, level surface

Slide 3-46

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Ladder Setup

- Extend the ladder 3-4 feet above the top support, if used to access roof or other elevated surface

Slide 3-47

47

Secure the Ladder

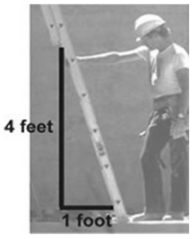
- Anchor or secure the top of the ladder when the 3-4 foot extension is not possible

Slide 3-48

48

Extension Ladder Setup

- Place the ladder base ¼ of the height of the ladder from the wall when using a straight ladder
  - To check, put your feet at the base of the ladder and extend your arm straight out
  - If you can touch the closest part of the ladder without bending your arm, or bending over, the ladder is at the correct angle
  - If not, the ladder is not at a safe angle

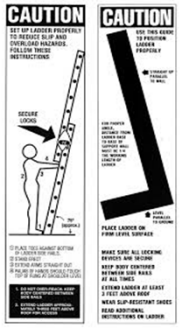


Slide 3-49

49

Use the Label

- Use the side label to verify that it is far enough from the wall



Slide 3-50

50

3 Point Rule

- When ascending or descending, the climber **must face the ladder**
- Contact with the ladder at three points means two feet and one hand, or two hands and one foot

Slide 3-51

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Safe Ladder Use

- Never reach too far to either side or rear

Slide 3-52

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Safe Ladder Use

- Do not allow others to work under a ladder in use

Slide 3-53

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Safe Ladder Use

- The bottoms of the first four rails are to be supplied with non-slip material for safety of user

Slide 3-54

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Safe Ladder Use

- Check shoes and rungs for slippery surfaces

Slide 3-55

55

Safe Ladder Use

- Never allow more than one person on a ladder

Slide 3-56

56

Safe Ladder Use

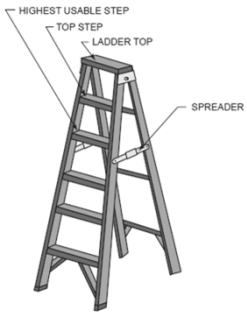
- Do not carry equipment or materials on ladders
- Have coworkers hand up tools and equipment instead of carrying them when on a ladder
- Use tool belts or hand lines to carry objects

Slide 3-57

57

Safe Ladder Use

- Never climb higher than second step from top on a stepladder or third from the top on a straight ladder



Slide 3-58

58

Safe Ladder Use

- Do **NOT** use a stepladder that is folded or in a leaning position.

Slide 3-59

59

Safe Ladder Use

- Never attempt to move, shift, or extend ladder while in use

Slide 3-60

60

Do Not Overload the Ladder

TYPE:	TYPE IAA	TYPE IA	TYPE I	TYPE II	TYPE III
LOAD CAPACITY:	375 pounds	300 pounds	250 pounds	225 pounds	200 pounds
RELATED USE:	Special Duty Professional Use	Extra Heavy Duty Industrial Use	Heavy Duty Industrial Use	Medium Duty Commercial Use	Light Duty Household Use

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Ladder Safety App

Get the Ladder Safety App

Learn more:
www.cdc.gov/niosh/topics/falls

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Electrical

63

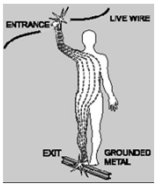
Electrical Injuries

- An average of one worker is electrocuted on the job every day
- There are four main types of electrical injuries:
  - Electrocution (death due to electrical shock)
  - Electrical shock
  - Burns
  - Falls

64

Electrical Shock

- Received when current passes through the body
- Severity of the shock depends on:
  - Path of current through the body
  - Amount of current flowing through the body
  - Length of time the body is in the circuit
- LOW VOLTAGE DOES NOT MEAN LOW HAZARD



65

Dangers of Electrical Shock

- Currents greater than 75 mA* can cause ventricular fibrillation (rapid, ineffective heartbeat)
- Will cause death in a few minutes unless a defibrillator is used
- 75 mA is not much current – a small power drill uses 30 times as much

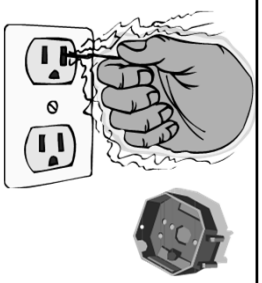
* mA = milliampere = 1/1,000 of an ampere

Defibrillator in use

66

Disconnect the Power First!!!

- Turn off the breakers on any equipment you are working on
- Don't work on high voltage circuits
- Cover open circuit panel boxes.
- Verify conduits prior to running metallic fish tapes



Slide 3-67

67

Tag it

- Attach tags at all points where such equipment or circuits can be energized
- Place tags to identify plainly the equipment or circuits being worked on

Slide 3-68

68

Keep the Ground

- Do not break off the ground.
- The path to ground from circuits, equipment, and enclosures must be permanent and continuous
- Violation shown here is an extension cord with a missing grounding prong

Slide 3-69

69

Hand-Held Electric Tools

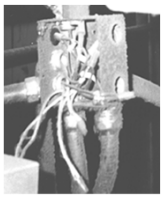
- Hand-held electric tools pose a potential danger because they make continuous good contact with the hand
- To protect you from shock, burns, and electrocution, tools must:
  - Have a three-wire cord with ground and be plugged into a grounded receptacle, or
  - Be double insulated, or
  - Be powered by a low-voltage isolation transformer

Slide 3-70

70

Cabinets, Boxes, and Fittings

- Junction boxes, pull boxes and fittings must have approved covers
- Unused openings in cabinets, boxes and fittings must be closed (no missing knockouts)
- Photo shows violations of these two requirements



Slide 3-71

71

Take Care

- Do not carry tools by the cord
- Do not use cord to hoist or lower tools
- Do not yank cord to disconnect it

Slide 3-72

72

Defective Tools

- Any tool found not in proper working order or that develops a defect during use, shall be immediately removed from service and not used until properly repaired

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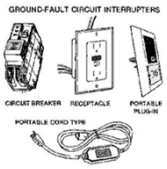
GFCI

The U S. Consumer Product Safety Commission (CPSC) recommends the use of a ground-fault circuit-interrupter (GFCI) with every power tool to protect against electrical shock hazards

- This device protects you from dangerous shock
- The GFCI detects a difference in current between the black and white circuit wires
  (This could happen when electrical equipment is not working correctly, causing current "leakage" – known as a *ground fault.*)
- If a ground fault is detected, the GFCI can shut off electricity flow in as little as 1/40 of a second, protecting you from a dangerous shock



74

Inspect the Cords & Tools

- Visually inspect, before use on any shift, for external defects (such as loose parts, deformed and missing pins or damage to outer jacket or insulation) and for evidence of possible internal damage (such as pinched or crushed outer jacket)

75

Treating Electric Shock

- Remove the victim from the source of electricity before you touch him
- If he is not breathing, begin rescue breathing immediately; a victim whose heart has stopped breathing needs CPR
- If the person is unconscious, but is breathing and has a heartbeat, you should place him in the recovery position and monitor his breathing and heart rate until medical help arrives

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Learn Basic First Aid

- Visit the American Red Cross Site for Options
- www.redcross.org/take-a-class/first-aid

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Electricity & Electronics

Slide 4-1

1

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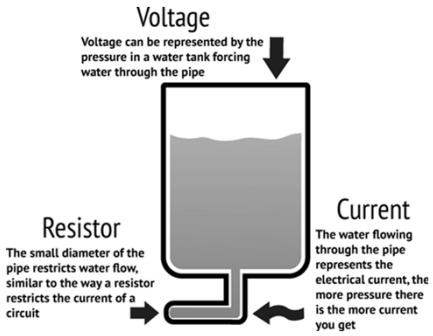
Electricity Basics

Slide 4-2

2

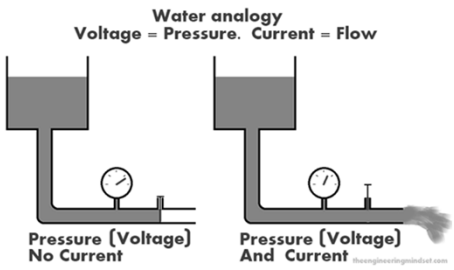
Electricity Water Analogy



Slide 4-3

3

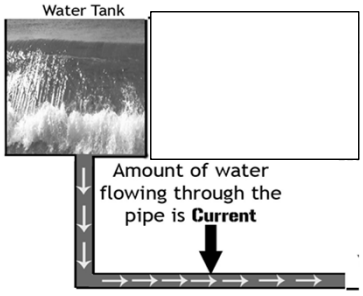
Voltage Water Analogy



Slide 4-4

4

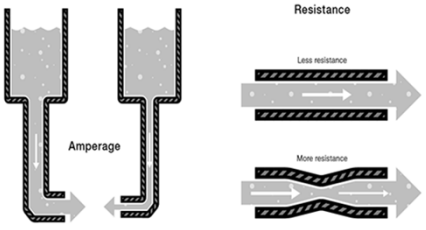
Current Water Analogy



Slide 4-5

5

Resistance Water Analogy



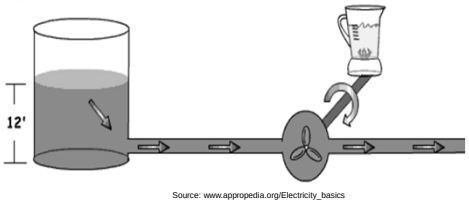
Bigger Pipe
Less Resistance
More Water
More Current

Smaller Pipe
More Resistance
Less Water
Less Current

Slide 4-6

6

Power Water Analogy



Source: www.appropedia.org/Electricity_basics

Power is how fast the wheel spins

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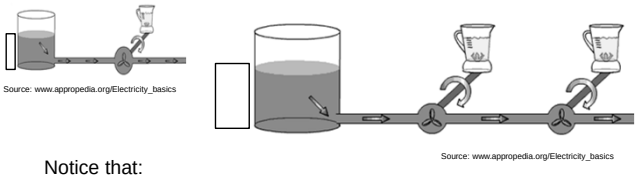
7

Series Circuit Analogy

Water Analogy



Source: www.appropedia.org/Electricity_basics

Source: www.appropedia.org/Electricity_basics

Notice that:

- The flow is 1/2 the speed of a single blender
- The two blenders in series are each going 1/4th the speed of a single blender

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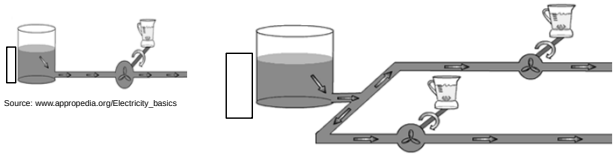
8

Parallel Circuit

Water Analogy



Source: www.appropedia.org/Electricity_basics

Source: www.appropedia.org/Electricity_basics

Notice that:

- Each blender is at the same speed as the single blender
- The flow from the tank is twice as fast as the single blender

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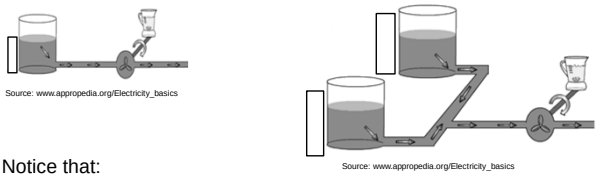
9

Adding a Tank in Parallel

Water Analogy



Source: www.appropedia.org/Electricity_basics

Source: www.appropedia.org/Electricity_basics

Notice that:

- The blender is the same speed as as the single blender with one tank
- The flow from each tank is half as fast as the single blender

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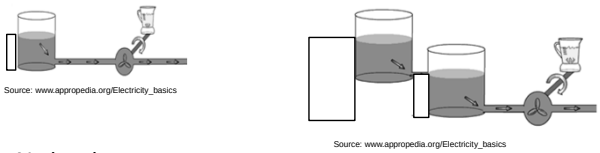
10

Adding a Tank in Series

Water Analogy



Source: www.appropedia.org/Electricity_basics

Source: www.appropedia.org/Electricity_basics

Notice that:

- The blender is 4 times the speed as the single blender
- The total flow is twice the speed as the single blender

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11

Water Tank - Electricity Analogy

Water Component	Electrical Analog
Tank	Battery
Tank Vertical Difference	Battery Voltage Difference
Water Flow	Electrical Current
Mechanical Energy Appliance (Blender)	Electrical Energy Appliance
Power=Head*Flow	Power=Voltage*Current

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12

Measuring Electricity

- **Voltage = Motivation –Force- Pressure**
  - Measured on Volts (V)
  - Symbol in equation is “E”
- **Current = How much**
  - Measured in Amps (A)
  - Symbol in equation is “I”
- **Resistance = Obstacles**
  - Measured in Ohms (Ω)
  - Symbol in equations “R”

Slide 4-13

13

Power = Watts = VA

- Is a value of the actual “work” being done by the electricity
- Is found by multiplying Volts times Amps (thus the VA)
- Is measured in Watts
- Symbol is “P”,“W” or VA

Slide 4-14

14

Power Source

- AC Commercial Power

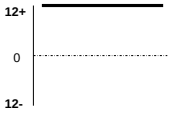
- DC Batteries

Slide 4-15

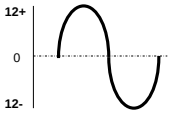
15

AC or DC

- Direct Current (DC)
  - Maintains same polarity at all times



- Alternating Current- (AC)
  - Polarity reverses direction periodically

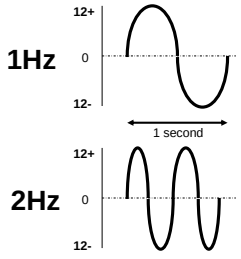


Slide 4-16

16

Hertz

- Number of complete cycles per second is the frequency
- Measured in hertz (one cycle per second), kilohertz, megahertz, gigahertz, or terahertz

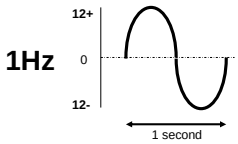


Slide 4-17

17

Hertz

- US electrical system based on 60Hz cycle
- Many other countries based on 50Hz cycle

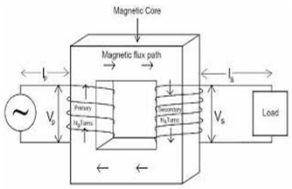


Slide 4-18

18

Transformers

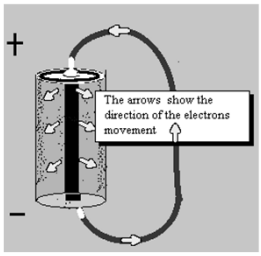
- Used to Reduce or Increase AC Voltage
- Rated by
  - Incoming Voltage
  - Output Voltage
  - Amperage or VA



19

Batteries

- A group of electrically connected cells that change chemical energy into electrical energy



20

Load

- Consumes power from the source
- Devices that do work
  - Sensors
  - Sounders
  - Annunciators

21

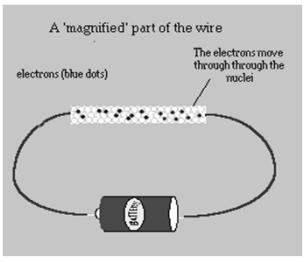
Sources of Resistance

- Anything that causes fewer electrons to flow;
  - smaller wire
  - longer wire lengths
  - splices
  - More components

22

Conductors

- Current carrying component, usually made from metal



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Common Materials Used As Conductors

- Silver
  - Best natural conductor but expensive and prone to oxidation
- Copper
  - Affordable, abundant, malleable, easy to protect against corrosion
- Gold
  - Costly but extremely resistant to friction and corrosion, easy to solder
- Aluminum
  - Inexpensive, malleable, does not solder well, corrodes easily
- Nichrome
  - Combination of copper, nickel & iron, stable over wide range of temperatures

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Conversions

Slide 4-25

25

Use Like Values

- Make sure you are using like values in your calculations
- Volts commonly expressed as volts
- Ohms commonly in kiloohms
- Amps commonly expressed as milliamps

Slide 4-26

26

Units of Measurement

Prefix	Description	Symbol
Micro	One millionth- 0.000001	μ
Milli	One thousandth- 0.001	m
Kilo	One thousand- 1000	k
Mega	One million- 1,000,000	M
Giga	One billion- 1,000,000,000	G
Tera	One trillion- 1,000,000,000,000	T

To save adding all those zeros Symbols are used

Slide 4-27

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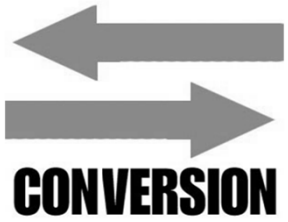
How to Convert

- Use the following charts to convert to like values



Slide 4-28

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Voltage Conversions (V)

Original Value	Desired Value	Do this
μV	V	Divide microvolts by 1,000,000
mV	V	Divide millivolts by 1,000
V	μV	Multiply volts by 1,000,000
V	mV	Multiply volts by 1,000

Slide 4-29

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Amperage Conversions (A)

Original Value	Desired Value	Do this
μA	A	Divide microamps by 1,000,000
mA	A	Divide milliamps by 1,000
A	μA	Multiply amps by 1,000,000
A	mA	Multiply amps by 1,000

Slide 4-30

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Resistance Conversions

Original Value	Desired Value	Do this
K Ω	Ω	Multiply kiloohms by 1,000
M Ω	Ω	Multiply megaohms by 1,000,000
Ω	K Ω	Divide Ohms by 1,000
Ω	M Ω	Divide Ohms by 1,000,000

Slide 4-31

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Power Conversions (W)

Original Value	Desired Value	Do this
KW	W	Multiply kilowatts by 1,000
mW	W	Divide milliwatts by 1,000
W	KW	Divide Watts by 1,000
W	mW	Multiply Watts by 1,000

Slide 4-32

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Current & Power Draw

Slide 4-33

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Calculations Important

- One of the most important things you can do to prevent false alarms is to perform calculations to determine if you have enough power in your system to do the job

Slide 4-34

34

Current Draw Calculation

Per Manufacturers instructions you must do current draw calculations to make sure you do not exceed panels output capacity

Device	Quantity	Standby Each	Alarm Each	Total Standby	Total Alarm
Control	1	150mA	220mA	150mA	220mA
Keypad	1	75mA	120mA	75mA	120mA
Motion Detector	2	35mA	75mA	70mA	150mA
Smoke Detector	2	45mA	120mA	90mA	240mA
Siren	1	-	650mA	0	650mA
Total				385mA	1380mA

Slide 4-35

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Battery Calculation

Convert all values to base unit (Amps)

Requirement – Per NFPA 72, National Fire Alarm Code, we must provide 24 hours of standby battery and then sound the alarm for 5 minutes.

Device	Total Standby	Total Alarm
Milliamps	385mA	1380mA
Multiplier	**Divide by 1000**	**Divide by 1000**
Amps	.385 A	**1.38A**

Slide 4-36

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Battery Power Requirements

Standard	Use	Non Alarm Minimum Operation	Alarm Sounding Devices
NFPA 731	Burglar & Emergency Alarms	4 Hours	15 Minutes
NFPA 72	Fire Alarms	24 Hours	5 Minutes
NFPA 72	Household Fire Alarms	24 Hours	4 Minutes

Slide 4-37

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Fire Alarm Calculation

Requirement – Per NFPA 72, National Fire Alarm Code, we must provide **24 hours** of standby battery and then sound the alarm for 5 minutes.

Total Non-Alarm Current	**.385A**	**X**	**24**	**9.24 AH**
Total Alarm Current	**1.38A**	**X**	**.08333** 5 minutes	**.115 AH**
Standby and Alarm				**9.355 AH**
Total Required Amp Hours	**9.355 Ah**	**X**	**1.2** De-rating factor	**11.226 AH**

Slide 4-38

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Household Fire Alarm Calculation

Requirement – Per NFPA 72, National Fire Alarm Code, we must provide **24 hours** of standby battery and then sound the alarm for 4 minutes.

Total Non-Alarm Current	**.385A**	**X**	**24**	**9.24 AH**
Total Alarm Current	**1.38A**	**X**	**.0666** 4 minutes	**.0919 Ah**
Standby and Alarm	**9.24 Ah**	**+**	**.0919 Ah**	**9.259 Ah**
Total Required Amp Hours	**9.259 Ah**	**X**	**1.2** De-rating factor	**11.110 Ah**

Slide 4-39

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Burglar Alarm Calculation

Requirement – Per NFPA 731, National Fire Alarm Code, we must provide **4 hours** of standby battery and then sound the alarm for 15 minutes.

Total Non-Alarm Current	**.385A**	**X**	**4**	**1.54 AH**
Total Alarm Current	**1.38A**	**X**	**.25** 15 minutes	**.345 AH**
Standby and Alarm	**1.54**	**+**	**.345**	**1.894 AH**
Total Required Amp Hours	**1.894 Ah**	**X**	**1.2** De-rating factor	**2.272 AH**

Slide 4-40

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20% Contingency

- Notice that you SHALL always have a de-Rating or a contingency factor in your power sources
- You should always add 20% to your total calculations to be sure that you have sufficient power for the “unknown”

Slide 4-41

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What Does This Mean?

- If your battery is rated at 7AH and you need at least 11.226 AH (27.858 for Remote Standard) of power you have a problem
- What do you do?
  - You can change the panel
  - Add a battery if the panel will support it
  - Add an auxiliary power supply

Slide 4-42

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What Happens Without Enough Power?

- False alarms after or during power failures
- Erratic operation – May not be able to disarm after alarm trips
- Motions may be more sensitive
- Battery will be under stress and will wear out faster

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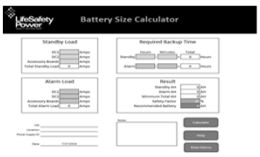
Battery Calculation Apps

- Check with your panel manufacturer for a battery calculation app or spreadsheet



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Voltage Drop

- Voltage drop calculations determine if there is sufficient voltage/current being delivered to the last device on a circuit to ensure that the last device is within its operating range for any given gauge (AWG) wire selected
- By calculating the voltage drop you can decide if additional power or larger wire are required

45

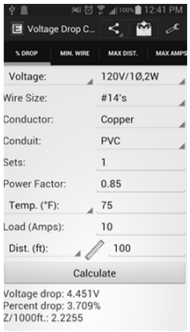
Voltage Drop Impact

- If resistance is too high on the wire or there is not enough power- your device will not get enough power
- When a device lacks power it does not work correctly
  - It may not be loud enough
  - It may false alarm
  - It may not activate when it should

46

Voltage Drop

There are apps to help you determine the voltage drop



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Reading Resistors

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Resistor

- Provides a specific amount of resistance
- Used to Control Current
- Resistor values can be determined
  - by using an Ohm-meter or
  - by reading the color bands

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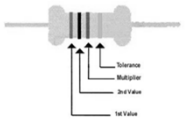
Read the Resistor Color Code

Begin with the band closest to the end of the resistor (1st Value); this is the first digit of the resistance. In the example, the first band is brown and the color table lists brown as "**1**", so our first digit = **1**. The second band is black, so it equals **0**. The final band is the multiplier which is red. That makes the multiplier "**10^2**" or "**00**". The resistor value would be **1000 (1K) Ohms**.



For instance
1st Value = 1
2nd Value = 0
and the multiplier = 00 (or multiply by 10^2)

1st Value	2nd Value	Multi-Plier
1	0	00

or
1,000

Tolerance Band: brown 1%, red 2%, gold 5%, silver 10%, no color 20%,

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Color Code

Color	#	Multiplier	X	Color	#	Multiplier	X
Black	**0**	[	**1**	**Green**	**5**	[33,333	**10^5**
Brown	**1**	[3	**10**	**Blue**	**6**	[333,333	**10^6**
Red	**2**	[33	**10^2**	**Violet**	**7**	[3,333,333	**10^7**
Orange	**3**	[333	**10^3**	**Gray**	**8**	[33,333,333	**10^8**
Yellow	**4**	[3,333	**10^4**	**White**	**9**	[,333,333,333	**10^9**

Tolerance Band gold 5% **silver 10%** no color 20%

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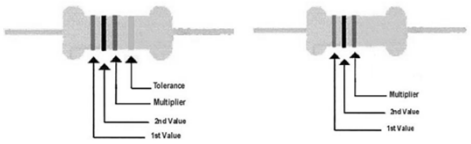
Tolerance

- Tolerance band is located by itself at the opposite end of the resistor.
- Gives us variation that this particular resistor provides.
- A sliver band resistor could vary from 900 to 1100 Ohms for example).



Tolerance Band: brown 1%, red 2%, gold 5%, silver 10%, no color 20%,

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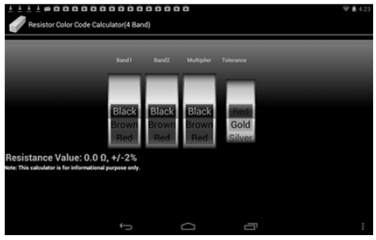
Resistor Color Code App



There are apps to help you read the resistor color code

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Circuits

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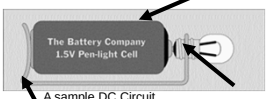
Parts to a Circuit



A sample DC Circuit

- Power Source
  - Develops power for the load
  - Wall socket, generator, battery
- Load
  - Consumes the power
  - Devices
- Conductors
  - Path for power
  - Wire

 Slide 4-55

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Types of Circuits

You will most commonly find:

- Burglary circuits (zones) – Series
- Robbery circuits – Parallel
- Fire circuits (zones) – Parallel
- Supervisory circuits – Parallel
- Power (auxiliary and all other)– Parallel
- Annunciation - Parallel

 Slide 4-56

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Circuit Symbols


Power Source

Resistor


Passover Without Connecting


Connection

 Slide 4-57

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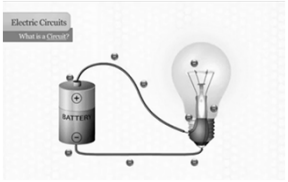
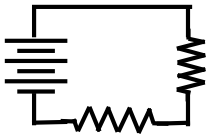
The Series Circuit

- A circuit in which the components are arranged end to end to form a single path for current





 Slide 4-58

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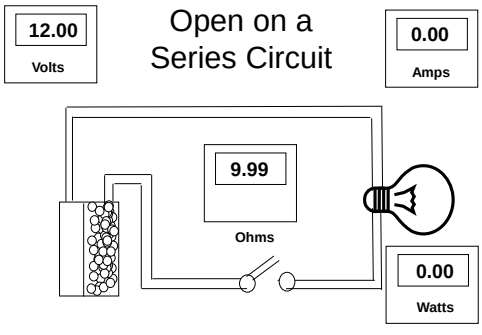
Open on a Series Circuit



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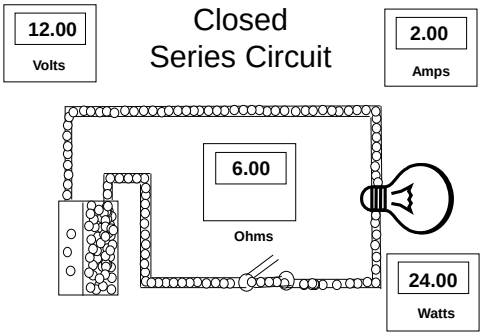
Closed Series Circuit



 Slide 4-60

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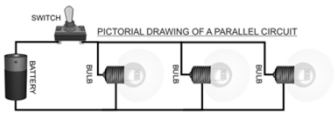
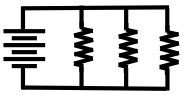
Parallel Circuits

- A circuit in which the identical voltage is presented to all components, and the current divides among the components according to the resistance of the components





Slide 4-61

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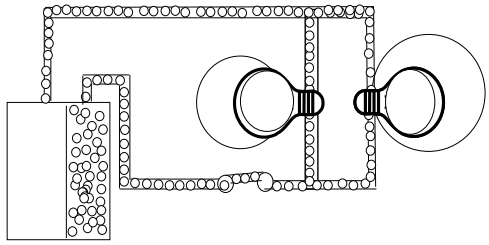
Closed Parallel Circuit



Slide 4-62

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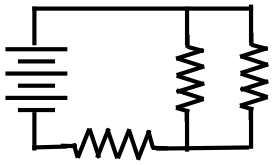
Series Parallel

- Some parts of the circuit flow in series
- Other sections are in parallel



Slide 4-63

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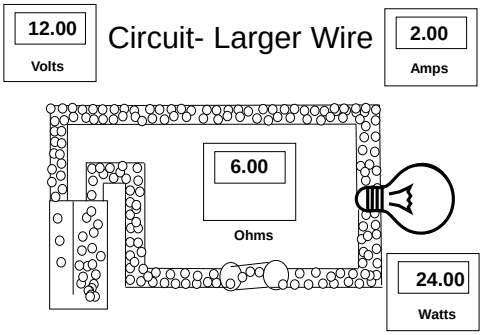
Circuit- Larger Wire



Slide 4-64

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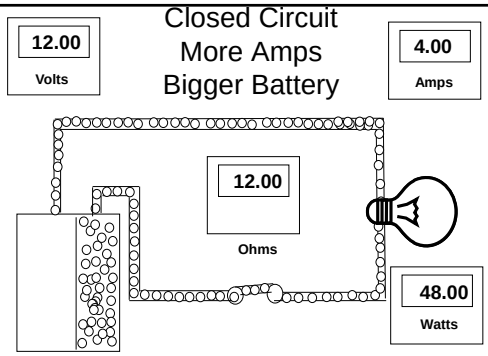
Closed Circuit More Amps Bigger Battery



Slide 4-65

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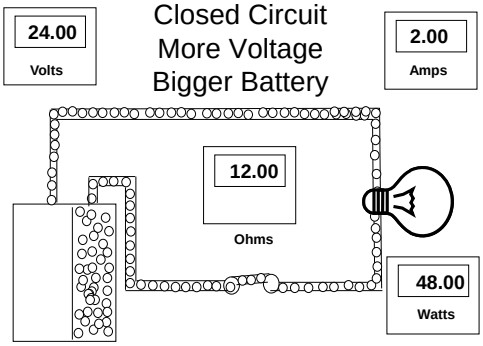
Closed Circuit More Voltage Bigger Battery



Slide 4-66

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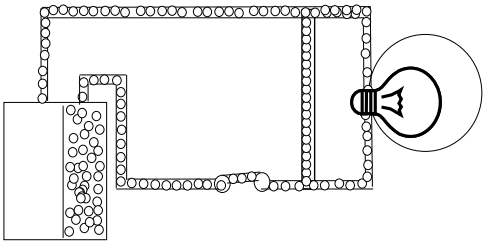
Short Circuit



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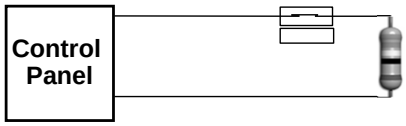
Series Circuits
End of Line Resistor



With Resistor At End Of Line
And Switch Closed
Normal Current Flows

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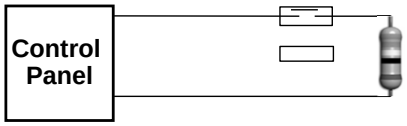
Series Circuits
End of Line Resistor



With Resistor At End Of Line
And Switch Open
No Current Flows- Alarm Detected

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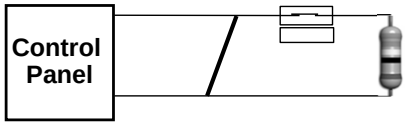
Series Circuits
End of Line Resistor



With Resistor At End Of Line
And Switch Closed with Wire Shorted
More Current Flows- Trouble Detected

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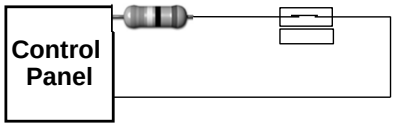
Series Circuits
End of Line Resistor



With Resistor At Panel
And Switch Closed
Normal Current Flows

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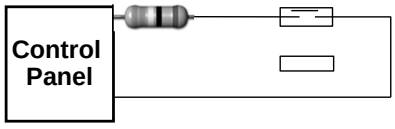
Series Circuits
End of Line Resistor



With Resistor At Panel
And Switch Open
No Current Flows

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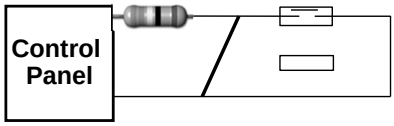
Series Circuits
End of Line Resistor



With Resistor At Panel
Switch Open & Wire Shorted
Current Still Flows No Trouble or Alarm is Detected

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Formulas

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Measuring Electricity

- Voltage= Motivation –Force- Pressure
  - Measured on Volts (V)
  - Symbol in equation is “E”
- Current= How much
  - Measured in Amps (A)
  - Symbol in equation is “I”
- Resistance= Obstacles
  - Measured in Ohms (Ω)
  - Symbol in equations “R”

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Power = Watts = VA

- Is a value of the actual “work” being done by the electricity
- Is found by multiplying Volts times Amps (thus the VA)
- Is measured in Watts
- Symbol is “P”,“W” or VA

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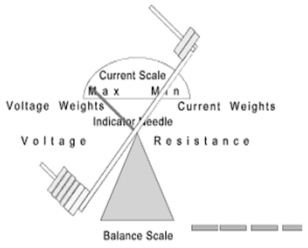
Relationships- Constant Voltage

- If Voltage is constant changes in Resistance Impacts Current
  - If you increase resistance - current is lowered
  - If you lower resistance - current is increased



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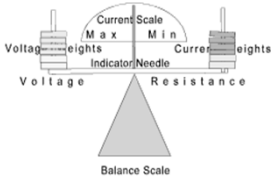
Relationships- Resistance Constant

- If Resistance is constant changes in Current impact Voltage
  - If you increase current – Voltage increases
  - If you Lower Current – voltage is lowered



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Ohm's Law

- A mathematics equation that sums up the relationship between Resistance, Voltage and Current
- Can be used to calculate component values
- Can be used to find an unknown value (Must know any two variables)

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Ohm's Law

- Can be mathematically manipulated to any of three formulas

E = I x R = ?Volts
I = E ÷ R = ?Amps
R = E ÷ I = ?Ohms

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Power Formulas

- P = I x E
- $P = I_2 \times R$
- $P = E_2 / R$

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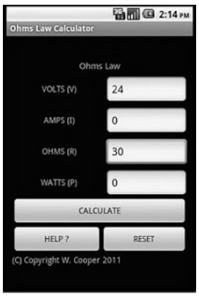
Ohms Law

There are apps to help you with the formulas



82

Circuit Formula Recap

Type	Series	Parallel
Voltage	Voltage divides between all the devices $E_T=E_1+E_2+\ldots$	Voltage stays equal at each device $E_T=E_1=E_2=\ldots$
Current	Current stays equal at each device $I_T=I_1=I_2=\ldots$	Current divides between all the devices $I_T=I_1+I_2+\ldots$
Resistance	Resistance divides between all the devices $R_T=R_1+R_2+\ldots$	Resistance divides between all the devices $1/R_T=(1/R_1)+(1/R_2)+\ldots$

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Intrusion Systems

1

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Overview

2

Burglar Alarm Systems

- Burglar Alarm Systems are also known as security systems and intrusion detection systems
- Regardless of the name, the system consists of sensors, at least one warning device, and a control unit
- Communications capabilities may be included to alert someone off site when the alarm is activated

3

Burglar Alarm Objectives

- Detect an intrusion
- Activate a warning device upon detection of an intrusion
- Deter crime
- Protect life and property
- Bring an appropriate response to an emergency
- Enhance apprehension of criminals

4

Burglar Alarm System Components

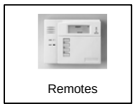
5

Burglar Alarm Components

- **Sensors** including: motion sensors, door and window contacts and glass break sensors allow the system to monitor what is happening at the alarm site

6

Burglar Alarm Components



Remotes

Control Unit & Power Supplies

- **Remotes** allow the user to arm (turn on) and disarm (turn off) the system and display what is going on
- **Control Panels** coordinate what happens in the system and provide power to the system devices

7

Burglar Alarm Components

Notification Devices

Signaling

- **Notification Devices** warn user and occupants when the alarm is activated
- **Signaling devices** communicate what is happening at the alarm site to a remote location

8

System Integration

- An alarm system may interact with:
  - **Cameras** - Example- cameras zoom in on a door when alarm is activated
  - **Access Control -** Example- Authorized user uses credential to unlock a door and the alarm is bypassed
  - **Home Automation -** Example- User hits away on touchpad which lowers heat, turns off lights and arms the alarm
  - **Energy Management -** Example- Alarm is armed and heat or air conditioning is lowered

9

System Integration

- **Here are some advantages with integration**
  - Can reduce costs
  - Coordinate activity between systems – example: disarming alarm – turns lights on
- **Here are some challenges with integration**
  - One system can adversely impact another
  - One component or system may not be designed to work with another

10

Integration With Other Devices

- Outputs (relays or voltage outputs) can be programmed to react to
  - inputs (opens or closures on a circuit)
  - or events (credential use)
- Systems can send data over a serial or internet connection to communicate with another device

11

System Integration

- Some programming will be required to tell the reacting system what to do when the initiating event occurs
- Communications protocol adaptor may be required
- Most common way to integrate is with a direct connection from a relay output of the access control system to an input of the other system

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Sensors

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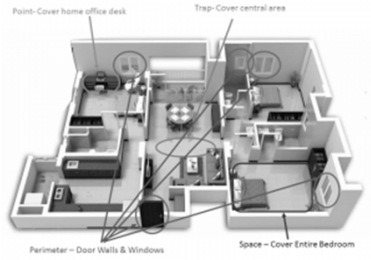
Sensor Use Examples



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Sensor Use Examples

- Point
  - Used to sense around specific objects
- Trap
  - Located in expected traffic area
- Space
  - Sense entire an area or room
- Perimeter
  - Sense penetration of outer barrier of an area

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Burglar Alarm Sensors

- Sensors allow the system to monitor what is happening at the alarm site
- Examples include:
  - Motion sensors
  - Door and window contacts
  - Glass break sensors

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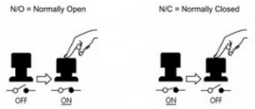
What is Normal?

- Sensors are usually marked as normal when no force or power is applied
- Some manufacturers do not follow this standard so be sure to check when you start using a specific product for the first time



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Switches & Contacts

18

How a Magnetic Contact Switch Works

- A two-unit device, consisting of a small permanent magnet (with no electrical connections) and a magnetically sensitive reed switch, which is physically wired into the circuit

Slide 5-19

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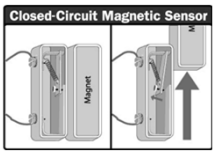
How a Magnetic Contact Switch Works

- Switch is activated whenever the magnet is brought close enough to it
- Moving the magnet further away deactivates the switch



Slide 5-20

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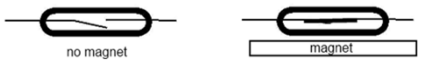
Normally Open Contacts



- A normally open standard contact has a single switch and a single magnet
- When the switch is near the magnet it stays closed
- When the magnet moves away it opens
- **Used in a closed circuit loop**

Slide 5-21

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Normally Closed Contacts

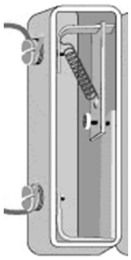
- A normally closed standard contact has a single switch and a single magnet
- When the switch is near the magnet it stays open
- When the magnet moves away it closes
- **Used in an open circuit loop**

Slide 5-22

22

Magnetic Contact Switch

- Original magnetic contact switches were open to the air and allowed dust to accumulate inside the switch
- Dust may prevent proper operation



Slide 5-23

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Magnetic Reed Switch

- With a Reed Switch the switch is enclosed in a sealed tube
- This prevents the environment from interfering with the switch
- Glass tube may break if switch is dropped which exposes the reed to dust and may prevent it from working

Slide 5-24

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Balanced Contact

- Used to reduce the chance of bypassing the contact with a magnet
- A magnet is added inside the switch assembly to balance the external magnet
- The balancing magnet makes it harder to hold the switch in place with a third magnet

25

Surface Mount Contact

- Devices are mounted on top of a surface
- Faster than recess mounting
- More exposed to tampering

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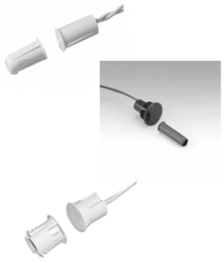
Recess Mount Contact

- Mounted in a hole drilled into a surface so that the object is flush with the top of the mounting surface
- Looks neater
- More secure because the wiring and switch location are concealed



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Built in Transmitters

- Transmitter to connect to wireless control panel is built in
- May use standard or longer life lithium battery
- Make sure it is compatible with your panel

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Gap Ratings

- The gap rating is the distance that the contact and magnet can be separated before the switch activates
- Gap ratings from 3/8 to 2 ½ Inches are available
- A larger gap will allow the door to adapt to vibrations or warping of the door

29

Where to Use Magnetic Contacts

- Used on doors and windows
- Switch is placed on frame
- Magnet is placed on door or window

30

Contact Location Considerations

- Poorly fitting doors or windows and improper installation are the primary causes of false alarms
- Extreme weather conditions which cause excessive movement of the door or window can cause a false alarm

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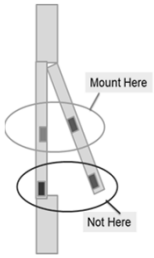
Mount Contact at Center

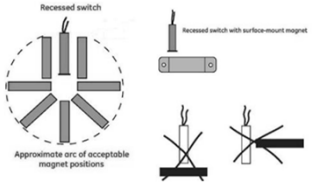
- Preferred mounting location is 12” or more from the frame toward the center of the door
- Avoids alarms when door moves out of adjustment



32

Mounting Positions For Recessed Switches

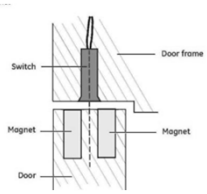
- Preferred Mounting
  - end-to-end
  - parallel to the switch
- Wide-gap switches are sensitive to the polarity of the magnet



33

Increase Gap Distances With A Second Magnet

- 2 magnets side by side can add 40% to gap distance of a recessed switch
- Mount the magnets with like poles in the same direction
- Magnets will push away from each other when mounted this way



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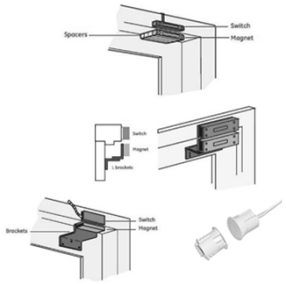
Mount on Steel Door or Window

- Gap on steel is approximately 1/2 distance in the air
- Use 25% percent of the rated gap in air
- Use spacers, sleeves or brackets



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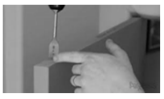
Tip to Mount Recessed Door Contacts

- Drill your hole through the top jamb of the door
- Close and latch the door
- Tap firmly on the drywall above the door
- Open the door slowly. The debris that fell out of the wall when you tapped on it should form a perfectly located circle where you need to drill to set your magnet



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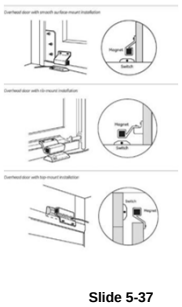
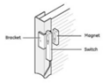
Rollup Doors

- Mount Rollup door contacts on the side with the lock.
- Make sure door does not pull up far enough to trip the switch
- Make sure the magnet is not mounted directly to metal





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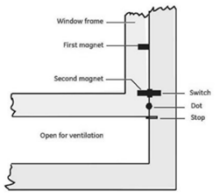
Window Ventilation Without False Alarms

- Install two magnets
- One to line up when window is in Closed position
- 2nd lines up with window opened for ventilation



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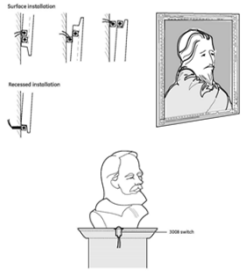
Monitor Artwork

Contacts can be used to monitor Artwork



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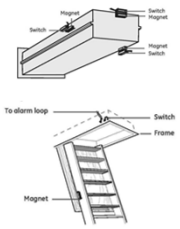
Monitor Drawers & Attics

- Contacts can be used to monitor drawers & attics



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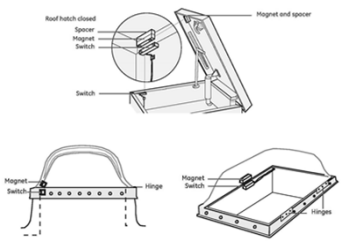
Monitor Hatches & Skylights

- Contacts can be used to monitor Hatches & Skylights



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Roller-plunger Contacts

- Used on doors, windows and cabinet doors
- Plunger held in when door or window is closed
- These sensors depend on direct physical operation or disturbance of the sensor to generate an alarm
- Spring-loaded or plunger devices trigger when a door or window is opened

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Roller-plunger Contact Installation

- Install on hinged side of door
- Only hermetically sealed, watertight and airtight switches should be used
- Should not be used on poorly fitting doors and windows

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Glassbreak Sensors

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Glassbreak Sensor Types

- Acoustic
- Shock
- Acoustic/Shock
- Screen

45

Acoustic Glassbreak Sensor

- Acoustic Sensors listen for the sound of breaking glass

- Click on the icon to hear the sound

46

Acoustic Glassbreak Sensor

- The sensors are housed in a single unit and mounted on a stable wall or ceiling facing the main glass surface

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Acoustic Glassbreak Sensor

- Proper placement calibration and testing are required to avoid false alarms
- Recalibration will be required if carpeting in the room is changed to hardwood or tile flooring or visa versa

48

Acoustic Glassbreak Tester

- Use a tester that is compatible with your Acoustic Glassbreak Detector
- Tester will digitally produce the glassbreak sound
- Follow the directions to calibrate the sensor to the room

49

Soft vs Hard Acoustics

Soft
- "Soft" acoustic rooms absorb vibration
  - Example- carpet, rugs, window drapery, acoustic ceiling tiles, sofas

Hard
- "Hard" acoustic rooms reflect sound
  - Example- window shutters, blinds, tile, laminate or wood floors

So if the room changes you need to recalibrate

50

Soft vs Hard Acoustics

Absorption of Reflected Sound at Various Frequencies

Material	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Brick	3%	3%	3%	4%	5%	7%
Carpet *(on concrete w/foam rubber pad)*	8%	24%	57%	69%	71%	73%
Drapes *(heavy velour)*	14%	35%	55%	72%	70%	65%
Drywall *(½" on 2x4s)*	29%	10%	5%	4%	7%	9%
Linoleum *(on concrete)*	2%	3%	3%	3%	3%	2%
Paneling *(⅜" on 2x4s)*	28%	22%	17%	9%	10%	11%
Plaster *(rough finish, over lath)*	14%	10%	6%	5%	4%	9%
Window Glass	35%	25%	18%	12%	7%	4%
Wood	15%	11%	10%	7%	7%	4%

51

Shock Glassbreak Sensor

- Shock sensors feel/sense the typical 5 KHz frequency shock wave that is created when glass is broken
- When the processor detects this shock it signals an alarm
- The sensors are housed in a single unit and mounted on the glass
- Use manufacturer approved adhesive
  - Avoid silicone, it will cushion the shock
- Do not use on loose fitting glass or glass with any cracks

52

Acoustic/Shock Glassbreak Sensor

- In dual-tech Acoustic/Shock Glassbreak sensors, an acoustic device is linked with a shock device
- This combination utilizes the complementary capabilities of both devices and provides for a low false alarm rate sensor

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Acoustic/Shock Glassbreak Sensor

How It Works- **Step One Acoustics**
- The **acoustic portion** of the sensor uses a microphone to detect frequencies associated with breaking glass
- Processor filters out all unwanted frequencies to only allows frequencies at certain ranges to be analyzed
- The frequency is compared to those associated with glass breakage
- If the signal matches frequencies characteristic of breaking glass, then a signal is sent to the AND gate

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Acoustic/Shock Glassbreak Sensor

How It Works – **Step Two Shock**

- The **shock portion** of the sensor "feels" for the 5 KHz frequency in the form of a shock wave created when glass is broken
- When the processor detects this shock, it sends a signal to the AND gate
- Once the AND gate has received both signals, an alarm is generated

Slide 5-55

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Acoustic/Shock Glassbreak Sensor

How It Works – **Step Three 1+2 = Alarm**

Once the AND gate has received signals from the Acoustic AND Shock portions of the sensor, an alarm is generated

Slide 5-56

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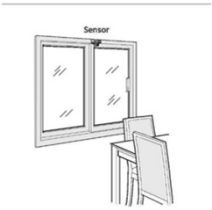
Applications - Small Rooms

- False alarms are more likely in small, acoustically live rooms such as small kitchens, glass entry airlocks, stairwells, small glass offices, and utility rooms
- Try shock sensors
- If you use acoustic sensor make sure to fully test



Slide 5-57

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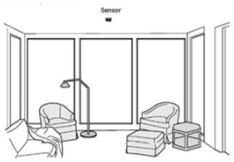
Applications - Large Rooms

- Be careful to match sensor range to room size
- If the sensor range extends beyond the room boundaries it is vulnerable to false alarms



Slide 5-58

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Applications – Interior Occupied

- Consider what can happen when the premise is occupied while armed
- Is the detector selected designed to resist false alarms created by normal activity?

Slide 5-59

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Applications – French doors & small windows

- Small windows have unique properties when they break
- Sound output may be low since there is not much glass to break
- Glass may pop out of the window frame when hit instead of breaking
- Modern French doors are usually two large panes of glass with false dividers between them

Slide 5-60

60

Applications - Windows with film

- Tinted film does not affect shock sensors
- Mount shock sensors on the glass not on the film
- Armor-coated glass may reduce shock sensor range

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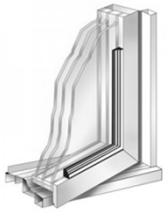
Applications - Insulated glass

- As long as the inside pane of the glass breaks, the sensor will detect the break
- It is possible to break the outside pane of glass without setting off an alarm



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Applications - Loud Environments

- Do not use Dual Technology Acoustic/Shock Glassbreak Sensor at places with loud music, clanging pots and pans, gym weights, and ceiling fans or sites with high levels of radio interference

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Applications - Glass display & jewelry cases

- Glass display case are extremely *live* and are vulnerable to false alarms if the case is accidentally struck by keys or other metal objects
- Acoustic sensors are only appropriate where the sensor will only be armed when the premises are not occupied

For occupied or 24-hour protection, use shock sensors.

64

Applications - Bathroom windows

- Humidity can be very high
- Bathrooms are acoustically live rooms
- Have a greater potential for false alarms

Shock sensors are a better choice than acoustic glass break sensors

65

Applications - Roll-up metal shutters

- Do not use Glassbreak Sensors with roll-up metal shutters to protect glass windows at night

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Screens

- Existing screen or new screen is laced with wire
- One corner of screen has wire to connect to system
- Opposite corner has switch
- Magnet is mounted on frame for switch

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Motion Sensors

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Types of Motion Sensors

- Passive Infrared (PIR)
  - The most commonly used
- Dual Technology (PIR & Microwave)
  - Used in area where PIR sensor may false
- No longer used because of difficulty to adapt to many locations
  - Microwave
  - Ultrasonic

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Passive Infrared (PIR)

- Passive Infrared Sensors
  - Are **PASSIVE** because they do not transmit a signal to sense the area
  - They sense changes in infrared (radiated thermal energy) to detect motion

Ceiling Mount

Wall Mount

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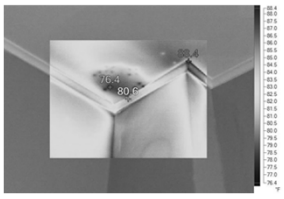
Infrared Energy

- All objects give off infrared energy
- An Infrared sensor can see the how much energy each object gives off



71

How it Works

- Simple PIRs look for a contrast between the background and the moving object
- When the radiation change captured by the PIR exceeds a certain pre-set value (commonly a 3 degree change), the thermal sensor produces an electrical signal which is sent to a built-in processor for evaluation and possible alarm

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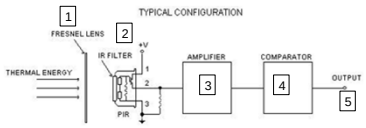
Parts of a PIR



1. Fresnel Lens Focuses Thermal Energy on the PIR Sensor
2. Sensor outputs electricity based on what it senses
3. Amplifier boosts low amounts of electricity to usable level
4. Comparator circuit decides when to trigger the sensor output
5. Output is used to report to the alarm panel

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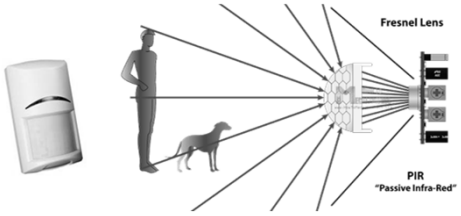
Fresnel Lens



The Fresnel Lens focuses the thermal energy onto the PIR Sensor

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PIR Sensor

- The PIR Sensor is a pyroelectric device that measures infrared (IR) light radiating from objects in its field of view

PIR Sensor

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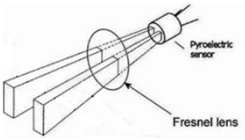
How a PIR Works



Each sensor zone is made up of two fields of view, one positive and one negative

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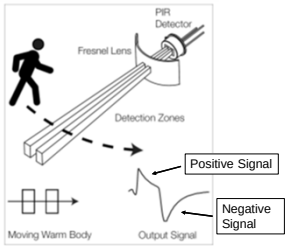
Single Zone

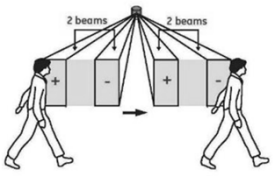
In a single zone detector, an alarm will be indicated when an intruder moves across one positive and one negative field



77

Dual Zone

With a dual zone sensor, an intruder must cross the positive and negative fields of two zones before an alarm is indicated

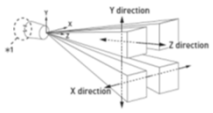


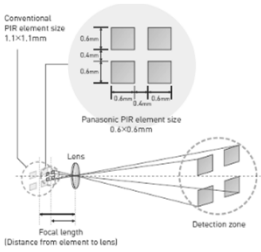
Dual PIR

78

Quad Zone

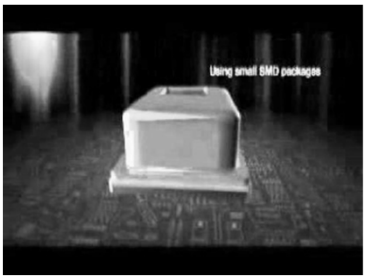
Using 4 zones allows tracking of more directions





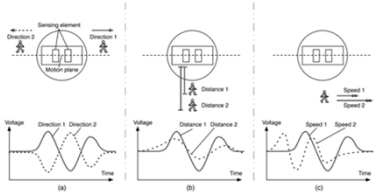
79

Grid Type



80

Signal Processing



- Signal processing is the mathematical analysis of the nature and characteristics of signals
- Goal is to block out "noise" that leads to false signals

81

Signal Processing

- The difference between one detector and another is often the sophistication of the signal processing
- Check the specifications of your detector to see how it does signal processing

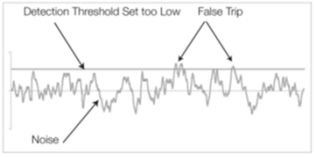
82

Signal Processing Examples

1. **DualCore:** Signals are analyzed in multiple domains, including amplitude, time, frequency and duration
2. **C3:** Correlates data from both channels simultaneously, instead of independently processing each
3. **MAP:** Timing and sequence of signals are compared to settings for specific environments to qualify each channel individually
4. **Queue Event Logic:** Pulse counting while looking for specific sequences of events
5. **Advanced:** Pulse counting with timing relationships
6. **Standard:** Basic pulse counting

83

Theshold Processing

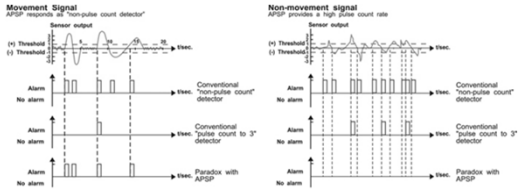


- Every PIR detector uses some sort of signal processing to determine if the pulses created by the PIR element indicate that motion is present
- All PIR's have a threshold to filter out background noise and signals created by minor temperature fluctuations

84

Pulse Count Detectors

- Any signal that exceeds the threshold is considered a pulse.



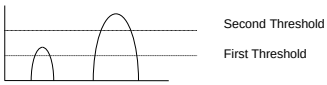
85

Pulse Count Detectors

- There is no qualification made as to the size and duration of the signal
- A pulse count detector will indicate an alarm condition if a number of pulses (typically 2 or 3) are detected within a set time period

86

Multi-Level Signal Processing



- Introduced to reduce false alarms
  - Second Threshold set based on research on walk tests
  - Signals processed at slower rate between 1st & 2nd thresholds
  - Signals processed at normal rate above 2nd thresholds

87

Background Contrast

- When background or ambient temperature approaches that of a human being (approximately 88F), the lack of contrast can make detection harder

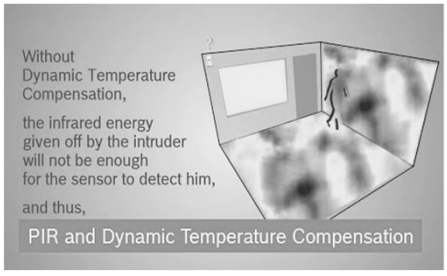
88

Temperature Compensation

- When the person to background contrast smaller - the output pulses from the PIR element will become smaller
- Most PIR detectors will suffer a decrease in the coverage pattern as a result
- Some detectors compensates at ambient temperatures below body temperature
- Others compensates both below and above body temperature

89

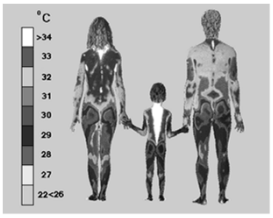
Temperature Compensation



90

Measuring Humans

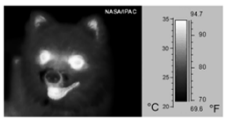
- Infrared energy is measured in microns, with the human body producing energy in the region of 7-14 microns



91

Analytics

- Some detectors are designed to use analysis to "see" the body dimensions of people and differentiate from backgrounds and pets



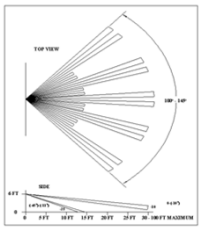
92

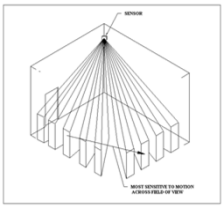
Sensor Considerations

- Check the manuals for:
  - Type of processing
  - Coverage pattern of each sensor
  - Mounting requirements
  - Environmental requirements
  - Recommended locations

93

PIR Patterns

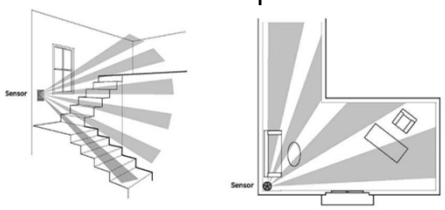




Variety of patterns and ranges are available

94

Location Options

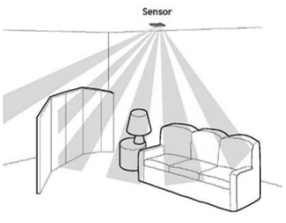


Mount to ensure proper operation (maximum coverage, minimal blockage)

95

Ceiling Mount

- Provides complete coverage of rooms with obstructions such as half walls and shelving that can block wall mounted sensor coverage



96

Avoid Occupied Areas

- Avoid areas that will be occupied while system is armed
- Normal human activity should not impact the sensor
- Connect the motion sensor to a zone that is not active when the system is armed

97

Avoid Vibrations

- Mount on a stable wall or ceiling
- Vibration caused by wind, traffic, pumps, etc. will lead to false alarms
- Small vibrations on a wall will cause a large difference in what the detector looks at

98

Avoid Temperature Changes

- Different surfaces will conduct outside heat and cold differently
- Windows may change more rapidly that walls for example
- Unstable temperatures lead to false alarms

Outside A Home

99

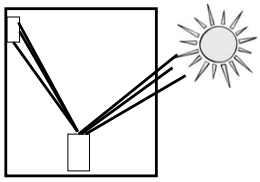
Avoid Drafts

Inside A Front Door

- The area around a window or door will let air in
- Wind or cold or hot air may impact your sensors

100

Avoid Reflections



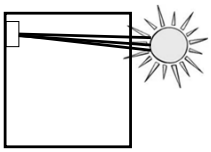
Avoid directing at a window, heat source or reflected heat source.

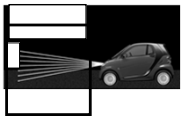
Infrared energy can be reflected off of any glossy surface such as counters, mirrors, windows, floors with glossy finish, and slick finished concrete

101

Aim Away From Windows

- Windows cannot only reflect infrared energy, but they can also allow sunlight or lights from cars to pass through to the detector

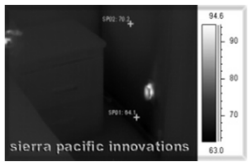




102

Avoid Automated Heat Sources

A Coffee Maker



A Plug in Air Freshener

If these items heat up and cool down while the system is active it may create a false alarm

103

Avoid Vents & Drafts

A vent or loose door or loose window will expose the detector to natural drafts or artificial ventilation

104

Avoid Moving Objects

Moving objects change what the PIR sees to cause a false alarm. Examples include:

- Drapes
- Signs
- Mylar Balloons

105

Avoid the Mail Slot

- Avoid looking at a mail slot
- Dropping mail will create a false alarm

106

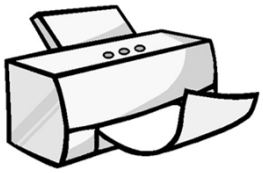
Avoid Humid Areas

- High Humidity around or in the detector can cause false alarms
- Use a properly sealed unit

107

Avoid Faxes & Printers

- Avoid aiming at fax or printer



108

Avoid Heater & Fireplaces

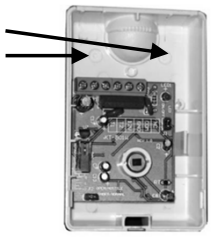
- Avoid radiators, fireplaces, heaters, etc.
- When they cycle on and off or cool off it can lead to false alarms



109

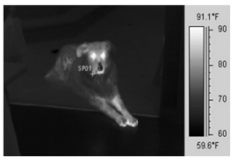
Seal the Detector

- Seal PIR entry holes, especially where cables come through the wall
- Insects or airflow can cause false alarms



110

Avoid Animals



A Dog

A Cat

111

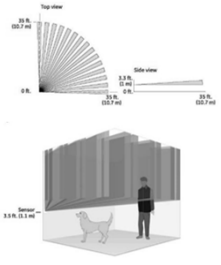
Pets

- Because PIR sensors are sensitive to moving, heat-radiating sources, they can be triggered by animals as well as humans
- To avoid this false alarm hazard, do one of the following:
  - Use a sensor with pet immunity
  - Use a sensor with a pet alley lens

112

Installation with a Pet Alley Lens

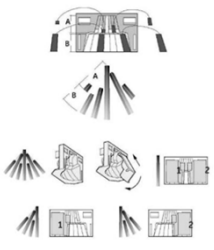
- Mask the sensor to avoid objects a pet could jump on
- Size of the pet should also be considered
- Remind the alarm user that furniture moved into the sensor coverage pattern can give a pet a place to climb or jump and can result in false alarms



113

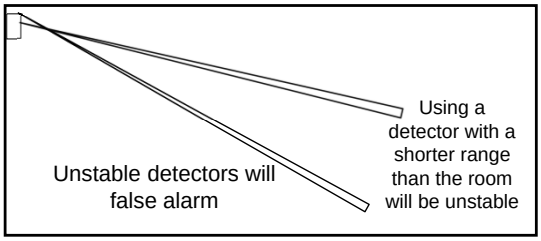
Masking Areas on Motion Sensors

- Most motion sensors include masks to modify the coverage
- Coverage curtains should be masked to avoid sources of false alarms
- Only use the masking kit provided by the manufacturer



114

Terminate PIR Patterns



Slide 5-115

115

Antimasking

- Optional technology that looks for a masking tamper and notifies the system of the problem
- Prevents the intruder form blocking the detector to return later

Slide 5-116

116

Explosive Atmospheres

- Areas such as munitions depots, grain storage areas, and chemical plants can involve explosive atmospheres
- It is imperative that PIR sensors used in such areas contribute no electrical signal or field that could cause ignition

Slide 5-117

117

Dual-Technology Motion

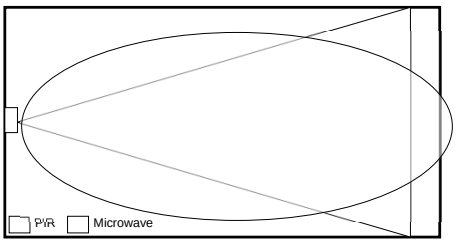
- PIR & Microwave sensing elements are located in a single casing, & are connected electronically by using the AND Logic function
- Since the two sensors will not "sense" an intrusion precisely at the same instant, the system is designed to generate an alarm when both sensors produce an output in a pre-selected time interval

Slide 5-118

118

Dual Tech Motion Detectors

Overhead view of patterns



Slide 5-119

119

Dual-Technology Passive Infrared / Microwave or Ultrasonic

- Avoid areas where environment will keep one of the technologies activated a significant amount of the time
- Seal wiring or mounting holes
- Avoid areas that will be occupied while system is armed
- Avoid directing at a window, heat source or reflected heat source
- Mount on a stable wall or ceiling

Slide 5-120

120

Protect Against Fluorescent Lights

- Check Specifications for a filter
  - Digital Fluorescent Light Filter:
    - Software algorithms provide infinite rejection of microwave interference due to fluorescent lights
  - Analog Fluorescent Light Filter:
    - Hardware circuitry provides rejection of microwave interferences due to fluorescent lights

121

Interference with Routers

- Microwave motion detectors will interrupt or keep wireless routers from working if the router is using the same frequency as the microwave detectors
- To fix it change the wireless router or the motion to one that is using a different frequency, relocate the detector so the microwave pattern does not cover the router, or use a PIR detector
- Check your manuals for the frequencies that the devices use

122

Walk Test

- To ensure proper operation, always walk test each sensor. To walk test, do the following:
  - Mount the sensor in the desired location
  - Walk throughout the intended coverage pattern.
  - Verify the sensor alarms
  - Most sensors walk test more accurately if you wait 10 seconds between tripping the sensor and walking again. This allows the sensor to stabilize between trips

123

Walk Test

124

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Other Sensors



125

Audio

- Audio detectors listen for noises generated by an intruder's entry into a protected area
- If a certain amount of noise is detected from a monitored area within a selected time period, an alarm signal is generated
- Operator listens to site to decide what is going on

126

Outdoor Sensors

- **Exterior Active Infrared**
  Beams are sent between posts
- **External Microwave**
  Beams are sent between posts

Slide 5-127

127

Considerations for Outdoor Sensors

- Presence of grass or vegetation
- Possibility of leaf accumulation
- Possibility of movement of branches
- Likelihood of snow accumulation
- Possibility of fog, mist or dust
- Occurrence of lightning
- Check manufacturer's recommendations

Slide 5-128

128

Outdoor Installation Guidelines

- **Sunlight.** Avoid direct sunlight on the plastic lens (even with UV stable plastics)
- **Temperature.** Make sure the temperature range is within sensor specifications
- **Humidity/rain/fog.** If conduit is used, run conduit out the side or bottom of the sensor to keep conduit condensation from draining into the sensor housing
- Make sure the conduit openings and the mounting holes on the sensor are well sealed

Slide 5-129

129

Birds and animals

- Depending on the size, speed, and proximity to the sensor, warm blooded animals can trigger an alarm
- The larger the animal, the farther away it can be detected
- Avoid directing the sensor towards bushes or branches where birds can perch
- You can mount two sensors in parallel to require alarm verification

Slide 5-130

130

Trees and bushes

- Tree branches or bushes can cause an alarm when the wind moves them, and can block detection
- Keep branches and bushes at least 30 ft. from the sensor

Slide 5-131

131

Testing Outdoor Sensors

- Follow manufacturer's instructions
- Make sure that device trips control and sends signal to the monitoring station

Slide 5-132

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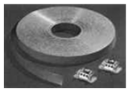
Outdated Sensors

- **Foil, or tape,** is a ribbon of metallic material that is attached to various surfaces such as glass, door panels, walls, etc.
- The foil is designed to break when an attempt is made to gain entry through the surface to which it is attached, thus causing the alarm to sound



Slide 5-133

133

Outdated Sensors

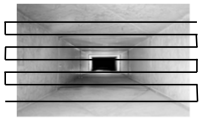
- **Pressure mat-** A small, flat mat that closes an internal switch when pressure is placed on it, usually by someone stepping on or leaning against the mat
- To be effective in a security system, a pressure mat must be strategically placed and concealed from view
- A pressure mat also is called a pressure switch

Slide 5-134

134

Outdated Sensors

- **Lacing-** Fine wire stretched back and forth across skylights, ducts, or other openings
- An intruder breaking a wire will trip the alarm
- Most modem alarm systems use motion detectors instead of lacing

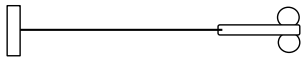


Slide 5-135

135

Outdated Sensors

- **Cord Trap-** A mostly outdated means of detection consisting of a cord or wire stretched across a doorway and connected to the protective circuit
- Breaking or pulling the cord loose breaks the circuit and trips the alarm
- Space-protection devices and photoelectric beams have replaced such traps in most modern alarm systems



Slide 5-136

136

Outdated Motion Sensors

Active Ultrasonic

- A motion detecting device that emits ultrasonic sound energy into a monitored area and reacts to a change in the reflected energy pattern
- Ultrasonic sound is transmitted from the device in the form of energy
- The sound uses air as its medium and travels in a wave type motion
- The wave is reflected back from the surroundings in the room/hallway and the device "hears" a pitch characteristic of the protected environment
- When an intruder enters the room, the wave pattern is disturbed and reflected back more quickly, thus increasing the pitch and signaling an alarm

Slide 5-137

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Outdated Motion Sensors

Microwave Sensors

- Motion detection devices that flood a designated exterior or interior area with an electronic field
- A movement in the area disturbs the field and sets off an alarm.
- Signals generated are within pre-set limits that do not affect humans or the operation of pacemakers
- Although very little power is used, the system provides enough energy for a detector to project a signal up to 400 feet in an uninterrupted line of sight.
- Most sensors are tuned to measure the Doppler shift between 20 Hz and 120 Hz
- Objects that fall within the range cause the sensor to generate an alarm signal

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Outdated Motion Sensors

Passive Ultrasonic or Infrasonic

- Motion detection device that "listens" for ultrasonic sound energy in an area & reacts to high frequencies associated with intrusion attempts
- Sensor "listens" for frequencies that have a range between 20 - 30 KHz
- Frequencies in this range are associated with metal striking metal, hissing of an acetylene torch, and shattering of concrete or brick
- Sound generated is transmitted through the surrounding air and travels in a wave type motion
- When the sound wave reaches the detection sensor, it determines if the frequency is characteristic of an intrusion
- If the criteria are met, an alarm signal is generated

Slide 5-139

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Emergency Alarm Systems

1

What is a Robbery?

- A robbery is the unlawful taking or attempted taking of property that is in the immediate possession of another by force or threat of force

2

Robbery Alarm Objectives

- Used to notify authorities that a hold-up, duress, panic or emergency is in progress

3

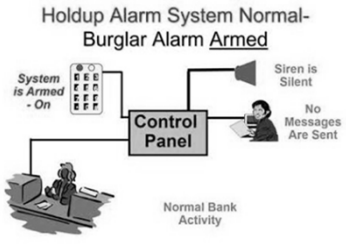
Several Types

- Robbery or Hold-up-
  - –Usually Silent
- Duress Or Ambush-
  - –Usually Silent
- Panic or Emergency-
  - –Usually Audible
- Medical
  - –Usually Silent

4

How They Work

- Activated by inconspicuous devices
- Triggers communications to alert someone off site



5

Silent Holdup/Robbery or Panic, Ambush/Duress Alarm

- A **silent** alarm signal generated by the manual activation of a device or the entry of a designated code into an arming station intended to signal a robbery in progress or a life threatening or emergency situation requiring law enforcement response
- **Proper Response** - Call requesting public safety dispatch, then attempt to verify the validity of the signal

6

Audible Panic

- An **audible** alarm signal generated by the manual activation of a device or the entry of a designated code into an arming station intended to signal a life threatening or emergency situation requiring law enforcement response
- **Proper Response** - Attempt to verify the alarm by placing one call to the premises to determine if the alarm is valid or not. Call requesting public safety dispatch if appropriate

7

Silent Medical Alarm

- A system that reports a medical problem for response by relatives, friends, neighbors, or by a community's EMS personnel, paramedics, or ambulance, depending on arrangements made with the monitoring facility.
- **Proper Response -** Attempt to verify the alarm by placing one call to the premises to determine if the alarm is valid or not. Follow agreed to instructions.

8

Buttons

- Button is designed to generate an alarm signal by the manual activation of a device intended to signal a robbery, holdup or emergency in progress
- Depressing the button closes or opens the circuit to indicate an alarm
- Can be in a fixed location or use wireless signal to be portable
- Usually concealed

9

Single Action Buttons

- Only requires pressing the button to activate.
  - –Does not allow you to identify which device was tripped
  - –Resets after use

10

Portable Key Fobs

- **Portable Key fobs**, used to allow alarm users to arm or disarm their systems, often have a single-action panic button that can too easily be activated.
- Key fobs regularly find their way into the hands of children, who regard the fobs as playthings and activate a false alarm.

11

Portable Pendants

- **Portable Pendants**, worn by alarm users around their necks, are easily activated when the wearer inadvertently bumps or presses the exposed button against an object

12

Keypad Buttons

- Pressing a button on the keypad generates an alarm signal
- May activate immediately or require the button to be held

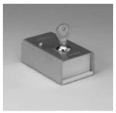
* Please note. Keypad Fire alarm activation SHALL be by two simultaneous or sequential operation

NFPA 72 29.10.9.9 ['19]

13

Latching – Locking Buttons

- Allows you to ID which device was tripped
- Needs to be reset after use
- Buttons remain in position after they are pressed until they are reset



14

Dual Action Buttons

- Require pressing and holding the button for a specified length of time or pressing two buttons to activate

15

Magnetic Lever Switches

- Use a magnet and reed switch encased in a hinged case
- When the case is pulled or opened the magnet is separated from the switch to change the status of the switch

16

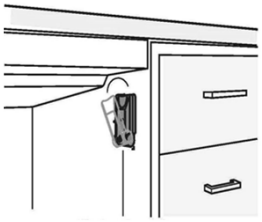
Piezo Pressure Strips

- Are concealed in an area that would not normally be subject to enough pressure to operate the switch
- When sufficient pressure is applied, a processor activates to generate an alarm

17

Button Locations

- The button is usually concealed in a location to allow it to be pressed without being noticed by the robber



18

Button Locations

- Do not use in areas where items will be stored around or on top of the device
- Boxes may shift or fall and hit the button

19

Duress Code

- Allows an alarm user to turn off an alarm system by entering a special code in the system's keypad which then sends a signal to the alarm company that the alarm user is being held hostage
- When the alarm company receives a duress code, they report a silent alarm indicating a hostage situation to law enforcement
- Many companies do not call the alarm user before reporting the alarm

20

Duress Code Issues

- When an alarm user enters the Duress Code by mistake, because the alarm is silent, the user is not aware that armed law enforcement personnel may be responding
- This creates a dangerous situation for both the alarm user and law enforcement personnel

21

One Plus Duress

- Public safety and alarm associations agree that you should not install one-plus duress alarms
- A One Plus Duress Alarm is the manual activation of a silent alarm signal by entering at an arming station a code that adds one to the last digit of the normal arm/disarm code (e.g., normal code = 1234, one plus duress code = 1235)
- The problem is that the alarm user may forget about the one plus duress feature and accidentally press the code. Because it is silent the user will not know what they have done until law enforcement arrives

22

Foot Rail- Kick Bar

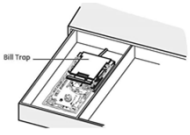
- Floor mounted arched enclosure that contains a switching device that operates when a person's foot is slid along the floor under the arch to make contact with a pivoting bar
- Most foot rails lock in place when activated until they are reset by a key

23

Money Clip

Placed in a cash drawer, with the bottom bill of a stack inserted in the switch

The alarm is activated by removing that bill



24

Medical Alarms

25

Avoid False Alarms

- Do not install one-plus duress alarms
- Use duress and panic features only when a clearly defined need is present
- Use dual action buttons that need to be squeezed from two sides or buttons that need to be held for a few seconds.
- Do not use single action panic buttons.
- Concealed panic buttons are often activated unintentionally by bumps

26

Avoid False Alarms

- It is recommended that pendants be worn on the outside of clothing where the user can easily activate the device
- When worn on the outside of clothing, it is easier to minimize accidental activation
- Use covers to protect the button
- Periodically check and replace wiring between money clip and counter or wall

27

Avoid False Alarms

- Frequent movement can cause breaks in the wires
- Wire money clips so that bills need to be removed from more than one clip to generate an alarm
- Key fobs regularly find their way into the hands of children. Children regard the key fobs as playthings. Keep the fob in an area that is out of reach of children
- Putting the fobs on a key chain, in a pocket or a purse can also result in an accidental activation

28

Train Users

- Train users on when to use the devices and on the benefits of using 9-1-1 to relay full information about the emergency

29

Tennessee Network of Security Integrators
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Residential Fire Alarm Systems

Slide 7-1

1

Tennessee Network of Security Integrators
TN Security Certification

Basics

Slide 7-2

2

Fire Effects

Fire produces a hostile environment

The majority of fatalities are due to smoke inhalation

The average person only has a few minutes to evacuate once smoke alarms sound

Slide 7-3

3

The Fire Threat

2018 Statistics

- 1,318,500 Fires (down 1000 from 2017)
- Caused $25.6 Billion in damages
- 3,655 Civilian deaths (up 8% from 2017)
- Caused 15,200 Civilian injuries

Every 24 seconds a Fire Dept responds to a fire.

Slide 7-4

4

Products Of Fire

Sensors look for products of fire

Slide 7-5

5

Fire Alarm Objectives

- Indicate & warn of abnormal conditions
- Provide sufficient warning to allow occupants to escape
- Summon appropriate aid
- Control facilities to control the fire
- Enhance the protection of life
- Reduce property loss & damage

Slide 7-6

6

Fire Alarm Systems

Initiation Devices (sensors)

Control Unit & Power Supplies

Notification Devices

Signaling

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Slide 7-7

7

Code Versions Used in this Course

- NFPA 70 - 2020 - National Electrical Code
- NFPA 72 - 2019 - National Fire Alarm & Signaling Code
- NFPA 101 - 2018 - Life Safety Code
- IRC 2018 - International Residential Code
- IBC 2018 - International Building Code
- Keep in mind that local municipalities may have different editions adopted. Always consult the AHJ in the municipality you are working in.

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Slide 7-8

8

Who is the AHJ anyway?

"The organization, office or individual responsible for approving equipment, installation or procedure"

- NFPA

- Fire Department: Chief, Fire Marshal
- Department of Labor
- Health Department
- Insurers
- Owners

NFPA 72 3.2.2 ['19]

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Slide 7-9

9

The AHJ can approve & accept products & procedures.

- "**Approved"** Accepted to the AHJ.
  - NFPA 72 3.2.1 ['19]
- **"Listed"** Equipment tested by a NRTL and placed on a list certifying it meets a set of standards.
  - NFPA 72 3.2.5 ['19]
- "**Labeled"** Equipment tested by a NRTL and a label, symbol, or other identifying mark is attached certifying it meets a set of standards.
  - NFPA 72 3.2.4 ['19]

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Slide 7-10

10

Fire System Survey

- Things to look for
  - Who is the Authority Having Jurisdiction (AHJ) on this project?
  - What fire code has been adopted?
  - Are their requirements beyond existing local and state fire codes? (insurance?)

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Slide 7-11

11

Carbon Monoxide Poisoning

- Each year in America, unintentional carbon monoxide poisoning claims more than 400 lives and sends another 20,000 people to hospital emergency rooms for treatment.

Source: USFA

TN Security Certification Course © TNSI 2019

Slide 7-12

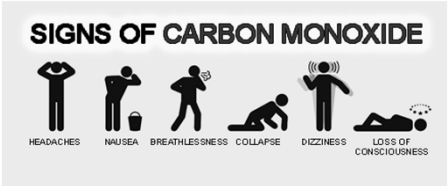
12

What Is Carbon Monoxide?

CO Poisoning can be reduced by proper detection and warning devices.

13

Effects of Carbon Monoxide?



14

Where Does Carbon Monoxide Come From?

- CO gas can come from several sources:
  - gas-fired appliances
  - charcoal grills
  - wood-burning furnaces or fireplaces
  - motor vehicles.

15

What Actions Do I Take if Carbon Monoxide Alarm Goes Off?

- If no one is feeling ill:
  - Leave immediately
  - On the way out if you can, ventilate the house with fresh air by opening doors and windows.
  - Get the Fire Department on the scene. They are the only ones with the training and equipment to asses the danger.
  - Call a qualified professional to investigate the source of the possible CO buildup.

16

What Actions Do I Take if Carbon Monoxide Alarm Goes Off?

If illness is a factor:

- Evacuate all occupants immediately.
- Determine how many occupants are ill and determine their symptoms.
- Call your local emergency number and when relaying information to the dispatcher, include the number of people feeling ill.
- Do not re-enter the home without the approval of a fire department representative.
- Call a qualified professional to repair the source of the CO.

17

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Initiating Devices

18

Residential Initiating Devices

- Types of Initiating devices used in residential settings include:
  - Manual Pull Stations
  - Fixed Heat Detector
  - Rate of Rise Heat Detector
  - Photoelectric Smoke Detector
  - Ionization Smoke Detector

19

Manual Pull Stations

- Manually activated device generally used to activate the fire alarm.
- Types are Single action with require just 1 action (such as pulling down) double action pull that require 2 actions (such as pushing in and then pulling down)

Single Action

Double Action

20

Fixed Heat Detector

- Detector that will trigger an alarm when the temperature at the device reaches a preset limit.
- Can be
  - –Wired or Wireless.
  - –Conventional, analog or addressable.
  - –Self restoring or single use.
  - –Fixed or analog
  - –Available in variety of temperature settings.

21

Rate of Rise Heat Detector

Detector that will trigger an alarm if the temperature at the detector increases at a preset rate.

- Could be Wired or Wireless.
- Could be conventional, analog or addressable.
- Could be self restoring or single use.
- Available in variety of temperature settings.

22

Combination Heat Detectors

- Triggers when temperature increases at preset rate or when temperature reaches preset limit
- Usually self restores
- Variety of temperature settings

23

Restorable or Non-Restorable

- Nonrestorable Initiating Device
  - – A device in which the sensing element is designed to be destroyed in the process of operation
- Restorable Initiating Device
  - – A device in which the sensing element is not ordinarily destroyed in the process of operation, whose restoration can be manual or automatic

24

Photoelectric Spot Type Smoke Detector

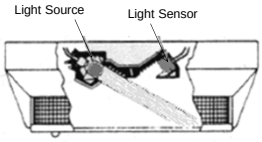
- Most photoelectric smoke detectors are of the spot type and operate on the light scattering principle
- A light-emitting diode (LED) is beamed into an area not normally "seen" by a photosensitive element, generally a photodiode
- When smoke particles enter the light path, light strikes the particles and is reflected onto the photosensitive device causing the detector to respond

Slide 7-25

25

Photoelectric Smoke Detector
Normal Situation

- Pulsed Light is sent into Chamber
- The light normally avoids the sensor

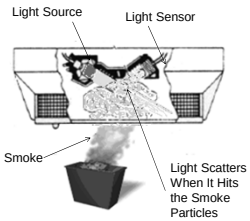


Slide 7-26

26

Photoelectric Smoke Detector
Alarm Situation

- Smoke reflects light into the sensor
- The reflected light causes the detector to alarm



Slide 7-27

27

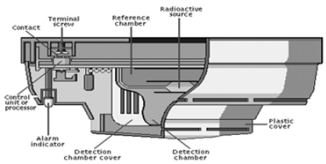
Ionization Smoke Detector

- Air in chamber is "ionized" to allow the air to conduct current
- Smoke particles reduce the level of ionization, disrupting the electric current flow and producing an alarm

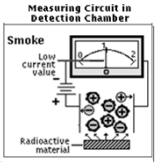
Slide 7-28

28

Ionization Smoke Detector
Normal Situation



Current Flows

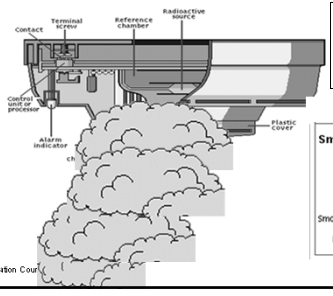


Current Flows Thru Chamber

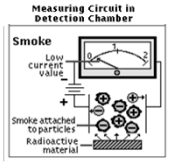
Slide 7-29

29

Ionization Smoke Detector
Alarm Situation



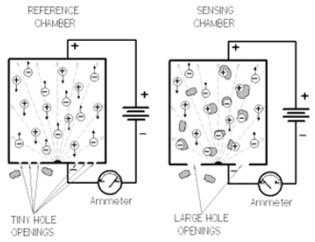
Current Blocked



Slide 7-30

30

Ionization Smoke Detector Dual Chamber Detector



31

Ionization Smoke Detector Dual Chamber Detector

- Changes in humidity and atmospheric pressure affect the chamber current and create an effect similar to the effect of particles of combustion entering the sensing chamber
- To compensate for the possible effects of humidity and pressure changes, the dual ionization chamber was developed and has become commonplace in the smoke detector market

32

Ionization Smoke Detector Dual Chamber Detector

- A dual-chamber detector utilizes two ionization chambers; one is a sensing chamber that is open to the outside air
- The sensing chamber is affected by particulate matter, humidity, and atmospheric pressure
- The other is a reference chamber that is partially closed to outside air and affected only by humidity and atmospheric pressure, because its tiny openings block the entry of larger particulate matter including particles of combustion

33

Photoelectric vs Ionization

34

Smoke Number & Location

Smoke Detectors

- Both IRC 314 & NFPA 72 Chapter 29 allow 2 ways to comply
  - The installation of smoke alarms or fire alarm systems or combinations of these shall comply with the requirements of this chapter and shall satisfy the minimum requirements for number and location of smoke alarms or smoke detectors by one of the following arrangements:

35

Smoke Number & Location

Smoke Detectors

Option 1: Smoke Alarms Primary

- The required minimum number and location of smoke detection devices shall be satisfied (independently) through the installation of smoke alarms.
- The installation of additional smoke alarms shall be permitted.
- The installation of additional system-based smoke detectors including partial or complete duplication of the smoke alarms satisfying the required minimum shall be permitted.

NFPA 72 29.3.3.1 ['19] & IRC R314.2 ['18]

36

Smoke Number & Location

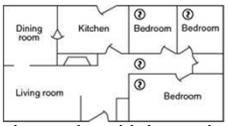
Smoke Detectors

- *Option 2: System Detectors Primary*
- Required minimum number and location of smoke detection devices shall be satisfied (independently) through the installation of system smoke detectors.
- Additional smoke detectors shall be permitted.
- Additional smoke alarms including partial or complete duplication of the smoke detectors satisfying the required minimum shall be permitted.

NFPA 72 29.3.3.1 & 2 ['19] & IRC R314.7 ['18]

37

Sleeping Area Spacing



Smoke Detectors

- Where required, approved single- and multiple-station smoke alarms shall be installed as follows:
  - In all sleeping & guest rooms
  - Outside of each separate sleeping area, within 21 ft of any door to a sleeping room, the distance measured along a path of travel
- A smoke alarm should be located between the sleeping area and the rest of the dwelling unit as well as in each bedroom.

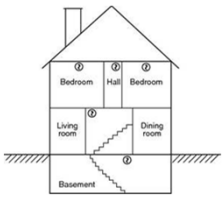
NFPA 72 29.8.1.1 ['19] & IRC R314.3 ['18]

38

All Levels

Smoke Detectors

- On each level, including basements
- On every level of a residential board and care occupancy (small facility), including basements and excluding crawl spaces and unfinished attics



NFPA 72 29.8.1.1 ['19] & IRC R314.3 ['18]

39

Living Areas

Smoke Detectors

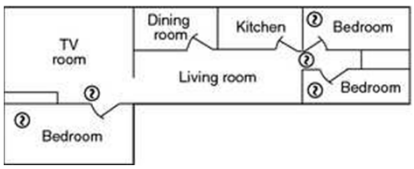
- In the living area(s) of a guest suite
- In the living area(s) of a residential board and care occupancy (small facility)

NFPA 72 29.8.1.1 ['19] & IRC R314.3 ['18]

40

Separate Sleeping Areas

Smoke Detectors



- In dwelling units with more than one sleeping area, a smoke alarm should be provided to protect each sleeping area in addition to smoke alarms required in bedrooms

NFPA 72 29.8.1.2 ['19]

41

Separate Sleeping Area

Smoke Detectors

- When Sleeping Area is separated from the adjacent living areas by a door, a smoke alarm shall be installed in the area between the door and the sleeping rooms, and additional alarms shall be installed on the living area side of the door

NFPA 72 29.8.1.2 ['19]

42

Large Homes

Smoke Detectors

- Where the interior floor area for a given level of a dwelling unit, excluding garage areas, is greater than 1000 square feet, smoke alarms shall be installed as follows:
  - All points on the ceiling shall have a smoke alarm within a distance of 30 ft or
  - Shall have one smoke alarm per 500 ft of floor area

NFPA 72 29.8.1.3.1 ['19]

43

Multi Level

Smoke Detectors

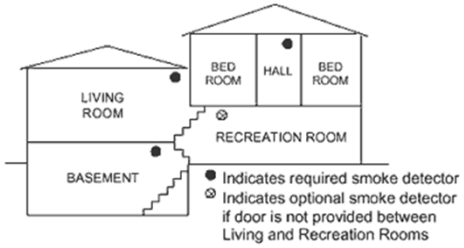
- Where dwelling units include great rooms or vaulted/ cathedral ceilings extending over multiple floors, smoke alarms located on the upper floor that are intended to protect the aforementioned area shall be permitted to be considered as part of the lower floor(s) protection scheme used to meet the requirements

NFPA 72 29.8.1.3.2 ['19]

44

Split Level Arrangement

Smoke Detectors

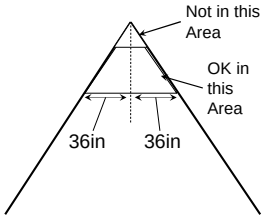


NFPA 72 29.11.3.4.10 ['19]

45

Peaked Ceilings

Smoke Detectors



Smoke alarms or smoke detectors mounted on a peaked ceiling shall be located within 36 in. horizontally of the peak, but not closer than 4 in. vertically to the peak.

NFPA 72 29.11.3.1 ['19]

46

Sloped Ceilings

Smoke Detectors

- Smoke alarms or smoke detectors mounted on a sloped ceiling having a rise greater than 1 ft in 8 ft horizontally shall be located within 36 in. of the high side of the ceiling, but not closer than 4 in. from the adjoining wall surface

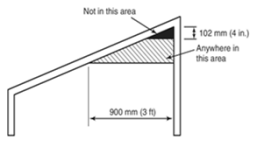


FIGURE A.11.8.3.3 Example of Proper Mounting for Alarms and Detectors with Sloped Ceilings.

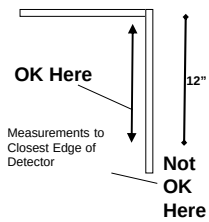
NFPA 72 29.11.3.2 ['19]

47

Wall Mounting

Smoke Detectors

Smoke alarms or smoke detectors mounted on walls shall be located not farther than 12 in. from the adjoining ceiling surface



NFPA 72 29.11.3.3 ['19]

48

Specific Location Requirements

Smoke Detectors

- Shall not be located
  - where ambient conditions, including humidity and temperature, are outside the limits specified by the manufacturer's published instructions
  - within unfinished attics or garages or in other spaces where temperatures can fall below 40 degrees F or exceed 100 degree F

NFPA 72 29.11.3.4.1 & 2 ['19]

Slide 7-49

49

Avoid Temperature Changes

Smoke Detectors

- Smoke alarms and smoke detectors shall be mounted on an inside wall
- Not Where the mounting surface could become considerably warmer or cooler than the room, such as a poorly insulated ceiling below an unfinished attic or an exterior wall

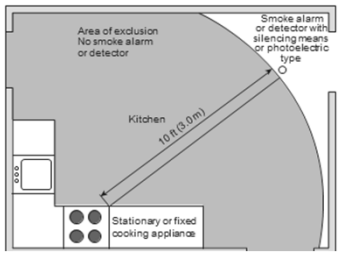
NFPA 72 29.11.3.4.3 & 4 ['19]

Slide 7-50

50

Example of Zone of Exclusion (gray area) Within Typical Residential Kitchen

Smoke Detectors

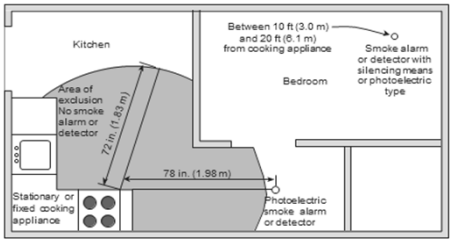


Slide 7-51

51

Example of Zone of Exclusion (gray area) Within Typical Residential Kitchen

Smoke Detectors



NFPA 72 29.11.3.4.5 & 6 ['19]

Slide 7-52

52

Bathrooms

Smoke Detectors

- Smoke alarms and smoke detectors shall not be installed within a 36 in. horizontal path from a door to a bathroom containing a shower or tub unless listed for installation in close proximity to such locations

NFPA 72 29.11.3.4.7 ['19]

Slide 7-53

53

Avoid

Smoke Detectors

- Within 36in of forced air heating or cooling system
  - NFPA 72 29.11.3.4.8 ['19]
- Within 36in of ceiling fan
  - NFPA 72 29.11.3.4.9 ['19]

Slide 7-54

54

Heat Detector Locations

Heat Detectors

- Heat detectors are used where smoke detectors are not appropriate. They are not Life Safety Devices.

55

Smooth Ceilings

Heat Detectors

- On smooth ceilings, heat detectors and heat alarms shall be installed within the strict limitations of their listed spacing.

NFPA 72 29.11.4.1 ['19]

56

Sloped Ceiling

Heat Detectors

- For rise greater than 1 ft in 8 ft horizontally, the detector or alarm shall be located within 3 ft of the peak
- The spacing of additional detectors or alarms, if any, shall be based on a horizontal distance measurement, not on a measurement along the slope of the ceiling

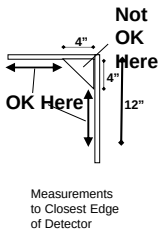
NFPA 72 29.11.4.2 & 3 ['19]

57

Wall & Ceiling

Heat Detectors

- Heat detectors or alarms shall be mounted on the ceiling at least 4 in. from a wall or on a wall with the top of the detector or alarm not less than 4 in. nor more than 12 in. below the ceiling
- Where the mounting surface could become considerably warmer or cooler than the room, such as a poorly insulated ceiling below an unfinished attic or an exterior wall, the detectors or alarms shall be mounted on an inside wall



Measurements to Closest Edge of Detector

NFPA 72 29.11.4.4 & 5 ['19]

58

Joists & Beams

Heat Detectors

- In rooms with open joists or beams, all ceiling mounted detectors or alarms shall be located on the bottom of such joists or beams

NFPA 72 29.11.3.4.6 ['19]

59

Open Joisted Ceiling

Heat Detectors

- Detectors or alarms installed on an open-joisted ceiling shall have their smooth ceiling spacing reduced where this spacing is measured at right angles to solid joists; in the case of heat detectors or heat alarms, this spacing shall not exceed one-half of the listed spacing

NFPA 72 29.11.4.7 ['19]

60

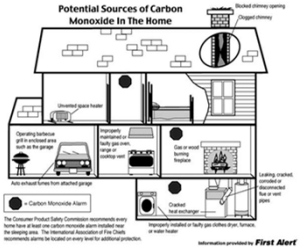
CO Detectors

- Detects a toxic colorless and odorless gas
- All CO detectors should be installed in accordance with NFPA 720 - the *Standard for the Installation of CO Detection and Warning Equipment* - which defines standards for both commercial and residential installations of CO detectors

61

CO Detectors - Residential

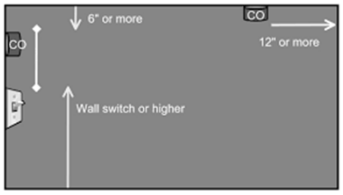
- Carbon monoxide alarms or detectors shall be installed as follows:
  - Outside each separate dwelling unit sleeping area in the immediate vicinity of the bedrooms
  - On every level of a dwelling unit, including basements
  - In all sleeping rooms and guest rooms containing installed fuel-burning appliances
  - In other locations where required by applicable laws, codes, or standards



NFPA 720 9.4.1.1 ['15]

62

CO Detector-Placement



- Each alarm or detector shall be located on the wall or ceiling per the Manufacture's instructions

NFPA 720 9.4.1.2 ['15]

63

Testing Fire Devices

- Follow manufacturer's instructions
- Testing smoke detectors may include using a magnet to draw an obstruction into the smoke sensor chamber. May also include using canned smoke to functionally test the detector (this is NOT a calibrated sensitivity test)
- Make sure that device trips control and sends signal to the monitoring station

NFPA 72 29.13.1 ['19]

64

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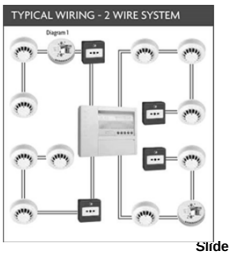
Circuits



65

Initiating Device Circuits (IDC)

A circuit to which automatic or manual signal initiating devices (smoke detectors, pull stations, flow switches, etc.) are connected where the signal received does not identify the individual device operated

66

Signaling Line Circuits (SLC)

- A circuit or path between any combination of circuit interfaces, control units, or transmitters over which multiple system input signals or output signals, or both, are carried
- "Signaling line circuits may include connections to digitally addressable fire alarm or supervisory initiating devices or connections between a protected premises fire alarm system control units and a proprietary supervising station."

Wiring fire alarms for reliability, NFPA Journal, Dean Wilson, Sept Oct 2000

Slide 7-67

67

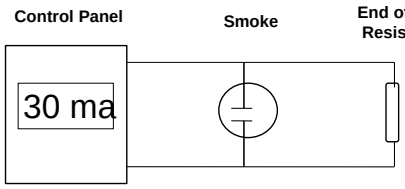
Notification Appliance Circuit (NAC)

A circuit or path directly connected to a notification appliance(s)
(Strobes, Bells, Horns, etc)

Slide 7-68

68

Typical Wiring Normal Condition

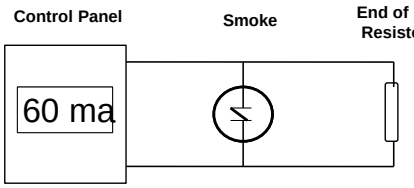


Current flows through the circuit to the end of line resistor and returns to the panel.
Current is limited by the end of line resistor.

Slide 7-69

69

Typical Wiring Alarm Condition



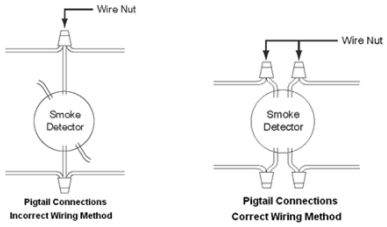
Current flows through the circuit in two paths to returns to the panel
- to the end of line resistor
- to the smoke detector

With two paths more current is allowed to flow and the panel goes into alarm

Slide 7-70

70

Device Wiring



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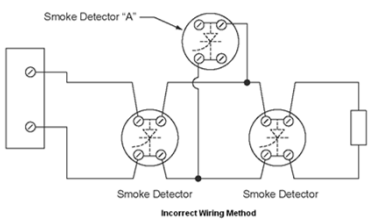
71

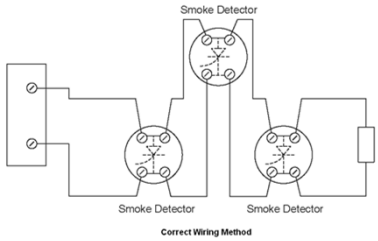
Device Wiring



Slide 7-72

72

Device Wiring



Correct Wiring Method

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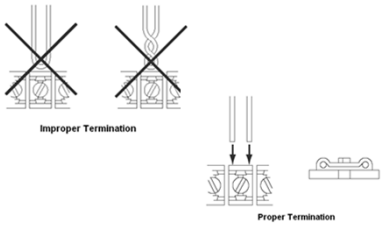
73

Proper Termination



Improper Termination

Proper Termination

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Notification Devices

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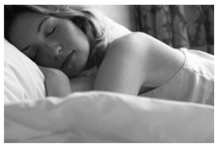
Slide 7-75

75

Fire Noise Levels

- Sounders must be 15dBA above average ambient noise or 5dBA above loudest intermittent regularly occurring noise or be 75dBA at each pillow or follow above, whichever is louder
- All doors must be closed



Click to listen

NFPA 72 18.4.6.1 & 2 ['19]

TN Security Certification Course © TNSI 2019

Slide 7-76

76

CO Noise Level

- Carbon monoxide alarms shall have a minimum rating of 85 dBA at 10 ft
- Shall be the Temporal 4 notification signal

NFPA 72 29.5.3.1 & 2 ['19]

TN Security Certification Course © TNSI 2019

Slide 7-77

77

Hearing Impaired

- Mild to Severe Hearing Loss requires Low Frequency 520Hz Waveform Sounder following dBA requirements
  - NFPA 72 29.5.10.1 ['19]
- Moderately Severe to Profound Hearing Loss either 110 candela strobe if more than 24 inches down from ceiling or 177 if less than 24 inches from ceiling
  - NFPA 72 18.5.5.8 ['19]

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Controls & Power Supplies

TN Security Certification Course © TNSI 2019 **Slide 7-79**

79

Power Supply Requirements

- Household fire and carbon monoxide alarm systems shall have two independent power sources consisting of a primary source that uses commercial light and power and a secondary source that consists of a rechargeable battery

NFPA 72 39.9.3.1 ['19]
TN Security Certification Course © TNSI 2019 **Slide 7-80**

80

Power Supply Requirements

- The secondary source shall be capable of operating the household alarm system for at least 24 hours in the normal condition, followed by 4 minutes of fire alarm or 12 hours of carbon monoxide alarm

NFPA 72 29.9.3.2 ['19]
TN Security Certification Course © TNSI 2019 **Slide 7-81**

81

Audible Notifications

- Audible notification signals shall be provided in the following priority order:
  (1) Fire alarm
  (2) Carbon monoxide
  (3) Other

NFPA 72 29.10.7.7 ['19]
TN Security Certification Course © TNSI 2019 **Slide 7-82**

82

Digital Alarm Communicator Transmitter (DACT) Residential

- Where a digital alarm communicator transmitter (DACT) is used, the DACT serving the protected premises shall only require a single telephone line and shall only require a call to a single digital alarm communicator receiver (DACR) number
- Where a DACT is used, the DACT test signals shall be transmitted at least monthly

NFPA 72 29.10.9.10.1 & 2 ['19]
TN Security Certification Course © TNSI 2019 **Slide 7-83**

83

Other Communications Methods

- Where a communication means other than DACT is used, only a single communication technology and path shall be required to serve the protected premises
- All equipment necessary to transmit an alarm signal shall be provided with a minimum of 24 hours of secondary power capacity and shall report a trouble condition indicating loss of primary power

NFPA 72 29.10.9.10.3 & 4 ['19]
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Instructions

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85

Provide the User

- An instruction booklet illustrating typical installation
- layouts
- Instruction charts describing the operation, method, and frequency of testing and maintenance of the warning equipment
- Printed information for establishing an emergency evacuation plan

NFPA 72 29.11.1.4 ['19]
TN Security Certification Course © TNSI 2019 **Slide 7-86**

86

Provide the User

- Printed information to inform system owners where they can obtain repair or replacement service, and where and how parts requiring regular replacement, such as batteries or bulbs, can be obtained within 2 weeks

NFPA 72 29.11.1.4 ['19]
TN Security Certification Course © TNSI 2019 **Slide 7-87**

87

Provide the User

- Unless otherwise recommended by the manufacturer's published instructions, smoke alarms shall be replaced when they fail to respond to tests
- Smoke alarms shall not remain in service longer than 10 years from the date of manufacture unless otherwise provided by manufacturer's published instructions

NFPA 72 29.11.1.4 ['19]
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88

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Control Panels

Slide 8-1

1

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Overview

Slide 8-2

2

Control Panels

- Controls the system
- Connects with the remote control(s)
- Activates annunciators
- Contacts the monitoring station
- Powers the system & devices

Slide 8-3

3

Selecting the Control

- Several factors should be considered when you select the control:
  - Number of sensors used
  - Number of sensor locations
  - Number of Sensor Type +Exuj/#Iluh/#Prwlrq/#Frqwdfw/#Hwf,
  - Ability to get wires to each sensor
  - Do you need Partitions
  - How much Power do you need?

Slide 8-4

4

Priority of the Control Panel

Most Residential panels are listed as Combination Panels.

Please note: The Priority of the system must be considered.

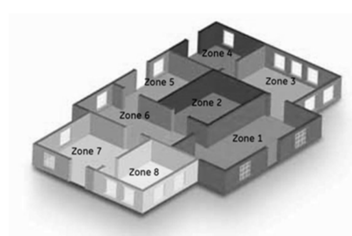
Once you add a Fire Alarm device to the panel, you must meet the wiring and code requirements as well as any local jurisdictions requirements needed for Residential Fire

Slide 8-5

5

Zones

- Allow you break up the system into parts to manage and control devices



Slide 8-6

6

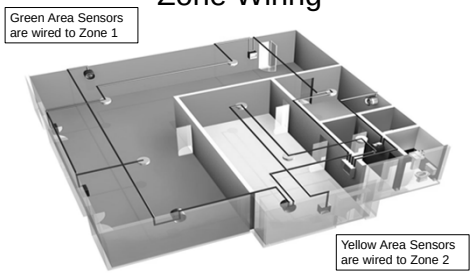
Zones

- Zones are identified by numbers
- Can be assigned text labels

Slide 8-7

7

Zone Wiring



Slide 8-8

8

Zones

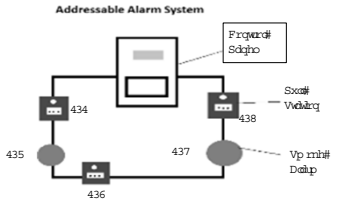
- Zones- Sensors are divided into groups by
  - Type of signal (Burglar, Fire, Holdup)
  - Type of device (Contact, Motion, etc)
  - Location (East, west, bedroom, living room, etc

Slide 8-9

9

Addressable - Point ID

- Each Sensor is identified at the control with a unique number
- ID maybe sent offsite
- Device can be labeled with text



Slide 8-10

10

Add Zones

Breaking large numbers of sensors or large areas into separate zones will help reporting and troubleshooting

Slide 8-11

11

Decide on Zones

You will need at least one zone for each type of device:

- Entry Exit
- Perimeter Instant
- Interior and/or Interior Follower
- Fire Manual
- Fire Automatic
- Panic or Silent Holdup
- Environmental
  - Flood
  - Cold
  - Heat
  - Gas

Slide 8-12

12

Wired or Wireless

- If you are unable to get wires to each sensor, wireless controls are the best bet
- If you can wire to any device, either option will do
- If you can wire to some locations and not others, hybrid controls with wireless and wired capability are an option

Slide 8-13

13

Partitions

If separate areas need to be controlled individually - partitions or additional panels may need to be added

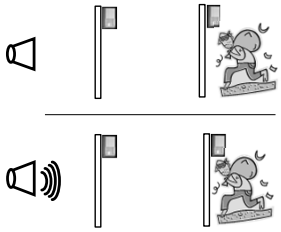
Ex: maid or guest rooms, separate areas of businesses

Slide 8-14

14

Cross Zoning

- Two devices are installed.
- The alarm will not signal without both devices tripping.



Slide 8-15

15

Control Location Considerations

- Check manufacturer's recommendations for:
  - Temperature range
  - Range of humidity
- Avoid
  - Attics and extremely hot or humid areas
  - Areas subject to flooding or moisture
  - Areas directly beneath plumbing
  - Mounting the unit outside

Slide 8-16

16

Control Location Considerations

- Consider Difficulty of
  - installation
  - connection to power and communication wiring
  - connection to sensor wiring

Slide 8-17

17

Consider the Environment

- Avoid high dust or dirt laden air
- Avoid sources of EMI- Electromagnetic Interference (transformers, radio transmitters)

Slide 8-18

18

Panel Spacing

- You must be able to open all doors a full 90 degrees
- 30” in front, 36” to side, open panel door 90 degrees
- Don’t mount boxes (alarm controls, structured wiring boxes, etc.) behind other equipment

NFPA 70 100.26 [’20]

Slide 8-19

19

Access & Protection

- Locate to ensure continued access for adjustment or repair
- Protect it from accidental physical damage

Should be able to work on the panel without a ladder

Slide 8-20

20

Avoid Condensation

- Water will seep thru concrete or cinder blocks
- Avoid Mounting the unit directly on concrete without an insulator or fiber washers
- Mounting on Plywood makes it easy

Slide 8-21

21

Consider Possible Remodeling

- Mounting the unit in an area which may be subject to remodel or change

If your control is in the furnace room and the user plans to add a bath you will have a problem

Slide 8-22

22

Protect the Control

- The central control box must be secured in some way against unauthorized use, or an intruder can defeat the purpose of the alarm system
- Box should be tamper resistant.
- Tamper switch should be installed to set off sirens when box is opened

Slide 8-23

23

Avoid Attack or Tampering

- Should not be
  - Visible to public
  - Accessible to unauthorized personnel
- Locate to reduce attack or tampering

Example of what not to do

Slide 8-24

24

Requirements for Electrical Installations

– Use proper fittings while entering boxes

– Fittings and connectors shall be used only with the specific wiring methods for which they are designed and listed

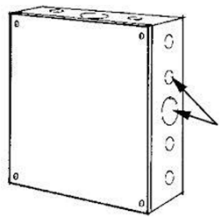
NFPA 70 300.15 ['20]

Slide 8-25

25

Requirements for Electrical Installations

– Flexible cords and flexible cables shall be protected by bushings or fittings where passing through holes in covers, outlet boxes, or similar enclosures



NFPA 70 400.17 ['20]

Slide 8-26

26

Requirements for Electrical Installations

- Unused cable or raceway openings in boxes, raceways, auxiliary gutters, cabinets, cutout boxes, meter socket enclosures, equipment cases, or housings shall be effectively closed to afford protection substantially equivalent to the wall of the equipment

NFPA 70 110.12 (A) ['20]

Slide 8-27

27

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Power

Slide 8-28

28

Power

- Control equipment uses transformers as their primary source of power
- Batteries are used for secondary or back up power

Slide 8-29

29

Transformers

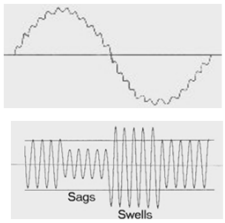
- Used to Reduce or Increase AC Voltage
- Rated by
  - Incoming Voltage
  - Output Voltage
  - Amperage or VA

Slide 8-30

30

AC Circuit Problems

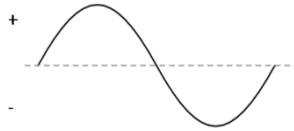
- Rough output, Sags and Swells can cause problems with electronic equipment



31

Dedicated AC circuit

- Using a dedicated AC circuit can reduce
  - Noise- RFI & EMI
  - Spikes, Surges, Brownouts, Sags and Swells



32

NFPA 731 Standard

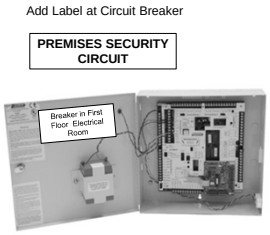
Primary Supply

- Primary (main) ac power shall be supplied either from a dedicated branch circuit or the un-switched portion of a branch circuit
  - NFPA 731 4.4.2.1 ['20]
- Circuit disconnecting means shall have a distinctive marking, be accessible only to authorized personnel, and be identified as "PREMISES SECURITY CIRCUIT."
  - NFPA 731 4.4.2.2 ['20]

33

Label Breaker Location

- Recommend dedicated breaker this can avoid unintentional power loss
- Permanently identify at the premises security control unit



NFPA 731 4.4.2.3 ['20]

34

Secure Transformer

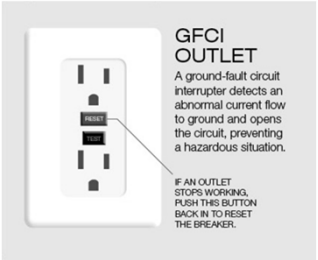
- Transformer should be appropriately fastened (according to code) so that it cannot be accidentally unplugged

NFPA 70 731 4.4.2.4 ['20]

35

Avoid GFCI Outlets

- Avoid ground fault interrupted circuits
- If circuit trips power will be cut to your transformer



36

Locating Transformers

- Accessibility to unauthorized personnel
- Range of temperature
- Difficulty of installation
- Difficulty of connection to control
- Check manufacturer's recommendations

Slide 8-37

37

Transient Protection

- Use a proper earth ground
- Use surge suppressers
- Use line conditioners
- Use uninterruptible power sources (UPS)

Slide 8-38

38

Backup Battery

- Capacity determined by security vulnerability assessment, design requirements, manufacture requirements, or other standards
  - NFPA 731 4.4.3.5 ['20]
- Replace according to manufactures requirements or within 5 years of manufacture
  - NFPA 731 4.4.4.2 ['20]
- Inspect and test every year

Slide 8-39

39

Factors That Impact Battery Life

- Temperature around the battery
- Age of the battery
- Number of charge cycles
- Large energy losses will occur through self-discharge if a battery is left in a hot vehicle

Slide 8-40

40

Calculate Power Requirements

- Check manuals for power (amps) used by each device
- Remember to use a common scale
  - Convert everything to amps or milliamps
- Remember the keypad(s), the audible device(s) motion and glass break sensors
- Add up all devices to find your total requirements

Slide 8-41

41

Battery Power Requirements

Standard	Use	Non Alarm Minimum Operation	Alarm Sounding Devices
NFPA 731	Burglar & Emergency Alarms	4 Hours	15 Minutes
NFPA 72	Fire Alarms	24 Hours	5 Minutes
NFPA 72	Household Fire Alarms	24 Hours	4 Minutes

Slide 8-42

42

Battery Location

Storage Batteries

- Permanently mark batteries with the month and year of installation
  - NFPA 731 4.4.4.1 ['20]
- Unless manufacture says otherwise batteries must be installed vertically
  NFPA 731 4.6.2.2 ['20]
- If not at panel then permanently note where they are located
  NFPA 731 4.4.4.7 ['20]

Charger Supervision

Supervise the batteries and charger to detect a failure of battery charging and initiate a trouble signal

NFPA 731 4.4.4.11 ['20]

Alarms During Storms

- If the Alarm triggers during a storm the storm may not be cause
- If your batteries are not up to the job, a false alarm may be generated when your alarm system powers up after a power failure caused by a storm
- Even a short power failure of a second or less may be long enough to cause a false alarm

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Remotes

Touchpads/keypads

- Similar to the keypad on a cell phone
- A preset combination number is entered into the keypad to arm (turn on) and disarm (turn off) the system
- The combination code can be changed
- Includes a display to show system activity

Keyfobs

- Small radio transmitter, commonly located on a key chain that is used to arm and disarm the alarm system
- May have a panic feature

Keyswitches

- High security key used to arm (turn on) and disarm (turn off) the system
- A red light is normally used to indicate if the system is armed

Slide 8-49

49

Smart Phone Apps

- Control of security system and home control via a smart phone or tablet application

Slide 8-50

50

Locating Remote Keypads

- Mount close to entry-exit doors
- Should not be accessible to unauthorized personnel
- Consider how difficult it will be to install
- Think about how hard it will be to connect to the control
- Check manufacturer's recommendations

Slide 8-51

51

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Configure & Program

Slide 8-52

52

Programming Methods

- Via notebook, tablet or smartphone
- Via control or keypad
- Via special programmer
- Via a modem
- Via the internet

Slide 8-53

53

Labeling Devices

- Use names and labels that the customer, the police or fire authorities & your fellow workers will understand
- Will everyone know
  - where Billy's room is?
  - north, south, east or west?
  - Right or left, from inside or out?

Slide 8-54

54

Avoid False Alarms

- Notify your monitoring center BEFORE you change a program
- Program changes may send accidental signals

55

Notify Occupants

Let all occupants know when your program changes might result in trouble buzzers or alarm sounds

56

Check Integration

- The changes you make on one device may impact another
  - Doors may lock, unlock or close
  - Rolling doors may close
  - Elevators may be recalled
  - HVAC Ducts may close and need to be manually opened
- Read the Directions!

57

Learn the Options

- Familiarize yourself with the options for each step of the program
- Make sure that a change in one step of your program will not impact another area of the program

Read the Directions!

58

Create Your Program

- Gather needed information
  - Device locations & descriptions
  - Identification or account number assigned to the system
  - Special requirements- 24 hour zones, long entry and exit paths, etc.
- Decide on options

59

Save Before Updating

- When you update an existing program make sure you have a copy of the most up to date program BEFORE you make changes
- Remember that if you upload or download a program it will probably replace the existing copy of the program

60

Programming Steps

- Record needed information
  - Use templates or programming sheets.
- Enter the program
- Save the program
- Make notes to help those who come after you

Slide 8-61

61

Backup Your Data

- Copy your data before and after you make changes

Slide 8-62

62

Create Program Library

You can save time and avoid mistakes by creating program libraries or templates for common situations

- Small Home
- Larger Home
- Commercial
- Etc.

Slide 8-63

63

Every Monitored Account Needs

- Receiver
  - Phone Number / IP Address / Frequency
- Account Number
- Communication Format
- Zone Types
- Signal Types

Slide 8-64

64

Receiver Phone Number / IP Address

- The phone number or IP Address that the control panel needs to reach your central station receiver

Please Remember !

- Your system must meet the standards for the services you are offering your customers
  - Intrusion, Fire and Life safety and Emergency Response systems ALL may have special requirements you must meet in your jurisdictions

Slide 8-65

65

Account Number

- Typically 3 – 6 digit number that identifies home or business
- May have a receiver and line card number, in front of the actual number that you program

01 – 05 – 1234

Receiver Line Card Account Number

Slide 8-66

66

Duplicate Accounts

- Caution –
- The same line card number and account number may be used on another receiver in the same central station
- Make sure you select the right phone number or IP address

Slide 8-67

67

Communication Format

- The control communicator at the alarm site sends digital data to a receiver at a monitoring center
- The format is like the language (English, French, etc.)
- The format used at the control communicator must match the format used at the receiver

Slide 8-68

68

Common Formats

- Contact I.D.
- SIA
- Modem IIIa2
- Modem IIe
- DMP
- ITI
- 4 x 2
- 3 x 1

Slide 8-69

69

Contact ID Format

Uses DTMF (touch tones)

Includes a four digit account number, one digit event code, three digit event identifier, two digit area, three digit zone/user number.

Example:

1234 E 134 01 001 and 1234 R 134 01 001

Where:

1234 = Account number
E or R = Alarm or Restore
134 = Delay perimeter zone
01 = Area number
001 = Zone number

Click on Icon to Hear Sound

Slide 8-70

70

SIA Format

Uses binary frequency shift keying (BFSK).

Format may also include a number (1, 3, 8, 20) that represents how many signals are sent during each phone call.

Examples:

FA1 BA03 OP006 1

Click on Icon to Hear Sound

Includes: Four digit account number, Event (FA=Fire Alarm; BA=Burglary Alarm; OP=Opening), Zone/User Number, and may include an area/partition.

Slide 8-71

71

Modem IIIa² and Modem IIe Format

– Formats that are proprietary to Bosch (formerly Radionics and Detection System) panels.

Four to ten digit account number, one digit identifier, three digit user/zone number, point text.

Examples:

1234 A 001 Alarm Zone 1 Back Door
1234 R 001 Restore Zone 1 Back Door
1234 N D25 Test Signal

Click on Icon to Hear Sound

Slide 8-72

72

DMP Format

– Uses Synchronous Data Link Control (SDLC), a networking communication format invented by IBM.

Reports up to 47 Characters including keypad displayed information:

Example:

1234 – Area: 01 – Main Bldg Open: User 101 John Doe

Click on Icon to Hear Sound

Slide 8-73

73

ITI Format

Format type that includes a five digit account number, one digit event identifier, and three digit user/zone number

Examples:

12-345 A001
12-345 W001
12-345 R001

Click on Icon to Hear Sound

Slide 8-74

74

Pulse Format

Including 3x1, 3x1 extended, 3x2, 4x2, and 4x3.

May include hexi-decimal (replacing numbers with letters). First number is number of digits in account number. Second number represents the number of digits in the event code.

Examples:

123 1 (3x1 format, account # 123, event type 1)
123 01 (3x2 format, account # 123, event type 01)
1234 16 (4x2 format, account # 1234, event/zone 16)
1234 E6 (4x2 format, account # 1234, event E, zone 6)

Click on Icon to Hear Sound

Slide 8-75

75

Zone Types

The type you select will determine how each zone will react to open, short, and normal conditions in the armed (away, stay) and disarmed modes

Slide 8-76

76

24 Hour Zone

– On regardless of arm/disarm status
– Initiates alarm immediately when tripped
– Examples
  • Hold-up
  • Ambush
  • Emergency
  • Fire

Slide 8-77

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Entry Exit Zone Types

- **Delay or Entry/Exit**
  – When violated, allows time to reach keypad for disarming
- **Instant**
  – If violated while system is armed, initiates an alarm immediately
- **Follower**
  – Instant if violated first, follows delay if entry/exit zone trips first

Slide 8-78

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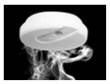
Smoke Detector Verification



- Upon activation, control will power down/restore power to device
- If zone trips again within time frame, fire alarm is initiated
- If zone does not trip within time frame, first trip is ignored

(For Smoke Detectors ONLY!)

Slide 8-79

79

Special Zone Types

- **Day Zone**
  - Trouble when disarmed, alarm when armed. (e.g. window foil, control panel tampers)
- **Chime**
  - Sounds at keypads only
  - Monitor when doors open

Slide 8-80

80

Signal Types

- How each zone will report to the monitoring station under given conditions (opens, shorts, normal)
  - **Alarm -** Event that requires action (dispatch)
  - **Supervisory** - System is off normal
  - **Trouble** - System will not work as designed
  - **Restore** - System or zone is back to normal condition
  - **Cancel** - Previous alarm signal, or alarm in process, is to be disregarded

Slide 8-81

81

Device Identification

- Various methods can be used to pinpoint the source of an alarm
- If too many devices activate the same signal, it can be difficult to locate the source on an alarm
- The number of devices wired to each zone should be limited to more accurately identify the source of a false alarm

Slide 8-82

82

Call Waiting

- Call waiting feature allows customer to receive multiple calls on a single phone line
- When the central station operator calls to verify the alarm when the alarm panel is still communicating, the operator will hear ringing and assume the site is not occupied
- Codes to disable the call waiting feature should be added to the panel programming so that the operator hears a busy signal when the panel is using the line

Slide 8-83

83

Test and Verify

Verify proper system operation after each major program change

Slide 8-84

84

Restore the System

Notify your monitoring center after you have finished all testing to restore the system to normal operation

Slide 8-85

85

Record All Changes

Make sure that all documentation is updated when you make a change

Slide 8-86

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Wiring the Control

Slide 8-87

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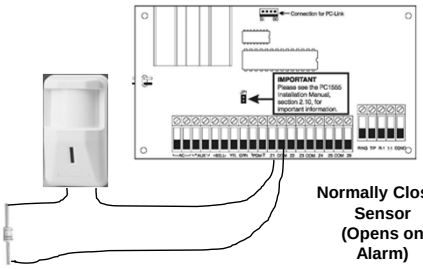
Connect the Sensors

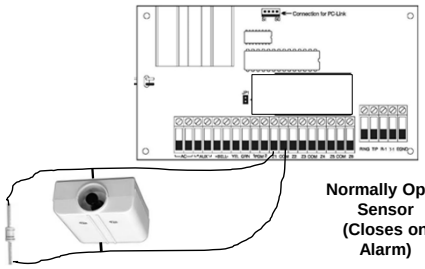


Normally Closed Sensor (Opens on Alarm)

Slide 8-88

88

Connect the Sensors

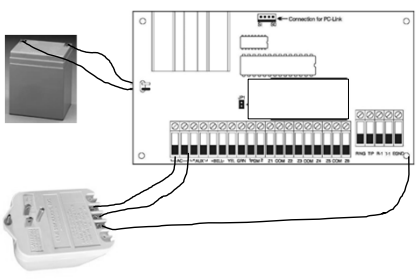


Normally Open Sensor (Closes on Alarm)

Slide 8-89

89

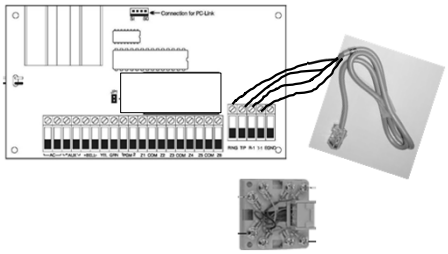
Connect the Power



Slide 8-90

90

Connect the RJ31 X



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Slide 8-91

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Communications & Networking

1

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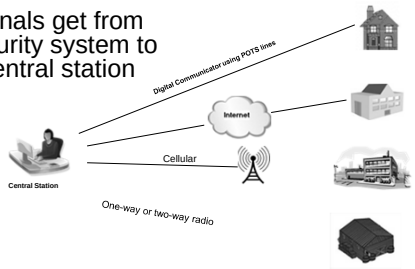
Overview

2

Communication

How signals get from the security system to the central station



3

Digital Communicators

- Digital Communicators are used to transmit a signal from the alarm site over regular telephone wires (POTS = plain old telephone service) to an alarm monitoring station
  - The communicator seizes the customer's phone line and electronically dials the central-station receiver
  - When the receiver answers, the communicator sends a message in the form of a sequence of tones
  - A mini -computer in the receiver accepts and acknowledges the message
  - It then prints out the information for display to the operator

4

Cellular

- Uses stationary cellular telephone equipment (Separate unit or a card added to a control)
- Like cellular telephones, it reports without wires to a nearby cellular tower to connect
- Enters the central station via a phone line or internet connection

Card added to Control

Separate Unit

5

Long Range Radio

- Messages are sent by radio transmitters or transceivers
- One-way radio goes from the alarm site to the central
- Two-way offers full communication
- May go thru other alarm sites or intermediate transceivers

6

Internet or IP

- Internet transmitters at the alarm site send data to a compatible internet receiver at a central station over the internet

7

Types of Alarm Signals

- **Fire Alarm**
  - A signal that reports a fire, water flowing in a sprinkler system, or dangerous conditions such as smoke or overheated materials that may combust spontaneously
  - **Proper Response-** Call premise to verify then call requesting public safety dispatch (Residential only)

8

Types of Alarm Signals

- **CO Detector Alarm**
  - An audible alarm signal generated by the l activation of a device intended to signal the presence of carbon monoxide is an odorless, colorless & toxic gas
  - **Proper Response-** Call the alarm site if no answer or anyone has symptoms call requesting public safety dispatch

9

Types of Alarm Signals

- **Holdup/Robbery Alarm**
  - Silent alarm signal generated by the manual activation of a device intended to signal a robbery in progress
  - **Proper Response** - Call requesting public safety dispatch, then attempt to verify the validity of the signal

10

Types of Alarm Signals

- **Emergency or Panic Alarm**
  - An audible alarm system signal generated by the manual activation of a device intended to signal a life threatening or emergency situation requiring law enforcement response
  - **Proper Response-** Attempt to reach a responsible party at the alarm site. If that contact fails, call requesting public safety dispatch

11

Types of Alarm Signals

- **Ambush or Duress Alarm**
  - A silent signal generated by the entry of a designated code into an arming station in order to signal that the alarm user is being forced to turn off the system and requires law enforcement response
  - **Proper Response-** Call requesting public safety dispatch, then attempt to verify the validity of the signal

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Types of Alarm Signals

- **Burglar Alarm**
  - Usually audible signal indicating a burglary or break in
  - **Proper Response -** Attempt to reach a responsible party at the alarm site If that contact fails, call a different phone number, usually the cell phone of a responsible party, in an attempt to verify the validity of the alarm signal prior to requesting public safety dispatch

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Other Types of Signals

- Responsible party should be contacted Public Safety **should not** be dispatched
  - **Trouble** - A signal indicative of a fault in a monitored circuit or component
  - **Supervisory** - A signal indicating the need for action in connection with the supervision of guard tours, the fire suppression systems or equipment, or the maintenance features of related systems
  - **Low Battery** - Indicates when battery is almost dead
  - **AC Power Fail** - Indicates that primary AC power has failed

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Other Types of Signals

- Responsible party should be contacted Public Safety **should not** be dispatched
  - **Industrial Process Alarm** - A signal that reports off normal condition for a wide variety of commercial and industrial processes, including sump-pump operations, water levels, pressures and temperatures, chemical processes, and special furnace operations
  - **Reset or Restoral** - Indicates that a device is restored to its original or normal condition
  - **Exit Error** - A signal produced when an entry/exit zone is still violated at the expiration of the Exit Time

15

Other Types of Signals

- Responsible party should be contacted Public Safety **should not** be dispatched
  - **Test Signal -** Sent in an effort to confirm proper operation of the equipment
  - **Late to Test Signal** - Failure to receive an anticipated test signal at the scheduled time
  - **Test Initiation Report** - At the initiation of a test, the control panel sends a message to the central station that a test is in progress
  - **Test Termination Report** - When a test is terminated, the control panel sends a message to the central station that the test is over

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Verification

- Gives the alarm user a change to cancel the alarm
- Verification
  - Call the site
- ECV- Enhanced Call Verification
  - call a different phone number
  - usually the cell phone

17

Audio & Video Verification

- Allows the monitoring center to either “hear” or “see” into the protected premise to determine if an intruder is present

18

Cancellation of Alarm Signal

- Notify the responding public safety agency if a response is no longer required

19

Notify the Right People

- Request a public safety dispatch only when required
- Some signals call for you to
  - Notify responsible party
  - Log for future reference

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Possible Responders

- Alarm User
- Alarm Company
- Guards
- Police-Sheriff
- Fire Department
- Ambulance

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Telephone
Public Switched Telephone Network (PSTN)

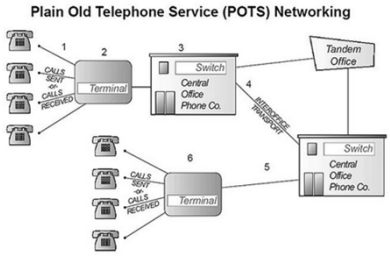
22

Plain old telephone service (POTS)

- Telephone service employing analog signal transmission over copper loops
- POTS remains the basic form of service connection to the telephone network in rural areas

23

The Network



24

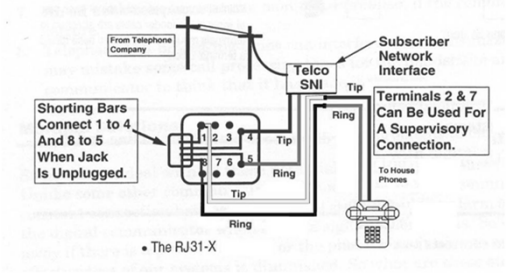
The RJ31-X

- The connection to the regular phone lines is made through the RJ31-X
- This provides an FCC approved dividing line between the telephone equipment and our equipment
- The RJ31-X, when properly wired, allows the alarm equipment to take priority over the phone lines when alarm signals need to be sent

Slide 9-25

25

RJ31-X Wiring



Slide 9-26

26

RJ31X Cord

- Use the approved cord to connect to the alarm panel and plug into the jack

Slide 9-27

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Subscriber Network Interface



- Point where the phone company responsibility stops and site owners begins

Slide 9-28

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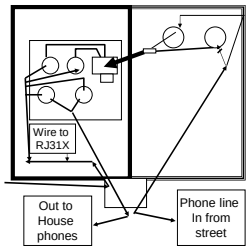
POTS Telephone Interface (SNI) Wiring

Option 1
- Green & Red to RJ31X,
- Black & Yellow back to House phones
- Remove green & red house wires.
- Put them on black & yellow terminals.
- Place RJ-31X's Yellow & Black Wires on yellow & black terminals



Slide 9-29

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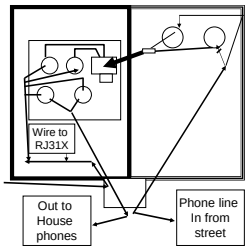
POTS Telephone Interface (SNI) Wiring

Option 2
- Pull the house phones off the terminals
- Connect the red & green house phone wires to the yellow and black from RJ31X with silicone filled connectors

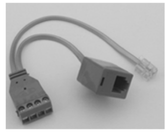


Slide 9-30

30

Easy Line Seizure Connection

- Run a 4 conductor wire from the alarm panel to the customer's side of the Telephone Network Interface
- Insert the 4-conductor alarm wire into the connectors header terminals R, T, R-1 and T-1
- Remove the jumper wire from the female socket
- Plug the male end of the connector into the socket & plug the male interface jumper wire into the connector female socket



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To Check Telephone Lines

- Use a Lineman's test set to:
  - Verify dial tone
  - Test ability to dial out
  - Check requirements to dial (Dial 9)
- Use a Meter to:
  - Verify if line is active
  - 48 to 52 volts DC on Hook
  - 7 to 9 volts DC Off Hook

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Cellular

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How Does Cellular Work?

- A cellular network is a radio network distributed over land through cells where each cell includes at least one fixed location transceiver known as base station
- Together these cells provide radio coverage over larger geographical areas
- User equipment, such as mobile phones, is able to communicate even if the equipment is moving through cells during transmission

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How Do Cell Phones Work?

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35

Generations

"G" stands for generation.
"LTE" is long term evolution

Jhqhudwlrq	Lqwurgxfhg	Pd{#Vshhg	Vxqvhw
4J	4<:6	517#Nesv	533;
5J#)#518J	4<<3	4#Pesv	• DW)W=3423425349 • Yhul}rq=62452534< • WOPreloh=62452535353 • Vsulqw#45264254
6J	5338	5#Pesv	• DW)W#45164154 • Yhul}rq#4516414< • WPreloh#Qr#Dqqrxqfhphqw • Vsulqw#45264255
7J2OWH	533<	4Jesv	B
8J	534;	8Jesv	B

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GSM or CDMA

- The infrastructure that cellular companies use
- GSM=Global System for Mobiles
- CDMA=Code Division Multiple Access
- 7 of the 10 biggest cell carriers in the US use CDMA
- Europe is mostly GSM
- Alarm systems typically use GSM

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GSM or CDMA

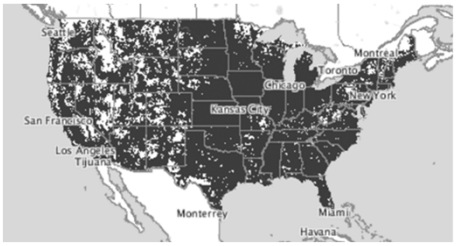
Carrier	
AT&T	GSM
T-Mobile	GSM
Sprint	CDMA
Verizon	CDMA
US Cellular	CDMA

38

Coverage Map - AT&T- US Cellular)

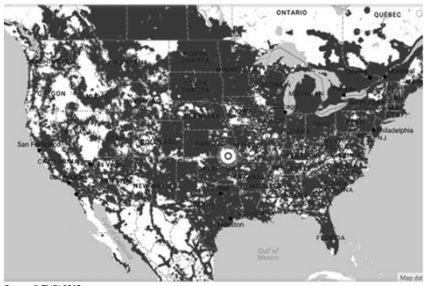
39

Coverage Map - Sprint



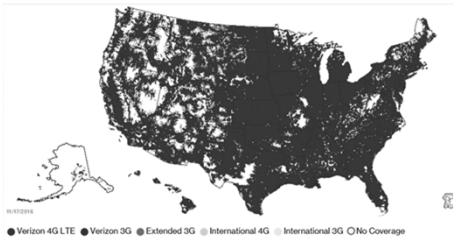
40

Coverage Map - T- Mobile



41

Coverage Map - Verizon



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What Is Cellular Alarm Monitoring?

- A “cellular chip” or “module” is installed into the Control Panel of the alarm system
- Cell service is provided by or thru the product manufacturer
- The cellular signal is sent through the data portion of a cellular signal, much like a text message, as opposed to the voice signals that are used by traditional cellular phones
- You register your site
- Signals are forwarded to your central station

43

Card or Separate Unit

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Connections

- Cell card unit connects by plugging into the control
- Separate unit connects via RJ31 X Cord
- Units communicate via compatible Digital Communicator Formats (Pulse, Contact ID, SIA, etc)

45

Antenna Options

- Antenna problems are unlikely unless the premises are located in a fringe network coverage area, in a building below ground level, or in a metal structure

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Tips for Improved Signal Reception

- The higher the antenna the better - Start in the drop ceiling above the unit and proceed up from there, to the roof if necessary
- The antenna should be as inconspicuous as possible for greatest visual security
- Try to keep the antenna away from sources of RF interference, including pumps, compressors, ovens, etc., or where metal objects can shield it or otherwise block the cellular radio RF signal
- Place the antenna perpendicular to the ground, either right side up or upside down - Do not mount the antenna horizontally
- Always use an antenna mounting bracket - Do not mount the antenna such that it is in contact with another object, as this may interfere with cellular reception and transmission

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Radio

48

Radio Communicators

- Unlike digital communicators, internet communicators, and cellular communicators, radio communicators do NOT need to involve a third party (phone or company) for service
- Radio systems are generally maintained by the alarm company

49

Radio Frequency

- The Federal Communication Commission (FCC) has set aside radio frequencies for use in alarm communications
- Frequency allocation may be viewed at:
  *www.**fcc**.gov/oet/spectrum/table/**fcc**table.pdf*

50

Radio Frequency

- The Federal Communication Commission (FCC) limits the power of the radio communicators to two watts
- Limiting the power of the transmitter also limits the range of the radio signal
- Exceptions may be made

51

One-way Radio Communicators

- Digital Alarm Radio Transmitters (DART) communicate without receiving any acknowledgement from the Digital Alarm Radio Receiver (DARR)
- Multiple transmissions are communicated in attempt to ensure that at least one transmission is received

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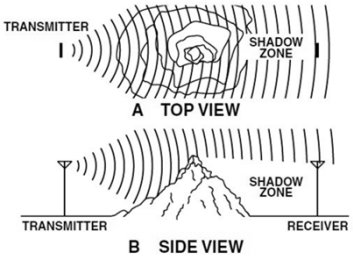
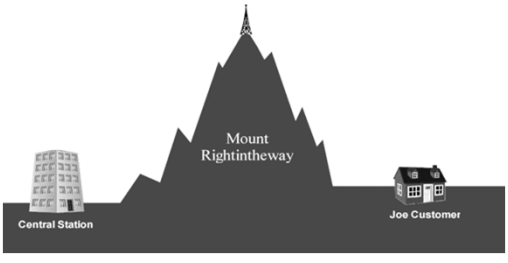
Signal Blocking



Radio signals are line of sight communicators.

53

Repeaters



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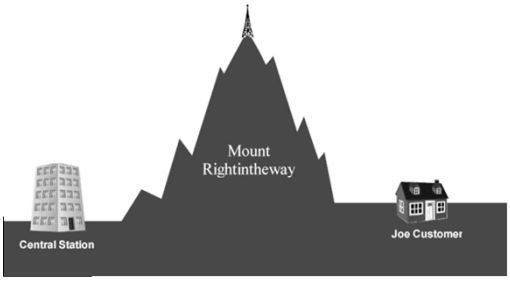
Two-way Radio Communicators

- Digital Alarm Radio Transmitters (DART) communicate and receive an acknowledgement from the Digital Alarm Radio Receiver (DARR)
- If the signal is not received, the transmitter re-transmits the signal again

55

Two-way communicator



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Transceiver

- A device capable of sending and receiving signals

Intrusion Transceiver Unit

Fire Transceiver Unit

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Two-way Radio Network

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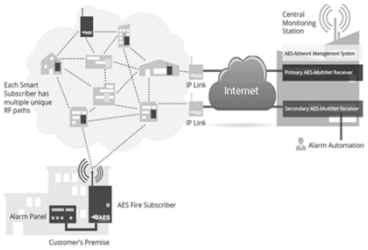
Mesh Radio Technology



Signals from a monitored alarm panel to the central alarm monitoring station may either go directly from the alarm panel to the receiver in the Central Station or it will "hop" through other subscribers along the way via one of many possible routes until it gets a confirmed delivery at the Central Station

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Radio Advantages

- Great for clients with no "home phone"
- Difficult to defeat
- Expanding radio network coverage
- Reliable
- Cost effective
- No third party service provider
- Fire communicator without backup

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Radio Disadvantages

- No third party service provider
- Limited range
- Inability to up/download panels

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Networking - IP

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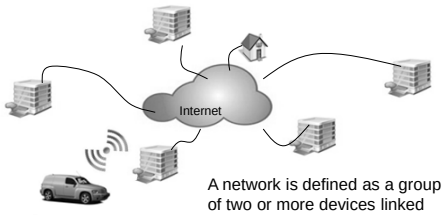
Networks



A network is defined as a group of two or more devices linked together

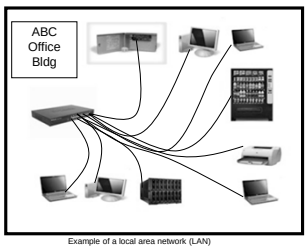
63

Types of Networks

- **Local-area networks (LANs)**
  The computers are geographically close together (that is, in the same building)
- **Wide-area networks (WANs)**
  The computers are farther apart and are connected by telephone lines or radio waves

64

Local Area Networks



Example of a local area network (LAN)

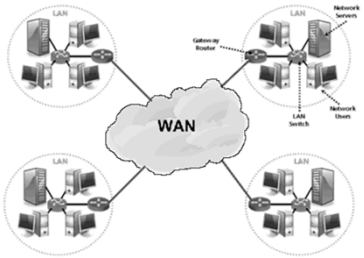
LANs typically go up to and include the router or firewall

Usually in a single building

65

Wide Area Network

- Wide area networks are used to transmit data between different LANs



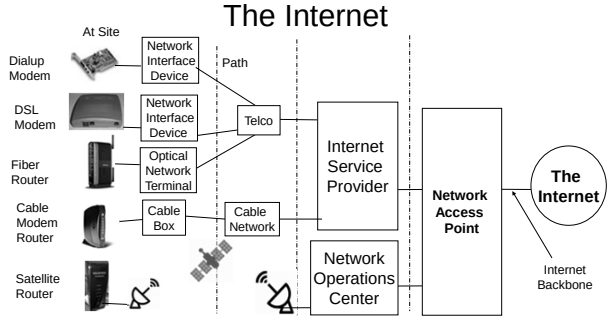
66

Internet

Global system of interconnected computer networks used to link devices

67

The Internet



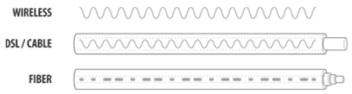
68

Last Mile Options

The "Last Mile" delivers high-speed Internet to residences and businesses
DSL, cable, and fixed wireless, fiber broadband connections bridge the "last mile" between the mainstream Internet "backbone" and customer residences

69

Options



While DSL and cable utilize existing phone and TV infrastructure to transmit data as frequency "vibrations" over copper wires, fiber networks transmit data using light over specialized cables packed with glass fibers

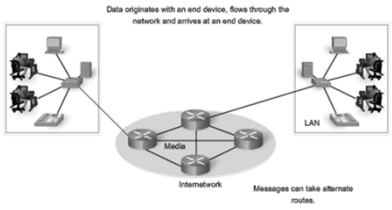
Light moves very fast (186,000 miles per second, to be specific), enabling speeds up to 1,000 Megabits (one Gigabit) per second on fiber-optic networks — almost 100 times faster than the US broadband average of 11.7 Megabit per second

70

Internet Backbone

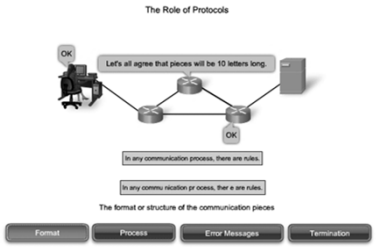
71

Routing Data



72

Role of Protocols



Source: http://www.highteck.net

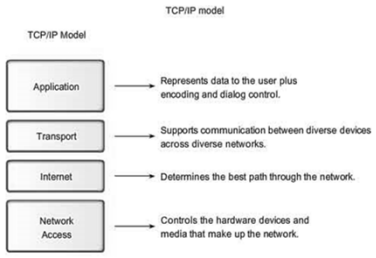
73

Internet Protocols

- Specifies how data should be packetized, addressed, transmitted, routed and received
- TCP/IP is the most widely used protocol

74

TCP/IP Layers



75

Application Layer

- The *Application layer* provides applications the ability to access the services of the other layers and defines the protocols that applications use to exchange data
- Common application layers:
  - HTTP used to transfer files that make up Web pages
  - FTP used for interactive file transfer
  - SMTP used for the transfer of email & attachments
  - POP3, IMAP – used to receive email

76

Transport Layer

- Manages the communication
- Two Types
  - *Transmission Control Protocol* (TCP)
  - *User Datagram Protocol* (UDP)

77

TCP

- TCP provides a one-to-one, connection-oriented, reliable communications service
- TCP is responsible for the establishment of a TCP connection, the sequencing and acknowledgment of packets sent, and the recovery of packets lost during transmission

78

UDP

- UDP provides a one-to-one or one-to-many, connectionless, unreliable communications service
- UDP is used when the amount of data to be transferred is small (such as the data that would fit into a single packet), when the overhead of establishing a TCP connection is not desired or when the applications or upper layer protocols provide reliable delivery

 Slide 9-79

79

Internet Layer

- Responsible for addressing, packaging, and routing functions
- Specifies the data origin & destination
- The core protocols of the Internet layer are IP, ARP, ICMP, and IGMP

 Slide 9-80

80

Internet Layer Core Protocols

- The *Internet Protocol* (IP) is a routable protocol responsible for IP addressing, routing, and the fragmentation and reassembly of packets
- The *Address Resolution Protocol* (ARP) is responsible for the resolution of the Internet layer address to the Network Interface layer address such as a hardware address

 Slide 9-81

81

Internet Layer Core Protocols

- The *Internet Control Message Protocol* (ICMP) is responsible for providing diagnostic functions and reporting errors due to the unsuccessful delivery of IP packets
- The *Internet Group Management Protocol* (IGMP) is responsible for the management of IP multicast groups

 Slide 9-82

82

Network Access

- Responsible for placing TCP/IP packets on the network medium and receiving TCP/IP packets off the network medium
- TCP/IP can be used to connect differing network types, including LANs & WANs

 Slide 9-83

83

IP Addressing

- Each TCP/IP host is identified by a unique logical *IP address* - Ex 192.168.1.x
- The IP address identifies a system's location on the network in the same way a street address identifies a house on a city block
- Just as a street address must identify a unique residence, an IP address must be globally unique and have a uniform format

 Slide 9-84

84

Each IP Address Includes

- The *network ID* (also known as a *network address*) identifies the systems that are located on the same physical network bounded by IP routers. The network ID must be unique to the internetwork
- The *host ID* (also known as a host address) identifies a workstation, server, router, or other TCP/IP host within a network. The address for each host must be unique to the network ID

 Slide 9-85

85

IPv4

- 32 bit addresses (looks like 192.168.1.1)
- Limited to 4,294,967,296 addresses
- Ran out on February 3, 2011
- Most commonly used by alarm system / receiver manufacturers
- Most will require port forwarding or NATing

 Slide 9-86

86

IPv6

- The world ran out of IPv4 addresses on February 3, 2011.
- IP Version 6 uses 128 bit addressing.
- Creates 3.4×1038 addresses.
- IPv6 addresses are represented as eight groups of four hexadecimal digits separated by colons, for example 2014:0bd8:85a3:1041:8080:8a2a:0370:7443

 Slide 9-87

87

IPv6

- Most ISPs support both IPv4 and IPv6
- Security products manufacturers typically still only support IPv4
- IPv4 and IPv6 should both be supported for many years

 Slide 9-88

88

Subnets

- Subnets define a specific number or devices on a network
- Can be used to restrict communication
- For example you might put the alarm panel on a different subnet from the office computers
- Tells device what IPs it can directly “call”
- Most common 255.255.255.0
- 255 indicates that octet must match
- Always use what IT gives you

 Slide 9-89

89

Gateway

- IP of device routes out of network
- Usually x.x.x.1 of IP scheme
- Sometimes x.x.x.254
- Always use what IT gives

 Slide 9-90

90

Domain Name Server - DNS

- It is easier to remember google.com than it is 74.125.227.65
- DNS "looks up" IP associated with a name
- Like using landmarks and store names rather than latitude and longitude when giving directions
- Alarm systems must use IP addresses, not DNS Per U.L.

91

Static or Dynamic Address

- Static
  - Address is assigned and remains until changed
- Dynamic
  - Address is assigned automatically each time the computer connects

92

Ports

- Any server machine makes its services available to the Internet using numbered **ports**, one for each service that is available on the server
- Clients connect to a service at a specific IP address and on a specific port

- Common Port Numbers
- echo 7
- daytime 13
- qotd 17 (Quote of the Day)
- ftp 21
- telnet 23
- smtp 25 (Simple Mail Transfer, meaning e-mail)
- time 37
- nameserver 53
- nicname 43 (Who Is)
- gopher 70
- finger 79
- WWW 80

93

Ports

- Imagine that you are a truck driver for Wal-Mart, hauling pineapples
- You know that the distribution center is located at 1234 Mockingbird Lane, but when you arrive, there are 65,534 overhead doors and one main entrance door
- Which door do you back your truck up to?
- You check the sign and see it door 25 is the right door

Delivery Doors
21- Hanes Underwear
23- Purina Dog Chow
25- Pineapples
80- Main Entrance

94

Ports

- Network traffic works the same way
- Each IP address has 65,535 doorways, called Ports
- Routers and/or Firewalls can route specific traffic to specific network devices based on what Port (doorway) the traffic enters the IP address through

95

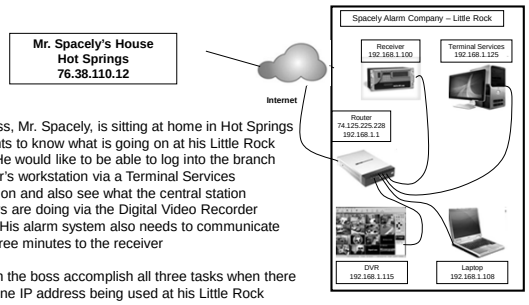
Ports

- So now, imagine that you are a DSC T-Link communicator
- You know that the Sur Gard System III receiver is located at 74.125.225.228, but when you arrive, there are four different receivers and several different servers and workstations at that entrance
- How do you get through to the receiver?
- You read the directions and see that 3020 is the default Port for the DSC T Link
- So you program your control panel to go to Port 3062

Common Ports

- 80 – the company's web-site address
- 2001 – DMP panels
  3062 – DSC panels
  5001 – Napco panels
  7070 – AES
  7700 – Bosch panels
- DVR ports are usually above 8000

96



Your boss, Mr. Spacely, is sitting at home in Hot Springs and wants to know what is going on at his Little Rock office. He would like to be able to log into the branch manager's workstation via a Terminal Services connection and also see what the central station operators are doing via the Digital Video Recorder (DVR). His alarm system also needs to communicate every three minutes to the receiver

How can the boss accomplish all three tasks when there is only one IP address being used at his Little Rock office?

97

Answer: Ports

- Mr. Spacely would access everything through IP address 74.125.225.228 but:
  - Get the branch manager's workstation through Port 3389 (Terminal Service default port).
  - Get the DVR through Port 8080 (XYZ DVR default ports).
  - His alarm panel (a DMP XR-500N) would access the DMP SCS-1R receiver use Port 2001 (DMP's default port)
- The router/firewall at the Tulsa office is configured to pass all traffic through
  - Port 3389 to IP address:192.168.1.125.
  - Port 8080 is passed to IP address: 192.168.1.115.
  - Port 2001 is passed to IP address: 192.168.1.100
- So when he logs into each IP address he can get what he needs

98

Internet Service Provider (ISP)

- Business or organization that offers users access to the Internet and related services
- Provide services such as Internet transit, domain name registration and hosting, dial-up access, leased line access and colocation
- Internet hosting services run servers, provide managed hosting, and include the Internet connection

99

DSL

- **Digital Subscriber Line** provides digital data transmission over the wires used in the "last mile" of a local telephone network
- Download speed ranges from 128 kilobits per second (Kbps) to 24,000 Kbps

100

Cable Modem

- Modulates a data signal over cable television infrastructure
- Cable modems are primarily used to deliver broadband Internet access, taking advantage of unused bandwidth on a cable television network

101

Fiber Modem

- Fiber-optics uses light instead of electricity to transmit data, the frequencies that are used are much higher and the data capacity is much greater
- Fiber-optic cable is made from glass or plastic which is not susceptible to electromagnetic interference like metal cables
- Data can flow over great distances without degrading.
- Interference and energy loss is the limiting factor for all types of communication transmissions and fiber optics handles these factors much better than other modes of transmission

102

Switches

- Traffic Control
- Unmanaged or Managed
- VLAN (Virtual Local Area Network)

103

Power Over Ethernet (PoE)

- Enables power to be provided using the same cable as that used for network connection
- 48-54 VDC
- Poe 15.4, PoE+ 25.5, Type 3 60, Type 4 100
- Verify total wattage switch can supply

104

Wireless Access Point

- 2.4gHZ or 5gHZ
- 802.11 B/G/N/AC
- Unsecured or Secured
- Point to Point

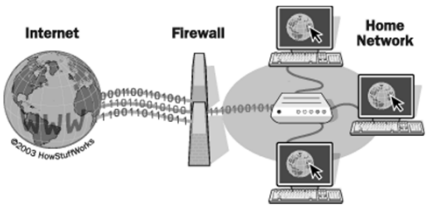
105

Router

- Controls traffic in and out of LAN
- Works with Firewall to decide

106

Firewall



- Program or hardware device that filters the information coming through the Internet connection into your private network or computer system
- If an incoming packet of information is flagged by the filters, it is not allowed through

107

Firewalls Can Block

- Specific IP Address- eg:216.27.61.137
- Specific Domain Name eg:www.tnesa.com
- Specific Protocols- eg:http, ip, smtp
- Specific Port numbers- eg: 80, 21
- Specific Words

108

Getting thru the Firewall

- Add your IP Address, Domain Name, Protocols, Port numbers or Words to the approved list
- Or Remove it from the bad list
- List may be at the firewall or on the internet or both
- Port forward- set aside one port number on the gateway to communicate

109

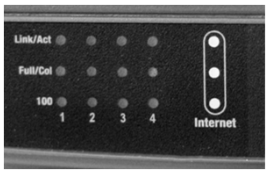
MAC Addresses & Firewalls

- A MAC address is a unique identifier of a router, modem or switch
- Network administrator can set a port to accept a connection from
  - any MAC address it sees
  - only the first MAC address it sees (any other address is refused and the connection dropped)
  - or a predetermined MAC

110

Check the lights

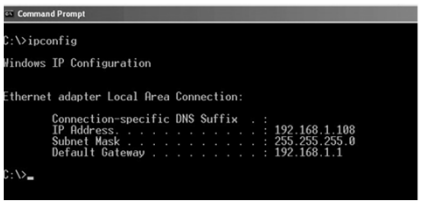
- Countless hours can be saved with a look at link lights



111

How to Find Your IP Address

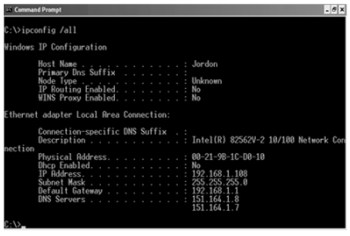
- Type ipconfig at the command prompt



112

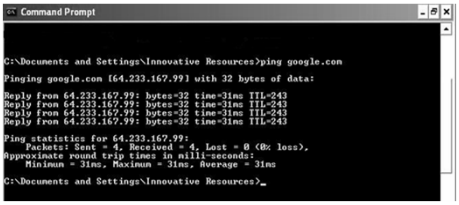
Ipconfig/all

ipconfig (internet protocol configuration) is a console application of some operating systems that displays all current TCP/IP network configuration values and can modify Dynamic Host Configuration Protocol (DHCP) and Domain Name System (DNS) settings



113

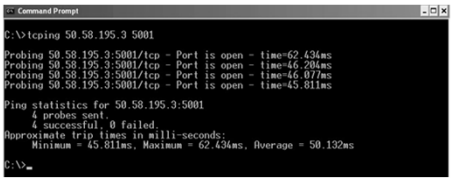
Ping



Short for Packet InterNet Groper, **ping** is a utility used to verify whether or not a **network** data packet is capable of being distributed to an address without errors. The **ping** utility is commonly used to check for **network** errors. The image is an example of what happens when a **ping** is sent

114

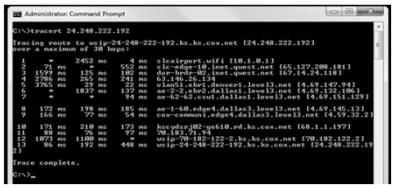
tcping



- To verify that connectivity can be made through a firewall/router, you will need to download a free program called "tcping." tcping may be downloaded here: http://www.elifulkerson.com/projects/tcping.php or http://download.cnet.com/TCPing/3000-2085_4-10770093.html

115

tracert



Another DOS (Command Prompt) command that is useful in networking is tracert, trace route

tracert will show you the path that an IP packet is taking from your location to any destination, along with the timing

116

CAT 5/6 Tester

- Verifies proper terminations
- Determines if an existing cable can support certain network speeds and technologies

117

Potential Internet Issues

- Unregulated
- No requirements for backup power
- Volume of traffic can delay or prevent data
- Multiple Service Providers involved in each communication –
  - Sender modem
  - Sender path
  - Sender ISP
  - Backbone
  - Recipient ISP
  - Recipient Path
  - Recipient Modem

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VoIP

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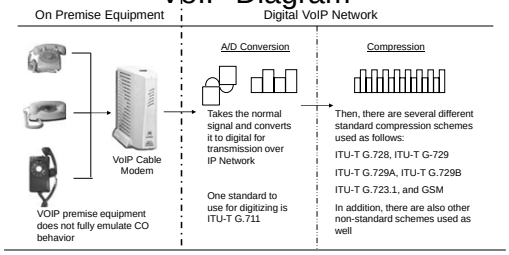
VOiP

- **Voice over Internet Protocol**, is a method for taking analog audio signals, like the kind you hear when you talk on the phone, and turning them into digital data that can be transmitted over the Internet

120

VoIP Diagram



Standards Are Not Well Established in VoIP Networks

121

ATA

- **ATA** -- The ATA (analog telephone adaptor) allows you to connect a standard phone to your computer or your Internet connection for use with VoIP
- The ATA is an analog-to-digital converter
- It takes the analog signal from your traditional phone and converts it into digital data for transmission over the Internet
- Examples: Vonage, CallVantage, magicJack

122

Softphones

- Softphones are VoIP applications. The term “softphone” is a merger of the words “software” and “telephone”
- A softphone will run on devices such as tablets, smartphones/iPhones and computers
- When you run a softphone, it will act as a VoIP telephone on your machine, thus allowing you to make calls through your computer and mobile devices
- Example: Ring, Skype, Google Hangouts

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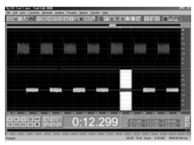
IP Phones

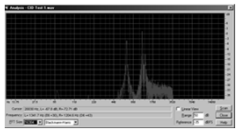
- IP phones look and function like normal phones, only with an Ethernet port that allows you to connect the phone directly to your router
- IP phones are usually on par with standard phones, and may even be of a higher quality
- Examples: Comcast, Vox, Charter, Cox

124

The Impacts of VoIP Systems



“1” Transmitted At the Panel



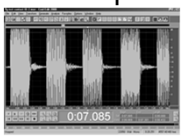
DTMF Detail Showing Proper Pairs

The screen shots above show a relatively clean Contact ID transmission. In this recording, the top grey waveform shows what was leaving the panel and the bottom waveform was taken at the receiver. The highlighted section is a transmitted digit “1”. Note that there is no signal in the space between the digits. The plot on the right is a spectrum analysis of the highlighted area. Note two clean peaks at 697 Hz. and 1209 Hz. (DTMF = Dual Tone Multi Frequency)

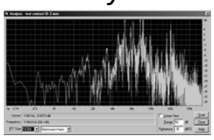
A Normal Contact-ID Transmission

125

One Specific VoIP System



Touchtone digits slightly decayed



DTMF Close up – Cannot be decoded

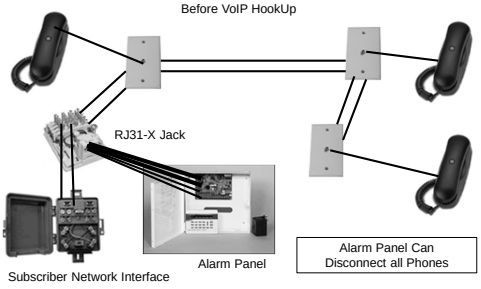
The screen shots above were from recordings of one VoIP network provider. Note the gradual decay of the tone as opposed to the clean breaks on the previous slide. This is one potential problem. On the spectrum analysis of the tone burst, note the many frequency peaks. Visible are individual DTMF component tones at 697, 852, 941, 209 and 1337 Hz.. This is very likely to confuse any DTMF decoder, not just those in an alarm panel. From listening to the recording, it is apparent that the receiver is not detecting any DTMF tones because it issues the next handshake tone in its search sequence.

A Problem For More Than Just Alarm Panels

126

Phone Wiring to Alarm System

Before VoIP HookUp

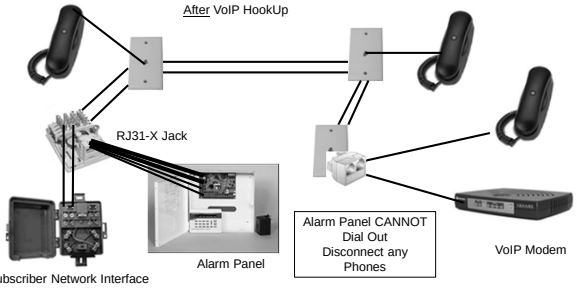


Slide 9-127

127

Phone Wiring to Alarm System

After VoIP HookUp



Slide 9-128

128

Challenges With VoIP Services Today

- Lack of standards leads to lack of reliability
  - No standards are mandated by the FCC for VoIP networks
  - Security panels that work in one network may not work in another provider's network
  - Equipment may work when tested and fail later

VoIP Service Does Not Equal POTS Line!

Slide 9-129

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Challenges With VoIP Services Today

- Lack of standards leads to Non Compliance
  - VoIP service often lacks backup power for some portions of the transmission path
  - Does not comply with current fire codes

VoIP Service Does Not Equal POTS Line!

Slide 9-130

130

Challenges With VoIP Services Today

- Lack of information and proper notice
  - Customers are inadvertently being led to believe that the VoIP service is equal to the phone company's service
  - Customers are not adequately informed of potential problems with alarm systems or other equipment
  - Rewiring by customer or vendor eliminates line seizure
  - Alarm companies are often not notified of switch until problem occur

VoIP Service Does Not Equal POTS Line!

Slide 9-131

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Notification Devices

Slide 10-1

1

Horns

- Noise -making device used to indicate an alarm or other event



Slide 10-2

2

Strobes

- A visual indicator light with very rapid, bright flashes
- Used to indicate an alarm or other event
- Lens colors may vary


Slide 10-3

3

Active Graphic Annunciator

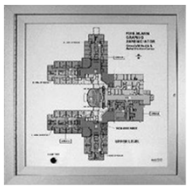
- Board or CRT screen with graphics to show alarm or sensor locations
- A visual indicator showing the location of an alarm
- Annunciators pinpoint the exact location of an alarm or problem


Slide 10-4

4

Static Graphic Annunciator

- LEDs illuminate areas of a map of the facility to show the location of an alarm or event
- Annunciators pinpoint the exact location of an alarm or problem
- With their help, the alarm subscriber can locate a faulted door or sensor at closing time. In addition, service personnel can quickly locate a system defect

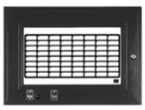


Slide 10-5

5

Tabular Annunciator

- LEDs illuminate a labeled area of a grid to show the location of an alarm
- Annunciators pinpoint the exact location of an alarm or problem
- With their help, the alarm subscriber can locate a faulted door or sensor at closing time
- In addition, service personnel can quickly locate a system defect


XL8 Tabular Annunciator

Slide 10-6

6

Siren

- An electronic device that produces a very loud, hard to ignore sound when activated
- Flush or surface mount
- Self contained or a combination of speaker and siren driver
- Continuous tone or multi-tone

7

Bell

- Electromechanical noise-making device
- A clapper is moved electromechanically to strike the bell and produce a loud ringing sound

8

Smoke Emitting Devices

- When activated it rapidly produces a dense smoke, fog or vapor that reduces visibility
- Intended to be integrated into the premises alarm system, but may be a self-contained stand-alone unit
- Should be manufactured specifically for this use and not adapted from other uses, such as entertainment
- Some models allow user programming, such as delays, resets and control of volume of emission

Check with your Fire Marshal before installing

9

Locating Audible Devices

- Audibility
- Conceal if possible
- Accessibility to unauthorized personnel
- Difficulty of installation
- Difficulty of connection to control
- Check manufacturer's recommendations

10

NFPA 72 Code Requirements

Average sound pressure

Shall Provide in every occupiable space whichever is greater

- 15 decibels (dBA) above the average ambient sound level

or

- 5 dBA above the maximum sound level having a duration of not less than 60 seconds

NFPA 72 18.4.4.1 ['19]

11

NFPA 72 Code Requirements

Maximum sound pressure

- Noise levels above 105 dBA Shall require a visual device.
  - NFPA 72 18.4.1.1 ['19]
- The maximum sound pressure level shall be 110 dBA at the minimum hearing distance from the audible appliance.
  - NFPA 72 18.4.1.2 ['19]

12

NFPA 72 Sleeping Area Requirements

- Sounders must be 15dBA above average ambient noise or 5dBA above loudest intermittent regularly occurring noise or be 75dBA at each pillow or follow above, whichever is louder
- All doors must be closed

Click to listen

NFPA 18.4.6.1 & 2 ['19]

13

Decibel Meter

- Measures sound pressure
- Useful in checking audibility requirement for fire systems
- Useful for audio/video systems

14

Sound Meter App

- A type 2 meter is required to test fire alarms
- Apps are not type 2 rated

15

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Access Control Systems

Slide 11-1

1

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Overview

Slide 11-2

2

Access Control

- A system to keep unauthorized personnel from accessing (entering) or egressing (exiting) a certain building, area, office, or other secure point
- Typically composed of a locking mechanism (mag-lock, strike, bolt) and reader (stripe, proximity, biometric) or button

Slide 11-3

3

Access Control Objectives

- Allow or deny access/egress based on possession of an certain item or physical trait.
- Track activity through a facility
- Report activity through a facility

*Access control is NOT time and attendance. Consult the Department of Labor before using access control system for time and attendance.

Slide 11-4

4

Access Control Readers

- Reads and decodes information to be processed by the access control system

Proximity | Fingerprint | Palm Geometry | Retina Scan | Keypad

Slide 11-5

5

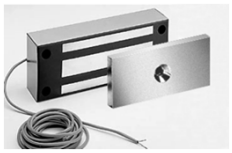
Exit (Egress) Control Devices

- Readers (for anti-pass back or traffic flow control)
- Buttons
- Motions and mats
- Door hardware

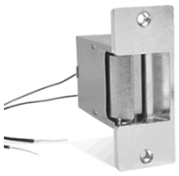
Slide 11-6

6

Locking Mechanism



Mag-lock



Door Strike

Electric Locks

7

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Codes & Standards

8

Applicable Codes

- International Building Codes
- Life Safety Code (NFPA 101)
- The American with Disabilities Act (ADA)
- National Electrical Code (NFPA 70)

9

Which Codes or Standards Apply

- Check with your local Authority Having Jurisdiction (AHJ)
- Local fire marshals office is a good place to start
- Review blueprints and plans with the AHJ **before** you install any equipment

10

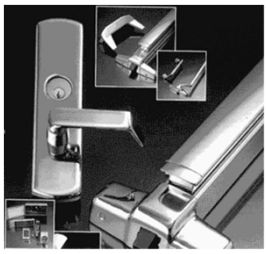
Identify Egress Requirements

- *Do **not*** prevent or delay a person's ability to exit an area
- Doors need to be opened readily from the egress (exit) side, whenever the building is occupied

11

"No Special Knowledge"

- Any person should be able to unlock a door and open it without any previous training or reading instructions



IBC 1010.1.9 ['18]

12

Sensor release of electrically locked egress doors

- Motion sensor and exit button are used to unlock the door from the egress side

IBC 1010.1.9.9 ['18]

13

Sensor release of electrically locked egress doors

- If you electronically lock & unlock the door, you shall meet all of the following criteria:
  - have a sensor that detects an occupant as they approach from the egress side of the door
  - the lock shall unlock upon loss of power to the sensor
  - doors unlock on loss of power to the lock or locking system

Continued on next slide

IBC 1010.1.9.9 ['18]

14

Sensor release of electrically locked egress doors

- a manual release device
  - located 40 to 48 inches above the finished floor
  - within 5 feet of the exit door.
  - identified with a sign that reads “PUSH TO EXIT”.
  - that directly interrupts the power to the lock — independent of the access control system electronics
  - the electric lock shall remain unlocked for not less than 30 seconds

IBC 1010.1.9.9 ['18]

Continued on next slide

15

Sensor release of electrically locked egress doors

- doors unlock on activation of the building automatic sprinkler system or fire detection system

  * doors SHALL remain unlocked until the fire detection system and the automatic suppression systems have been reset

- the door locking system units shall be listed in accordance with UL 294.

IBC 1010.1.9.9 ['18]

16

Door hardware release of electrically locked egress doors

- Door hardware is used to unlock the door from the egress side

IBC 1010.1.9.10 ['18]

17

Door hardware release of electrically locked egress doors

Door hardware release of electric locking systems shall be permitted on doors in the means of egress in any occupancy except Group H where installed and operated in accordance with all of the following:

- The door hardware that is affixed to the door leaf has an obvious method of operation that is readily operated under all lighting conditions.
- The door hardware is capable of being operated with one hand

IBC 1010.1.9.10 ['18]

18

Door hardware release of electrically locked egress doors

- –Operation of the door hardware directly interrupts the power to the electric lock and unlocks the door immediately.
- –Loss of power to the electric locking system automatically unlocks the door.
- –Where panic or fire exit hardware is required by Section 1010.1.10, operation of the panic or fire exit hardware also releases the electric lock.
- –The locking system units shall be listed in accordance with UL 294.

IBC 1010.1.9.10 ['18]

19

Power Failure

- Door must unlock if power is lost to the exit sensor
- Loss of power to the part of the system that controls the door should unlock the door

IBC 1010.1.9.9 ['18]

20

Restricted Egress From The Stair Side In The Event Of A Fire

- The IBC and the LSC differ on how you can lock and unlock stairwell doors.
- In todays world there are other items you must consider:
  - Active Shooter
  - Man made incidents (intentional or unintentional)
  - Natural Disasters
  - 1st Responder Entry
- Check with the fire marshal or building inspector before you finalize it

IBC 1010.1.9.12 ['18] & NFPA 101 7.2.1.5.8 ['18']

21

Fire Rating of a Door

- Doors rated by ability to withstand & prevent fire spread
- Door rating covers the door, the door frame & all hardware on the door or the frame
- Drilling holes in the door (even if they do not go through to the other side) can affect the rating

22

Delayed Egress Systems

23

Delayed Egress Permitted

- Permitted in Following occupancies with approved sprinkler systems or fire alarm system:
  - Group B, F, I, M, R, S and U occupancies
  - Group E classrooms with an occupant load of less than 50.

* Shall not be put on the main exit or exit access door

IBC 1010.1.9.8 ['18]

24

Delayed Egress Requirements

- Shall deactivate upon actuation of the automatic sprinkler or fire detection system
- Shall deactivate upon loss of power controlling the lock or lock mechanism, allowing immediate free egress
- Shall have the capability of being deactivated at the fire command center & other approved locations

IBC 1010.1.9.8 ['18]

25

Delayed Egress Requirements

- A physical effort to exit applied to the egress side door hardware for not more than 3 seconds shall initiate an irreversible process that shall allow such egress in not more than 15 seconds (30 seconds where approved)
- Initiation of the irreversible process shall activate an audible signal in the vicinity of the door
- Once the delay electronics have been deactivated, rearming the delay electronics shall be by manual means only

IBC 1010.1.9.8 ['18]

26

Delayed Egress Requirements

- The egress path from any point shall not pass through more than one delayed egress locking system
- Exceptions:
  - In Group I-2 or I-3 occupancies, the egress path from any point in the building shall pass through not more than two delayed egress locking systems provided that the combined delay does not exceed 30 seconds
  - In Group I-1 or I-4 occupancies, the egress path from any point in the building shall pass through not more than two delayed egress locking systems provided the combined delay does not exceed 30 seconds and the building is equipped throughout with an automatic sprinkler system

IBC 1010.1.9.8 ['18]

27

Delayed Egress Requirements

- A sign shall be provided on the door and shall be located above & within 12 inches of the door exit hardware:
  - For doors that swing in the direction of egress, the sign shall read: PUSH UNTIL ALARM SOUNDS. DOOR CAN BE OPENED IN 15 [30] SECONDS
  - For doors that swing in the opposite direction of egress, the sign shall read: PULL UNTIL ALARM SOUNDS. DOOR CAN BE OPENED IN 15 [30] SECONDS
  - Exception: Where approved, in Group I occupancies, the installation of a sign is not required where care recipients who because of clinical needs require restraint or containment as part of the function of the treatment area

IBC 1010.1.9.8 ['18]

28

Delayed Egress Requirements

- Emergency lighting shall be provided on the egress side of the door
- The delayed egress locking system units shall be listed in accordance with UL 294

IBC 1010.1.9.8 ['18]

29

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Credentials

30

Types

- Traditional
  - –Magnetic stripe
  - –Wiegand strips
  - –Barium ferrite
  - –Barcode Cards
  - –Hollerith Cards
  - –Infrared
  - –Optical
- Contactless
  - –Proximity
  - –Contactless smart cards
- Biometrics

31

Style

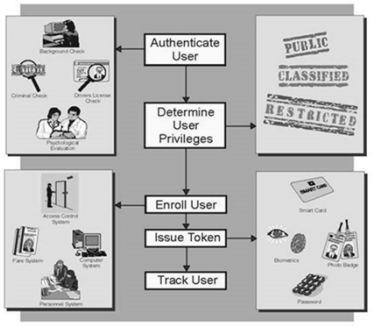
Card

Key

Fob

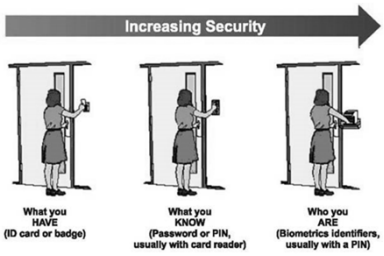
32

Credential Steps



33

Credential Security



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Readers & Keypads

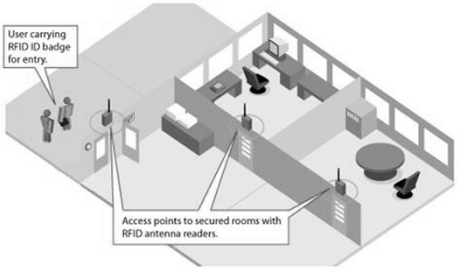
35

Reader Styles

- **Swipe** readers require the user to drag a credential along a path at certain speed within a slot or guide
- **Insertion** readers require the user to insert a credential into a slot at a particular speed
- **Contactless or Proximity** readers scan the credential from a distance and no physical contact between the credential and the reader is required

36

RFID Systems



37

Keypad Operation

- Can be used in conjunction with a credential or standalone
- Generally a four to ten digit number is used for a keypad combination

38

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Locks & Barriers

39

Types

Locks
- Electric Strikes
- Electric Bolts
- Magnetic Locks
- Electromechanical Locks
- Vertical Exit Rods

Barriers
- Parking Gates
- Over head doors
- Turnstiles
- Elevator control

40

Fail Safe

- **A failure will cause a safe or open condition**
  - Allows immediate egress even if the power has failed
  - To remain locked, electric power must be applied constantly
  - Lock will release and remain unlocked when power is removed

41

Fail Secure

- **A failure will cause a secure or closed condition.**
  - Lock does not require electric power to remain locked
  - Lock is unlocked or released when power is sent to the lock
  - Safety disadvantage to a fail secure lock is that without a mechanical override feature, there is no way to release the lock in a power outage

42

Fail Secure

- Most electric strike applications call for fail-secure operation
- A fail secure electric strike stays locked from the outside coming in, even without power
- For egress, a doorknob or lever on the lock allows for safe or “free” exit
- Backup power may be required in either type of operation

43

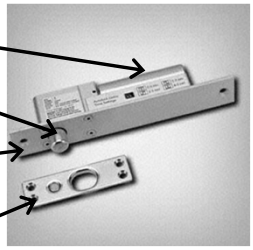
Electric Strikes

- Provide remote release of a locked door
- Allow the door to be pulled or pushed open without retracting the latch bolt
- This occurs by the releasing of the electric strike lip (sometimes called a keeper or gate)
- When the door closes the latch bolt rides over the lip and falls into the strike pocket

44

Electric Bolts

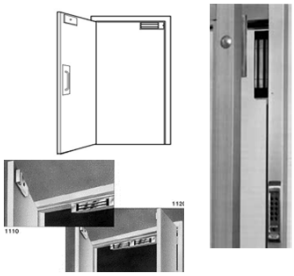
- Solenoid
- Bolt assembly
- Lock front or housing
- Mating strike plate or block



45

Electromagnetic Locks

- Electromagnet is normally mounted on the door frame
- Strike plate or armature is mounted on the door



46

Electromechanical Locks

- Standard locks modified so that they can be controlled with electricity, in addition to being controlled with knobs or levers

47

Barrier Gate or Arm

- Motorized unit which raises a wooden or fiberglass gate arm from a horizontal position to a vertical position to allow the passage of a vehicle
- Gate arms allow pedestrian traffic and can be raised and lowered very quickly

48

Swinging or Sliding Gate

Swing To Each Side

Slide To One Side

Tilt Up

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49

Turnstiles

- Can be used in high traffic areas to restrict entry to a single person at a time
- Usually observed by a guard or attendant who can deal with anyone attempting to piggyback

Standard

Optical

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Exit Devices

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Exit Buttons

- Buttons that make or break the power when pressed

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52

Exit Sensors

- Sensors used for sensing when someone approaches a door to unlock the door at the proper time

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53

Exit Bars

- ***Mechanical exit bars*** use a switch that is depressed when the bar is pushed to break or make a circuit to unlock a door
- **Electronic exit bars** use the changes your body makes in a capacitance field to release an electronic or magnetic lock or strike
- **Optical exit bar** uses two directionally opposed infrared detection circuits to sense an exit request. As a person touches the bar the light beam is broken

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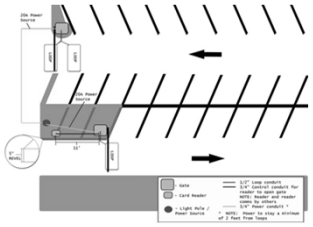
Vehicle Loop Detectors

- Use a coil of wire buried in the driveway which is connected to an inductive loop detector



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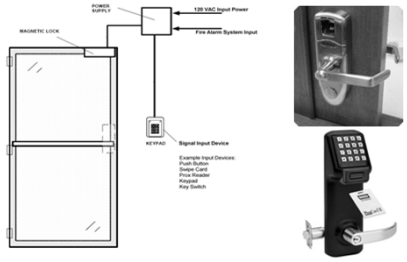
Controller & Software

56

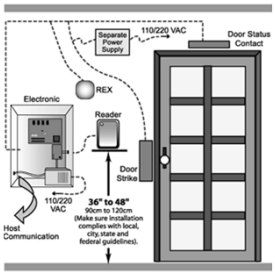
Single Door Self Contained



57

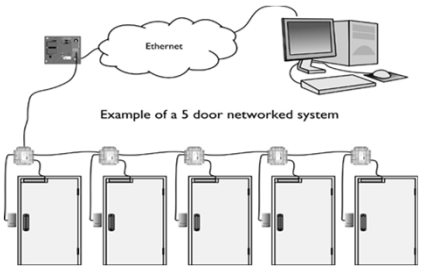
Controller with Readers

- One to 4 Door Controller with Readers



58

Multi-door



59

Type Of Power Supply

- Locks need
  - –12 Volt - AC
  - –12 Volt - DC
  - –24 Volt - AC
  - –24 Volt - DC
- 24 volt Advantage
  - –Less current required to operate a 24 volt lock than a 12 volt model
- 12 Volt Advantage
  - –12 volt batteries are more readily available

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Video Surveillance Systems

1

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Overview

2

Cameras

- AKA - Closed Circuit Television Systems (CCTV).
- Systems composing:
  - television camera
  - video monitor
  - transmission medium (Cable, fiber or wireless) connecting the two

3

CCTV Camera Objectives

- Monitor the premises.
- Record Activity
- Deter crime
- Alter behavior
- To NOT alter behavior (covert)

4

Common Uses

- CCTV can be found in many places, including airports, casinos, banks, and the streets
- Cameras can be placed in inconspicuous or obvious places

5

Camera Types

- Black and white
- Color
- Dome
- Pan / Tilt / Zoom
- Bullet
- Vandal Proof
- High Definition (mega-pixel) or NTSC

6

Transmission Methods

Connecting the cameras to the recorder

- Coax (RG59U, RG6U, or RJ11U)
- IP based (Cat5e or Cat6)
- Baluns (video over UTP – unshielded twisted pair)
- Fiber Optics
- Wireless

7

Recorders

Video Cassette Recorder (VCR)

Digital Video Recorder (DVR)

- PC Based (Windows operating system)
- Imbedded (typically Linux)

Network Video Recorder

8

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Law & Standards

9

Guidelines On Video Surveillance

- Covert video surveillance is illegal when:
  - –The subject has a reasonable expectation of privacy (4th Amendment rights) i.e. in a bathroom; motel room; changing room
  - –If audio eavesdropping is also taking place

10

Guidelines On Video Surveillance

- Covert surveillance may be illegal when:
  - –The person with authority over the premises has not consented
  - –The reason for the video surveillance fosters an illegal purpose

11

Law on Taping

- Mechanical or electronic interception of audio is unlawful without a party to the conversation's consent
- This is Federal Law and most states have similar statutes. Video taping is another matter
- There is no Federal Law that prohibits video recording
- Video taping legislation is likely to pop up in most jurisdictions and you should watch for it
  - – http://www.kirschenbaumesq.com/articles.htm

12

United States Codes, Title 18, Section 2510

- "Oral communication means any 'oral communication' uttered by a person exhibiting an expectation that such communication is not subject to interception under circumstances justifying such expectation"

13

Avoid Smoke Detector Cameras

- "A smoke detector has one purpose and that is to protect people against fires, Keeping non-working fire detectors with hidden cameras off the market protects the public from a false sense of security and a very real invasion of their privacy." NY Attorney General
- The Fire Code provides that items such as these non-working smoke detector cameras pose a fire safety danger because they present the public with a false sense of safety. Henrietta NY Fire Marshal

14

DORI Standard

15

DORI Standard

Developed by the British Security Industry Association

- **Detect -**To enable the operator to reliably and easily determine whether or not any target (e.g. a person or vehicle) is present.
- **Observe** - To enable characteristic details of an individual, such as distinctive clothing to be seen, whilst allowing a view of activity surrounding an incident

16

DORI Standard

- **Recognize** - To enable the operator to determine with a high degree of certainty whether or not an individual shown is the same as someone they have seen before
- **Identify** - To enable identification of an individual beyond reasonable doubt.

17

What Will Cameras See?

18

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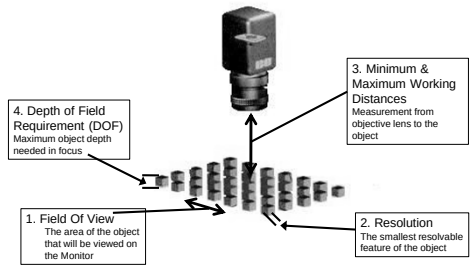
Camera & Lens

19

Cameras and Lenses



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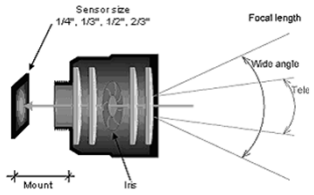
Lens

- Collects the light from the scene and forms an image of the scene on the light sensitive area of the camera



21

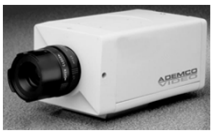
Camera

- Converts the visible scene formed by the lens into an electrical signal suitable for transmission

22

Box Camera

- Mounted to a wall or any vertical area



23

Infrared Camera

- Uses infrared light instead of the regular lighting spectrum in order to produce better images in complete darkness or low light conditions

24

Bullet Cameras

- Most bullet cameras are weatherproof and sealed without the ability to use different lenses
- Small size and integrated design
- Some bullet cameras have infrared LEDs built-in

25

Dome Camera

- Domes cannot be easily manipulated or vandalized
- Direction the camera is pointing is hidden

26

Board Cameras

- Basically fixed lens mounted on a circuit board
- May be packaged in a small case (Mini Cameras) or dome (Mini Dome) or simply sold unpackaged

27

Concealed Cameras

Use of cameras that look like smoke detectors may violate fire codes

28

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Mounts & Hardware

29

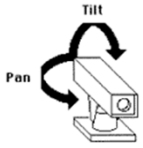
Mounting Hardware

- Rated for
  - –Indoor – Outdoor
  - –Weight
  - –Explosion proof

30

Pan Tilt

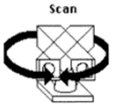
- Pan - (Scan left and right)
- Tilt - (Look up and down)



31

Scanner

- Pan or Scan left and right
- No remote control moves automatically form side to side
- Up and down direction is set manually



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Dome

- Plexiglas hemisphere
- Tinted Dome may prevent subjects from seeing which direction a camera is pointing

33

Indoor Housings

Standard

Flush Ceiling

Corner

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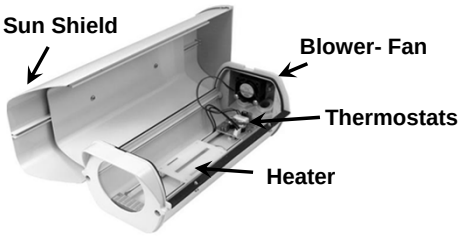
Outdoor Housings



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Monitors, Controls & Transmission

36

Monitors

- Displays the image from the camera by converting the electrical video signal into a visible signal on the monitor screen

37

Distribution Amplifiers

- Takes the single video signal and reproduces the exact signal into multiple outputs

Back of Amp

38

Switchers

- Selects Cameras manually or automatically to display their images on single or multiple monitors, recording equipment or a printer

39

Video Multiplexers

- Takes multiple camera signals and combines them onto one channel so you can record them on a recording system of your choice (i.e. VCR, DVR, DVR software, etc.)

40

Internet Connection

- Allows viewing and perhaps control at a remote location

On a computer

On a mobile computer or phone

41

Recording Solutions

- VCR
- DVR
- PC Based
- Networked

42

Recording Periods

24-hour Records in real time	
Time-lapse Skips frames to reduce storage	
Event Records based on an event	

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43

Compression

- Information is captured at the source and is encoded (compressed) by an encoder
- The compressed data can then be transmitted across a network or telecommunications link and decoded (decompressed) by a decoder
- The decoded information can then be displayed
- The encoder/decoder, or “codec” can be software, hardware, or both

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44

Transmission Link

- Carries the electrical video signal from the camera to the remote monitor
  - –Coaxial Cable
  - –Unshielded Twisted Pair- UTP
  - –Fiber optics
  - –RF
  - –Microwave
  - –Infrared
  - –IP

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45

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Cable & Connections

Slide 13-1

1

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Grounding

Slide 13-2

2

Grounding is Required

- Electrodes permitted for grounding
  - Metal underground water pipe
  - Metal frame of building or structure
  - Rod & pipe electrodes –Iron or steel- 8ft length 5/8 in diameter
- Need 6 ft of Space from any other electrode
- Install bonding jumper between electrodes

Slide 13-3

3

Unify Grounds

- When you ground multiple components, it is critical that all components are connected to the same grounding system
- Using different grounding systems will create secondary current paths or ground loops that can degrade performance and cause damage to the components

Slide 13-4

4

Grounding Properly

- Ground wire from control to ground must be at least 14 AWG wire
- If run outdoor, ground wire must be 6 AWG wire OR be protected
- If protection is conductive, ground protection must also be grounded

Slide 13-5

5

Examples of ground clamps

Slide 13-6

6

Manufacturer's Grounding

- Check the manufacturer's instructions for any special grounding and protection requirements

7

Transformer With Ground

- Using a transformer with a connection to ground is one way to safely connect to ground

8

Test For Proper Ground

- Measure resistance of your selected ground compared to a known good ground
- Example of a known ground- a cold water pipe or steel structure that is in direct contact with the ground
- The resistance should be less than 50 ohms

9

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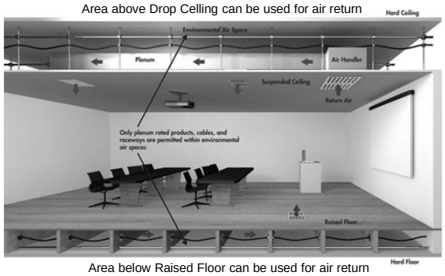
Fire Stopping

10

Plenum Spaces

Area above Drop Celling can be used for air return

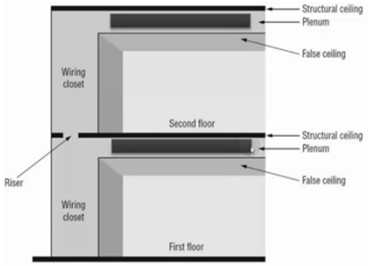


Area below Raised Floor can be used for air return

11

Need for Sealing Penetrations

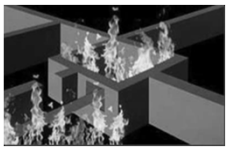
- Left unsealed Ceilings, Floor Space, Closets and Walls allow Fire and Smoke to spread



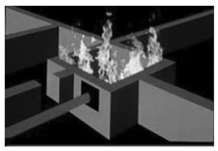
12

Need for Sealing Penetrations

- A fire stop, when properly installed, does exactly what it says
- It stops the spread or advancement of fire from one section of a structure to another



Fire spreads to next room



Fire contained in first room

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Slide 13-13

13

Firestop Violations

- Firestop Violations are the most common error found by building inspectors

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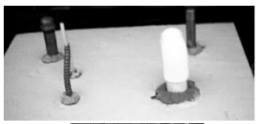
Slide 13-14

14

Seal The Floors & Ceilings

- If you make a hole you break the fire stop
- Seal it with an approved sealant



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Slide 13-15

15

Seal The Walls

- A fire stop, when properly installed, does exactly what it says
- It stops the spread or advancement of fire from one section of a structure to another

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Slide 13-16

16

Seal the Riser

- Make sure to seal holes that go between floors as well

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Slide 13-17

17

Use the Right Cable

- Plenum rated cable is required in Plenum
  - Because ordinary cable introduces a toxic hazard in the event of fire, special plenum cabling is required in plenum areas
  - In the event of fire, its outer material is more resistant to flames and, when burning, produces less smoke than ordinary cabling
- Plenum or Riser rated cable is required in a Riser

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Slide 13-18

18

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Connecting Wire

19

Splicing

- Splicing is a critical part of the job
- Proper connection of wiring avoids service calls and false alarms
- Use
  - Solder and tape
  - Solder and crimp
  - Crimp with proper connector & tools
  - Terminal or barrier strips or punch blocks

20

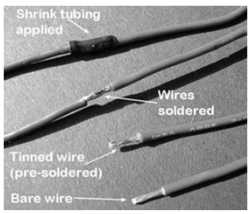
Splices & Connections

- Solid Connections are Critical
  - Punch down blocks
  - Terminal strips
  - Crimp type solderless connections
  - Wirenuts
  - Soldering

21

Connections

- Wire splices should be twisted, hot soldered and covered with electrical tape or secured with solderless crimp connectors crimped with the appropriate tool



22

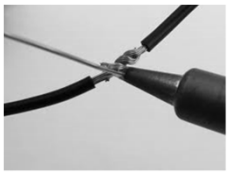
Soldering/Desoldering Techniques

- Only use rosin core solder
- Keep the tip of the soldering iron or gun clean and tinned
- Clean the parts to be soldered

23

Soldering/Desoldering Techniques

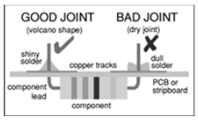
- Start with a strong mechanical joint
- Use a properly sized soldering iron or gun
- Heat the parts to be soldered, not the solder



24

Soldering/Desoldering Techniques

- Use only enough solder to fill all voids
- Keep everything absolutely still for the few seconds
- A good solder connection will be quite shiny - not dull gray or granular



25

Match the Connector

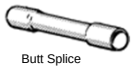
- Match connectors to wire type
- Check to make sure the connector is rated for the environment and use
- Make sure it can handle the voltage and amperage
- Read the directions
- Use a Crimp tool as specified

26

Crimp Type

B Connectors

Spade lugs



Butt Splice

Crimp Connector

Quick Disconnect

27

Crimp Connectors

- Use a proper tool to provide even compression on all sides of crimp connectors

28

Terminal Strips

Barrier Strip

Terminal Strip

29

Twist on or Push type

Wire Nut

Push In Connector

30

Rack, Patch Panel & Connection Box

- Consider Patch panels


M Block Mount


M or 66 Block


66 Block Clip


110 Block with legs

31

Backboard Installation

- Pre designed back boards may save time


Backboard for M Blocks

32

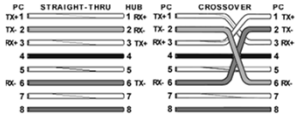
Connection Tools

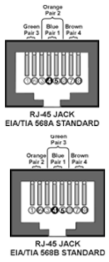
- Discard worn blades on punch tools
- Insulate metal blades when working on live lines
- Let the tool do the work do not use excess pressure

33

RJ45 Connectors

- Follow the specifications for your use
- Use a crimp tool

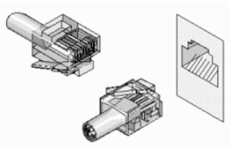




34

RJ45 Connectors

- Make sure connectors are plugged in all the way
- Little locking tab on top is prone to snapping off, which leaves a connector without a reliable means of attachment to its jack



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Fastening & Protecting Wire

36

Running Wires

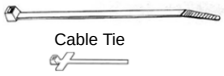
- Raceways, cable assemblies, boxes, cabinets and fittings shall be securely fastened in place
- Cables and raceways shall not be supported by ceiling grids
- Raceways shall be used only as a means of support for other raceways, cables, or nonelectric equipment if identified as such or contain/support Class 2 wiring

Slide 13-37

37

Fastening Wire

- Options to Fasten Wire


Cable Tie


Nylon Cable Clips

Cable tie with Label


Cable Tie With Screw Mount

Slide 13-38

38

Cable Fasteners

- Avoid cable fasteners
  - With sharp edges
  - That might crimp the cable



Good


Can be Bad

Slide 13-39

39

Routing cable and wire

- Keep your wiring neat


D rings


Structured Cabling Enclosure

Slide 13-40

40

Connection & Mounting Boxes

Mounting Boxes are available to help you mount the device and conceal holes made to route wiring

Slide 13-41

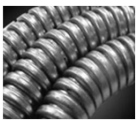
41

Protecting Wiring

Exposed surface wiring can be protected with:


Wiremold


Conduit


Greenfield

Slide 13-42

42

Conduit



- Metal conduit such as Electrical Metallic Tubing (EMT) or Galvanized Rigid Conduit (GRC) can be bent to the angle you need
- Practice on scrap conduit

43

Conduit Bends

- NEC allows no more than 360 degrees of bend in any one cable run (between pull boxes or terminations)
- More bends makes it harder to pull the wire thru

44

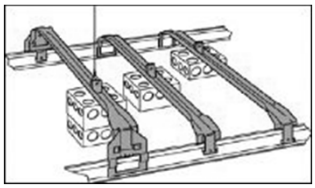
Rough in Device Component Locations

- Pull wire into any mounting or connection boxes whenever possible
- Use bushings to protect cable when pulling through sharp knockouts
- Leave enough slack for the connection and a service loop
- Clearly mark un-terminated cable to avoid damage by other trades

45

Mounting Boxes, Running Wire, Etc.

- Boxes and cables must be independently supported
- Check with AHJ on requirements when mounting to acoustical ceiling tiles



46

NFPA 731- Wiring Standards

- A conductor shall be spliced or joined with a mechanical splicing device listed for this purpose
- Unless specifically allowed by the manufacturer's wiring specifications, low voltage electronic premises security system wiring shall be spaced at least 2 in. from conductors of any light and power circuits, unless one of the circuits is in raceway listed for the purpose
- Wires and cables shall not be placed in such a manner as to prevent access to equipment
- Conductors under a single terminal shall be of the same gauge and composition

47

Wiring Methods

- Shall not strap, tape or attach to another conduit or raceway for support (must be independently supported)


48

Wiring Methods

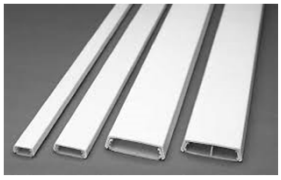
- Separate by barrier from other classes
- Associated system wiring permitted with 1/4” minimum spacing between high voltage and low voltage conductors within the same enclosure
- From different class from other systems 2” minimum spacing between high voltage and low voltage conductors

NFPA 70 725.136 ['20]

49

Protect Wiring

- Wiring for fire systems shall be protected within 7’ of the floor
- This is a good idea for other wiring as well



50

Metal Protective Plates

Used to protect wiring

51

Don’t Share Holes, Conduits, Boxes

- High voltage conductors and low voltage conductors may not be run in the same conduits or boxes
- This and the 2” rule means no more running alarm wiring through the holes drilled and used by the electrician (remember induction)

52

Abandoned Cable

Article 800.2 Definitions

- Installed communications cable that is not terminated at both ends at a connector or other equipment and not identified for future use with a tag

800.52 Installation of Communications Wires, Cables, and Equipment

- (B) Spread of Fire or Products of Combustion ...The accessible portion of abandoned communications cables shall not be permitted to remain

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Abandon Cable Exception

Non-Fire-Rated-Ceilings. For installations in the cavity of an existing non-fire-rated ceiling assembly, cables less than 0.25 in diameter shall be permitted to be installed unsupported from the building structure in accordance with the following:

- a. Fixed or Hard Ceilings. In areas having fixed or hard ceilings with access points or access panels, a combined total of three cables from Article 640, 650, 725, 760, 770, 800, 820 and 830, shall be permitted to be placed between access points or access panels in the ceiling. Additional cables shall be in accordance with 300.11.
- b. Suspended Lay-In Ceilings. In areas having suspended lay-in ceilings, in any 10 ft x 10 ft ceiling area, a combined total of three cables from Article 640, 650, 725, 760, 770, 800, 820 and 830, shall be permitted to be installed directly on the ceiling grid. Additional cables shall be installed in accordance with 300.11 FPN. Cables of all types are included in the total limit of three cables, not three cables from each article."

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Fasteners

55

Match the Fastener

- Remember to use a fastener to match the surface you are mounting to

56

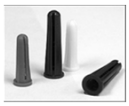
Proper Fasteners

Hex Bolt
Eye Bolt
Flat Washer
Finish Washer
Lock Washer
Drywall Screw
Machine Screw
Wood Screw
Self Drilling Screw

57

Solid Material Anchors

Plastic Expansion Anchors



Ribbed Expansion Anchors

Leadwood Screw Anchor

Concrete Drop-In Anchors

58

Hollow Wall Anchors

Winged Plastic Anchors

Molly Bolts aka Sleeve Anchors

Threaded Drywall Anchors

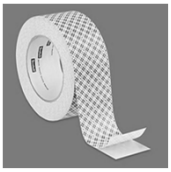
Threaded Drywall Toggles

Toggle Bolts

59

Double Stick Tape

- Make sure the surface of the device and the mounting surface are clean
- Use denatured alcohol to clean the surface
- Make sure the tape will support the weight of the device
- May seem ok – but sag over time



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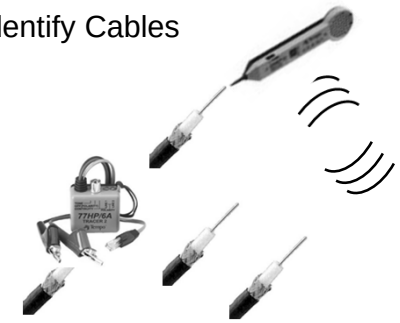
Identify & Label Cables

Slide 13-61

61

Identify Cables

- Use a tone generator and inductive probe to identify cables



Slide 13-62

62

Label Tag Wire /Cable

- Permanent "Sharpie®" marker to write on the cable
- Preprinted numbers or letters
- Custom labeling system

Slide 13-63

63

Label Tag Wire /Cable

- Use wire markers
- Record wiring runs on a floor plan
- Record wiring runs on a wire chart

Slide 13-64

64

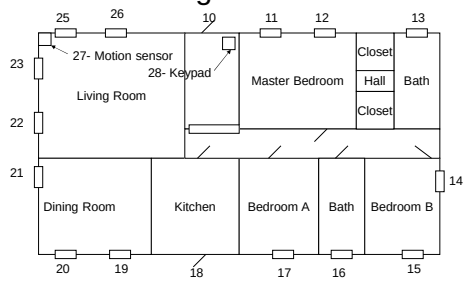
Record Wiring On A Wire Chart

- Mark each wire with a number or letter
- List the number and a description of the wires location and use
- Include a description of any splices
- Record wiring runs on a floor plan

Slide 13-65

65

Mark Wiring on a Floor Plan



Slide 13-66

66

Mark Cable For Construction

- Mark cable on construction sites in several locations
- Wiring may be cut by other trades
- Consider mounting plywood on your own at your control location to avoid problems with other trades
- Protect cable labels that may be painted over

 Slide 13-67

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Cable

 Slide 13-68

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N.F.P.A. 70- NEC

The National Electrical Code

Significant Sections

- Article 110 – (Requirements for Electrical installations
- Article 250- (grounding)
- Article 300- (plenums and raceways)
- Article 725- (control circuits)
- Article 800- (communications)

 Slide 13-69

69

Wire Categories

Category	Maximum data rate	Usual application
CAT 1 (de facto name, never a standard)	Up to 1 Mbps (1MHz)	Analog voice (POTS) Transformers, Doorbell wiring
CAT 2(de facto name, never a standard)	4 Mbps	Used in the IBM cabling system for Token Ring networks
CAT 3	16 Mbps	Voice (analog most popular implementation) 10BASE-T Ethernet
CAT 4	20 Mbps	Used in 16 Mbps Token Ring, otherwise not used much. Was only a standard briefly and never widely installed.

 Slide 13-70

70

Wire Categories

Category	Maximum data rate	Usual application
CAT 5	100 MHz	100 Mbps TPDDI 155 Mbps ATM No longer supported; replaced by 5E. 10/100BASE-T 4/16MBps Token Ring Analog Voice
CAT 5E	100 MHz	100 Mbps TPDDI 155 Mbps ATM Gigabit Ethernet Offers better near-end crosstalk than CAT 5
CAT 6	Up to 250 MHz	Minimum cabling for data centers in TIA-942. Quickly replacing category 5e.

 Slide 13-71

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Wire Categories

Category	Maximum data rate	Usual application
CAT 6E	MHz (field-tested to 500 MHz)	Support for 10 Gigabit Ethernet (10GBASE-T) May be either shielded (STP, ScTP, S/FTP) or unshielded (UTP) This standard published in Feb. 2008. Minimum for Data Centers in ISO data center standard.
CAT 7 (ISO Class F)	600 MHz 1.2 GHz in pairs with Siemon connector	Full-motion video - Teleradiology Government and manufacturing environments Fully Shielded (S/FTP) system using non-RJ45 connectors but backwards compatible with hybrid cords. Supports 10GBASE-T for a full 100m.

 Slide 13-72

72

Wire Types

- Wire varies by
  - Conductor size (AWG)
  - Type of insulation or jacket
  - Solid or Stranded
  - Shielded or not
  - Type of stranding to match bandwidth

73

AWG

- American Wire Gauge
  - Indicates the diameter or cross section of a conductor
  - Represents current carrying limitations due to resistance
  - Lower the number the thicker the wire

74

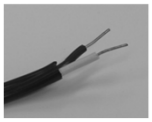
Jacketed

- An overall protective covering for two or more conductors
- Adds a second insulation layer
- Takes the abuse of installation instead of the conductor insulation
- Helps prevent ground faults and short circuits
- Provides additional tensile strength to the cable

75

Solid vs. Stranded

- Solid indicates a single strand of a particular gauge conductor
  - More rigid / less flexibility
  - More susceptible to breakage
- Stranded indicates multiple strands composing a single conductor
  - More flexible
  - Less likely to break when nicked or bent



76

Common Sources Of Interference

CRT's,	DC-AC or DC-AC converters
Televisions	Non-interruptible power supplies
Motors	AC switching relays
Pumps	Induction heaters
AC power cables	Computer monitors
Lock power wiring	Light dimmers
Generators	Phone and other signal wiring
Ceiling Fan	Florescent Light

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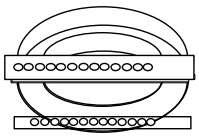
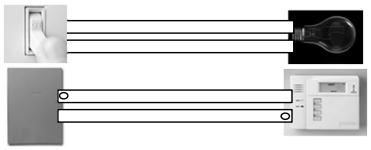
EMI- Electro Magnetic Interference

- A disturbance that interrupts, obstructs, or otherwise degrades or limits performance
- Electrical interference may be caused by power lines or electrical equipment
- Can mask data signals on cabling and telephone lines



78

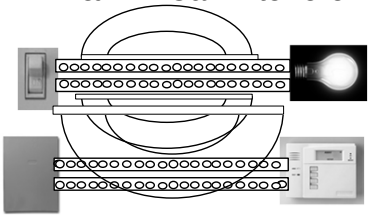
EMI & RFI Can Interfere



Keypad data gets thru when light is off

79

EMI & RFI Can Interfere



Keypad data gets blocked when light is on

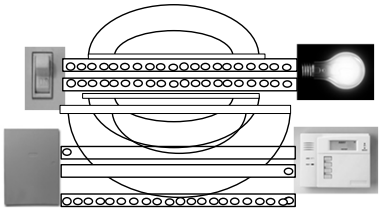
80

Shielded

- An overall metallic covering over the conductors
- More costly
- Much more immune to RFI & EMI
- Shield must be connected to a ground source to work (typically at one end only)
- A must if required by manufacturer's installation instructions

81

Shielded Cable



Interference goes to ground thru Drain Wire in Shielded Cable

Keypad data gets thru when light is on

82

Separate From Other Circuits & Equipment

- Avoid any possible sources of interference
  - Do not put data wiring in the same conduit with the AC power cables, lock power, and other signal wiring
  - Keep at least 12 inches between data wiring from all other wiring and sources of interference
  - Wiring should not be installed near elevator controls or electrical switching equipment

83

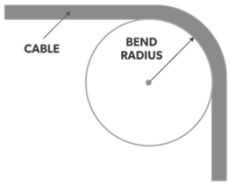
Avoid EMI

- Stay at least 3 feet away from fluorescent light boxes and other sources of electrical interference
- Stay as far away as possible from cables and wiring that may carry high-frequency signals
- Avoid high voltage cable
- Avoid areas like electrical equipment or transmitter rooms etc., where EMI interference is expected

84

Bends

- Avoid sharp bends, which affects the cable impedance causing network distortion



85

Supervision

- Connect to allow supervision of devices
- Wire in and out of each device
- No “T” taps

86

Supervision

In the Panel
IS NOT
End of Line

Put the end of line device after the last device

87

Length : Resistance

- NFPA-70, the National Electric Code provides information about the amount of resistance per 1000’ of a conductor based on its gauge size

AWG #	Ohms per 1000 ft	Ohms Per Ft
18	6.386	.0006386
22	16.20	.0162
24	25.67	.02667

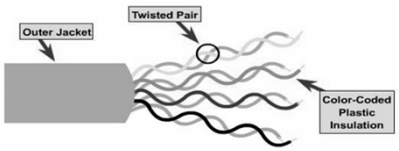
88

Resistance Adds Up

- Wire Resistance is more critical for power consuming devices
  - Main wire from transformer to control
  - Wire from control to audible devices
  - Wire from control to remote keypads
  - Ground wire
- Read the manufacturers instructions or call if not listed

89

Un Shielded Twisted Pair- UTP



- Each pair of conductors within the same jacket are twisted independently from other conductors

90

Benefits of UTP Cabling

- Better interference rejection than coax
- Greatly reduces EMI and induction
- Greatly reduces induction between pairs within the same cable
- Less expensive than dedicated coax or fiber

91

Benefits of UTP Cabling

- Unlimited bend radius
- Physically smaller than coax
- Easiest media to install and reconfigure
- Easy to terminate
- In many cases, the wire is already installed

92

Combined UTP & Coax

- Simple switching device called a balun can be used to connect coaxial lines to UTP, so you can combine both in a single system

93

UTP Wiring – Don'ts

- If UTP is specified –
  - Do not use shielded twisted pair wire
  - Don't use un-twisted wire
- Do not use phone company copper between buildings that has: dial-tone, 48 volts, loading coils, bridge-taps, switching, or long paths back to the phone company's central office and back

94

UTP Wiring – Don'ts

- Be alert to the following common failures:
  - Plugs designed for stranded wire used for solid wire
  - Plugs designed for round wire jacket used with flat wire
  - Conductors not fully seated when crimped
  - Plugs installed with a low-cost crimping tool
  - Conductors going to wrong pins, miswired

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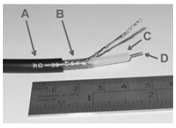
Coax

96

Coax Cable

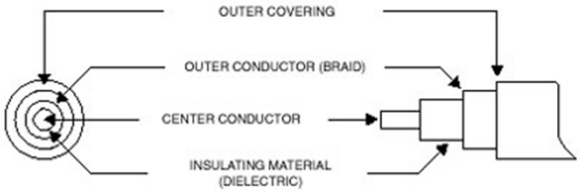
- **Coaxial cable**, or **coax** is a type of cable that has an inner conductor surrounded by a tubular insulating layer, surrounded by a tubular conducting shield



Coaxial cable composed of:
A.Outer plastic sheath
B.Woven copper shield
C.Inner dielectric insulator
D.Copper core

97

Coax Construction



98

Braid or Shield

- Acts as a second conductor or ground connection between the camera and the monitor
- Acts as a shield against unwanted external signals – EMI
- Amount of wire strands in the braid determine how much EMI it keeps out
- Use 95% copper shield- aluminum foil shielding or foil wrap material are not suitable for CCTV work

99

Impedance

- A wire specification applying primarily to coax cables
- Typically 75Ω for CCTV and LAN wiring.
- Can affect picture quality
- Can affect data reliability if incorrect

100

Select & Install Cable

- Factors that govern the selection of cable:
  - location of cable runs
    - Indoor or outdoor
    - Underground
    - Plenum or Non Plenum
  - Need for flexible cable
  - Maximum length of the individual cable runs

101

Problem With Aluminum Cable

- Used in Cable TV or Antenna Systems
- Has higher resistance
  - Seven times higher than copper
- Distorts horizontal sync pulses

102

Coaxial Connectors

- Read and follow the manufacturers directions for each type of Coax Connector
- Crimp types require a crimp tool
- Compression types require tool made for the manufacture of the compression connectors.

103

BNC Connectors

Twist **Crimp** **Compression**

104

Crimping Tools

- Use a proper tool to provide even compression on all sides of crimp connectors

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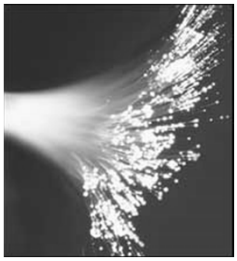
Fiber

106

Article 770

- Check for requirements for fiber optic systems



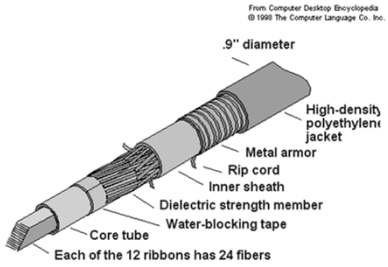
107

How Fiber-Optic Cable Works

- Light rays are transmitted in a glass strand
- Beam of light is first modulated by impressing the electronic information onto the light beam
- Light beam directed into one end of fiber-optic cable
- Modulated information travels with the light beam to the other end
- At other end is demodulated and converted back into it's original electronic form

108

Fiber Optic Cable



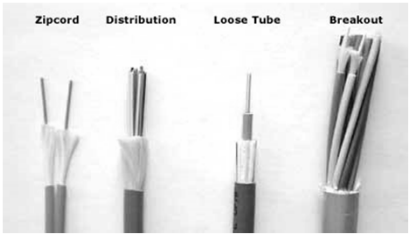
109

Types of Fiber Cabling

- Jacket varies by use
  - Plastic jacketing
  - Kevlar wraps
  - Fiberglass strength members
- Up to 144 strands of fiber under one jacket with a 1-in. diameter

110

Cable Types



111

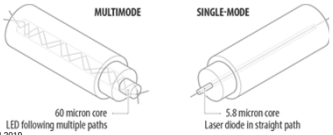
NEC Cable Types

NEC Rating	Description
OFN	Optical fiber non-conductive
OFC	Optical fiber conductive
OFNG or OFCG	General purpose
OFNR or OFCR	Riser rated cable for vertical runs
OFNP or OFCP	Plenum rated cables for use in air-handling plenums
OFN-LS	Low smoke density

112

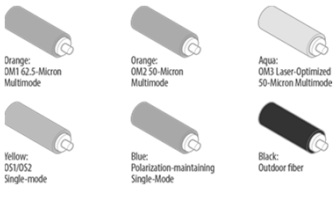
Single Mode Vs Multimode

- There are two types of optical fiber: single-mode and multimode
- Single-mode has a smaller core and carries laser diode transmissions over large distances. Multimode transmits LED light through a bigger core, where light “bounces” in multiple paths over shorter distances
- Multimode is significantly cheaper than single-mode, making it common for shorter distances within city networks



113

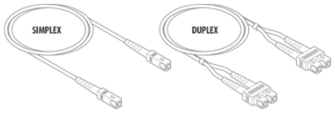
Fiber Optic Cable Color Code



114

Simplex vs Duplex

- Duplex cables include two separate fiber-optic cables connected by the outer coating, with two entry/exits on either end
- Data only flows in one direction on either cable, making them a good fit for high-traffic connections like backbone ports, fiber switches and servers



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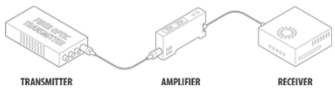
Fiber Benefits

- Distance
- Immunity to EMI and RFI
- Security of Signal
- Dark Fiber
- Large Bandwidth
- Ethernet Security Devices
- Multiple Channel or Multiplexed Signals

116

Transmitters, Receivers & Transceivers

- Transmitters that take a video signal from any camera, and convert it to signals that can be transmitted over fiber-optic cables
- Receivers that convert signals coming from a fiber optic cable to standard video output for monitors, recorders, or switching equipment
- Transceivers which can transmit video over fiber optic, while providing a 'return' path for camera control



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Optical Signal Loss

- Signal loss is expected when using fiber optics
- Stems from
  - length of fiber
  - end connectors
  - splices

118

Eye Safety

- Fiber optic sources, including test equipment, are generally too low in power to cause any eye damage
- Check connectors with a power meter before looking into it
- Some systems have very high power and they could be harmful, so better safe than sorry

119

Beware of Glass

- Dispose of all scraps properly
- Always use a properly marked container to dispose of later and work on a black pad which makes the slivers of glass easier to spot
- Do not drop them on the floor where they will stick in carpets or shoes and be carried elsewhere
- Do not eat or drink anywhere near the work area

120

Pulling Fiber Optic Cable

•Make sure the cable is long enough for the run

•It's not easy or cheap to splice fiber

•Consider putting fiber inside plenum-rated conduit

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121

Pulling Fiber Optic Cable

- Do not
  - Pull on the fibers, pull on the strength members only!
  - Exceed the maximum pulling load rating
  - Exceed the cable bend radius
  - Twist the cable

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Distribute Pulling Forces

•Use Indirect attachment to distribute pulling forces

Indirect

Direct

Slide 13-123

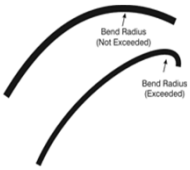
123

Bend Radius

•Check specifications of individual cable manufacturer

•A 2-IN. BEND RADIUS IS "FUTURE PROOF"

•1-in. bend radius is sufficient for the lay-in of fiber-optic cable it's not sufficient for the installation of fiber-optic cable under pull forces



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124

Cable Lubricants

- Use lubricants to lower friction forces

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Standard Connectors

ST

SC

FC/PC

Slide 13-126

126

Small Form Factor (SFF) connectors

LC

MT-RJ

Opti-Jack

Slide 13-127

127

Small Form Factor (SFF) connectors

Volition

E2000/LX-5

MU

MT

Slide 13-128

128

Zero Tolerance for Dirt

- Airborne particles absorb lots of light and may scratch connectors if not removed
  - Try to work in a clean area
  - Always keep dust caps on
  - Use lint free pads and isopropyl alcohol to clean the connectors

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129

Fiber Optic Cleaver

- A tool that precisely "breaks" the fiber to produce a flat end for polishing or splicing

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130

Retractable Diamond Scribes

- High quality fiber optic diamond scribes are specifically made for the scratch and pull technique of scribing optical fibers

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Fiber Optic Inspection Scopes

- Light is introduced into the optical path (axis) so that it comes out of the tip of the objective and strikes the sample perpendicular to the fiber end-face
- It produces excellent detail of scratches and contamination

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132

Optical Time Domain Reflectometer (OTDR)

- Injects a series of optical pulses into the fiber under test
- Extracts light that is scattered and reflected back
- Intensity of the return pulses is measured

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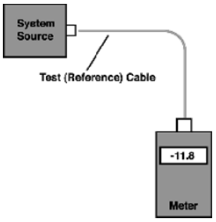
Power Meter

- Power in a fiber optic system is like voltage in an electrical circuit
- It's important to have enough power, but not too much



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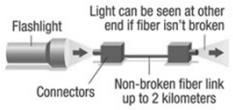
Test With Flashlight

- Least expensive and simplest fiber continuity tester
- Can test multimode fiber links as long as three miles
- Fiber optic manufacturers supply flashlights with special adapters which allow direct connection of typical connector types, such as ST and SC, to the flashlight's lens



135

Visual Fault Finder

- Provide light source that can be sent thru fiber
- Light will show from fault

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Infrared Detection Cards

- You will be able to visually see the presence of infrared light when it is directed on the active area of the card

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On Site Wireless

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On Site Wireless Systems

- Typically refers to initiating devices communicating to the control panel via radio frequencies

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139

When To Use Wireless Transceivers

- When a wired connection is not an option
- When the cost of pulling wire is equal to or more than the cost of the required transmitting and receiving equipment
- May allow the job to be completed with less labor to offset the cost of additional equipment
- Some systems allow you to use whichever method is most cost effective on the same system

Slide 13-140

140

Typical Range

- Depends on the construction of the building and the equipment used
- Most manufacturers cite a typical outdoor line of sight range of up to 1000 feet and a range inside the building from 300 to 500 feet
- Because the RF signals will penetrate wood, concrete and stone, but not metal, the range will vary from building to building and perhaps within the building

Slide 13-141

141

How Can I Be Sure the Equipment Is Going To Work?

- Perform placement tests on each transmitter in a wireless system as per manufacturer's instructions
- Test after the building construction is completed

Slide 13-142

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RFI- Radio Frequency Interference

- Signals from amateur radios, CBs, and radio and television stations
- Can interfere with data transmissions
- Can Block Radio signals

Slide 13-143

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How Do Systems Vary?

- Systems use a variety of antennas to focus the signals and most use either the 900 Mhz or 2.4 Ghz frequencies to communicate.
- Because both of these frequency ranges are used by other devices, some manufacturers use spread spectrum technology to reduce interference and also reduce the chance of illegal monitoring

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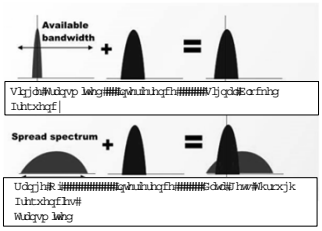
Spread Spectrum



- Frequency of the transmitted signal is deliberately varied to provide greater bandwidth and also reduces the impact of interference

145

Limited Battery Life

- Typical lifespan for wireless batteries is 1-5 years.
- Will need additional service calls to replace batteries
- Lithium batteries may add to lifespan

146

NFPA 731 Requirements

- Each transmitter shall be individually identified at the receiver/control unit
- The battery shall be capable of operating the low-powered radio transmitter for not less than 1 year
- Maximum allowable delay from activation of an initiating device to receipt and display by the receiver/control unit shall be 90 seconds
- Removal of a low-powered radio transmitter from its permanently installed location shall cause a signal that indicates its removal and identifies the affected device

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Zigbee

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ZigBee – What is it?

- ZigBee is the wireless language that everyday devices use to connect to one another

149

Who is Using it

- ZigBee is used by a variety of cable and telecommunication companies including Comcast, Time Warner Cable, EchoStar, DirecTV, Charter, Rogers, Deutsche Telekom, Videocon
- ZigBee is also available in do it yourself products

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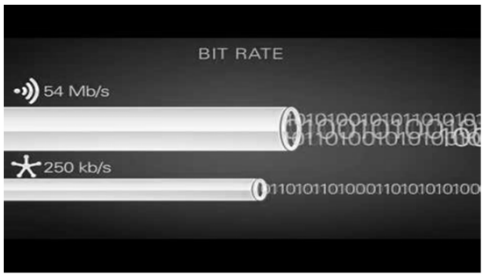
Zigbee Demonstration

151

Zigbee vs Wi Fi



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Connections

Z-wave

153

Z-Wave – What is it?

- Z-Wave is a wireless technology that makes regular household products, like lights, door locks and thermostats "smart"
- Z-Wave products "talk" to each other wirelessly and securely and can be accessed and controlled on your phone, tablet or PC

154

Z-wave Demo

155

Z-Wave Users

- Alarm.com
- Total Connect
- SecureCom Wireless
- iBridge

156

Devices

There are currently over 1,000 Z-Wave compatible devices, including:

- Door locks
- Light switches
- Electrical outlets
- Alarm sensors (burglary, fire, CO, water, etc.)
- Thermostats
- Window shades
- Many more

157

Z-Wave Frequencies

- Zwave operates at 908.42 MHz in the US (868.42 MHz in Europe) using a mesh networking topology
- Zwave utilizes GFSK modulation and Manchester channel encoding

158

Z-Wave Capacity

- A Zwave network can contain up to 232 nodes
- Reports exist of trouble with networks containing over 30-40 nodes

159

Z-Wave Profiles

- Zwave operates using a number of profiles (think of them like languages), but the manufacturer claims they interoperate
- Use care when selecting products as some products from certain manufacturers are not compatible with other manufacturers' products

160

Z-Wave Network ID

- Each Z-Wave network is identified by a Network ID
- The Network ID (aka Home ID) is the common identification of all nodes belonging to one logical Z-Wave network
- Network ID has a length of 4 bytes and is assigned to each device by the primary controller when the device is added into the network
- Nodes with different Network ID's cannot communicate with each other

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Z-Wave Node ID

- Each device is identified by a Node ID
- The Node ID is the address of the device / node existing within network
- The Node ID has a length of 1 byte

162

Healing Overcomes Obstacles

- Devices can communicate to one another by using intermediate nodes to route around and circumvent household obstacles or radio dead spots that might occur though a message called “healing”
- Delays will be observed during the healing process
- A message from node A to node C can be successfully delivered even if the two nodes are not within range, providing that a third node B can communicate with nodes A and C
- If the preferred route is unavailable, the message originator will attempt other routes until a path is found to the "C" node

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WiFi

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Allows devices to connect to the Internet or communicate with one another wirelessly within a particular area

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Wi-Fi

WIFI can be used to connect devices

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WiFi

Standard	Top Speed	Band
802.11 a	54-Mbps	5 GHz
802.11b	11 Mbps	2.4 GHz
802.11g	54-Mbps	2.4 GHz
802.11n	54 Mbit/s to 600 Mbit/s	2.4 or 5 GHz
802.11ac	433.3 to 1300 Mbit/s	5 GHz

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5 GHz and 2.4 GHz frequency bands

Band	2.4 GHz	5 GHz
Channel	Three (3) non-overlapping channels	23 non-overlapping channels
Standard	Wireless-B, G, and N	Wireless-A, N, and AC
Network Range	Up to 150 Feet Indoors Up to 300 Outdoors	Up to 50 Feet Indoors Up to 100 Outdoors
Interference	More Likely - used computers to access the Internet for simple browsing and email	Less Likely- used for usage that requires uninterrupted throughput

- Physical obstructions in homes such as brick walls and metal frames or siding reduce the range of a WiFi network by 25% or more
- 5 GHz WiFi connections are more susceptible to obstructions than are 2.4 GHz

168

Routers

- A router is a networking device that forwards data packets between computer networks
- The Traffic Cop

169

Access Point

- A wireless access point (WAP) is a device that allows a Wi-Fi compliant device to connect to a wired network.
- Usually connects to a router (via a wired network) as a standalone device, but it can also be an integral component of the router itself

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Security Key

- Security passcode for wireless network
- Matching Keys need to be used on the router and all devices
- Several Types
  - WPA2- Wi-Fi Protected Access
  - WPA- Wi-Fi Protected Access
  - WEP- Wired Equivalent Privacy

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Why Wi-Fi Networks Fail

- Mother Nature - Water in Leaves can block signals

- Tall Ceilings - Antenna above 35 feet will reduce range

172

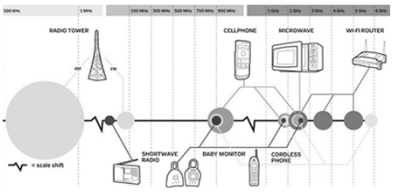
Why Wi-Fi Networks Fail

- Capacity Challenges - Too many devices can lead to clash for resources
- Conflict - Bluetooth, microwaves or other devices can interfere

173

Why Wi-Fi Networks Fail

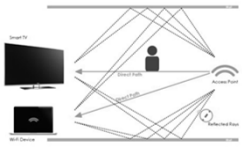
- Wrong Frequency Choice – 2.4 GHz is less likely to lose power- 5GHz handles more data

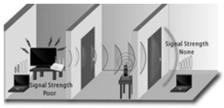


174

Why Wi-Fi Networks Fail

- Reflection - Reflecting surfaces such as stainless steel can help
- Metal - Metal mesh can block signals





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Practical Applications

1

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Meters

2

Analog Multimeter

- Used to measure electrical quantities such as voltage, current resistance, frequency, and signal power
- An analog multimeter displays these values via a dial, typically a moving pointer
- Analog is best for detecting "swingers"

3

Digital Multimeter

- Digital is much more durable and forgiving

4

General Meter Use

- Set to measure what you want to measure, volts, amps, ohms
- Check the range setting to make sure you will not exceed it
- Power down when not in use

5

Scales

- Check the scale to verify what you are measuring
- Digital Multimeters may automatically adjust to what is being measured
- For example
  - –Ohms are measured in multiples of ten and given the designation 'K' or 'M' with 'K' standing for 1,000 ohms and 'M' standing for 100,000,000 ohms.
  - –Amps would be displayed as mA, milliamps or 1/1000 of an amp or A for full amps.
  - –Volts will also be displayed as mV or volts.

6

Scales

- Analog meters show several scales for amps, volts and ohms.
- Make sure you use the right one

7

Analog Meter Calibration

- Calibrate before each use
- Find the “ohms adjust” screw
- Set meter to measure ohms
- Touch the probes together
- Adjust the needle to 0

8

Measurements

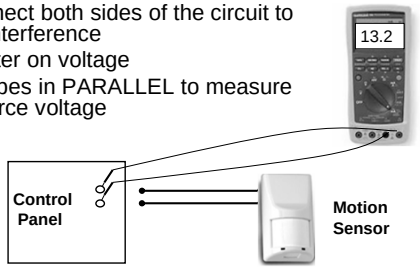
What measurements should you take with a meter?

Voltage	Current	Resistance
- Source	- Device Draw	- Circuit
Without a load	- Circuit Draw	- Device
With a load		
- At Device		

9

Measure Source Voltage without a load

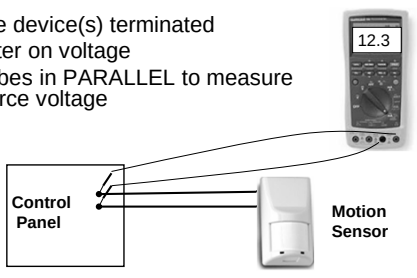
- Disconnect both sides of the circuit to avoid interference
- Put meter on voltage
- Put probes in PARALLEL to measure the source voltage



10

Measure Source Voltage with a load

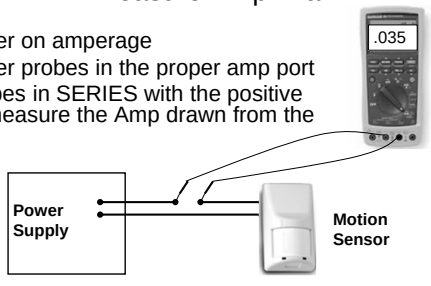
- With the device(s) terminated
- Put meter on voltage
- Put probes in PARALLEL to measure the source voltage



11

Measure Amp Draw

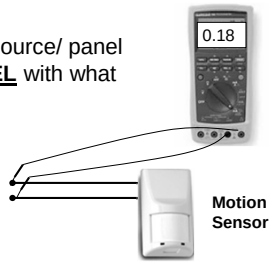
- Put meter on amperage
- Put meter probes in the proper amp port
- Put probes in SERIES with the positive line to measure the Amp drawn from the source



12

Measure Resistance

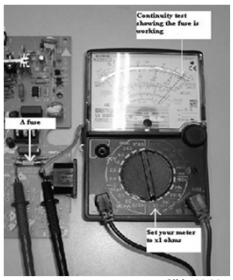
- Put meter on Resistance
- Disconnect from power source/ panel
- Place leads in **PARALLEL** with what you are measuring



13

Meter Fuse or Breaker

- Power down the unit
- Unplug transformer
- Unplug batteries
- Pull fuse out of holder



14

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Troubleshooting- Find the Problem

15

Diagnose Source Of Problem

- Remember the troubleshooting steps
  - Listen
  - Observe
  - Correct
  - Verify

16

Detailed & Accurate Diagnosis

- This is an absolute must!
- "It's broke" or "It doesn't work" doesn't tell you anything
- Ask; who, what, when, where & why?

17

Ask...

- What zone(s)?
- Is it time related?
- Is it event related?
- Is it user related?
- Is it environment / weather related?
- Have any other contractors been working in the area?
- Any recent remodels, roof leaks, etc.?
- Keep a log to show trends and patterns

18

Compare Operation

- Compare the current operation to desired operation
  - Ask your central station
  - Observe the situation
  - Test operation
  - Check voltage and resistance

19

Test Operation

- Read the Directions
- Walk test
- Sequence through the operation as the user would
- Check voltage, resistance, tones
- While checking resistance move wiring or vibrate components to verify firm connections

20

Use Process of Elimination

- Use process of elimination
  - Substitute good parts for suspected bad parts
  - Bridge or jump out sections of a circuit
  - Cool or heat a component to restore to normal operation or reveal abnormal operation
- Note changes

21

Use Common Sense

- "Nothing works"; check: power supply, fuse, transformer or circuit breaker?
- If the keypad or other components are working…its not auxiliary power

22

Powered Devices

- Make sure voltage to powered devices is within the manufacturers range
  - On AC Power
  - And on Battery power
- Does the site have frequent power failures?

23

Poor Troubleshooting Techniques

- "Shotgun" approach - change out components until the problem goes away
- "Curing the symptom" - not correcting what caused the problem in the first place
- Failure to replace outdated components or technology known to cause problems
- Failure to maintain system on a regular basis (i.e. battery)

24

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Troubleshooting- Types of Problems

25

No Functions

- Problems that result in a totally dead unit or affect multiple functions are generally power supply related

26

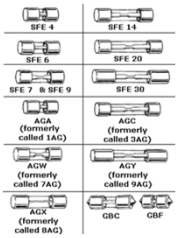
Signs of Short Circuits

- Blown fuses, breakers or transformers
- Increased heat
- Low voltage
- High amperage
- Smoke or smell of smoke

27

Fuses

- Interrupts circuit when amperage goes over a certain level
- Protects wiring and devices
- Not re-useable



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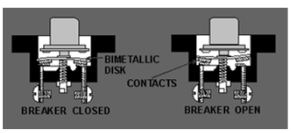
Breakers

- Interrupts circuit when amperage goes over a certain level
- Protects wiring and devices
- Can be reset after they trip



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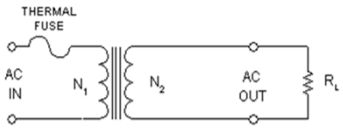
Thermal Fuse

- Addition of a thermal fuse to the primary circuit insures safe operation in the event of an output short circuit or overload



Some versions will reset if disconnected from source

30

Signs of Open Circuits

- Infinite resistance
- Zero Amperage
- Inoperable device

31

Overloading

- A very common mistake made during the original design and installation
- Too many devices drawing too much current from the panel's power supply

32

Signs of Grounds

- Abnormal voltage readings
- Abnormal amperage readings
- Abnormal resistance readings
- Shocks
- Abnormal circuit performance
- Tripped ground fault interrupters
- Blown fuses or breakers

33

Remodeling Or Movement Of Items

- Potential Problems
  - –New walls
  - –Cut wires
  - –New Flooring
  - –Dust and Debris
  - –Removed Walls
  - –New Materials may absorb sound or heat differently

34

Dust, Dirt & Contaminants

- Dust and dirt in of on a sensor can block or increase sensitivity

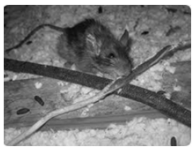
35

Animals, Insects & Rodents

Animals in a room with motion sensors

Insects on or in sensors

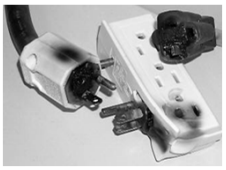
Rodents chewing wiring



36

Signs of Mechanical Faults

- Noisy operation
- Abnormal operation
- Visual clues
  - –Cracks, burns, charred areas
- Smells
- Heat
- Circuit failure



37

Environment- heat, moisture, airflow

- Cold air, hot air or moisture can effect operation

38

People

- Improper use can cause a problem
  - –New Users
  - –Change in hours
  - –Using a new door

39

Entry Exit Delay

- Check to make sure all users can easily walk the distance in the time allowed.

40

Swingers

Problems that are erratic or intermittent - that come and go suddenly - are almost always due to bad connections - cold solder joints or internal or external connectors that need to be cleaned and reseated

41

Blocked Ventilation

- Make sure vents remain unblocked
- Check that cooling fans operate

42

Undersize Wiring

- Mostly a factor on;
  - –Long runs (>200')
  - –Data or Polling loops
  - –High current devices (i.e. sirens & horns)
- Most manufacturers recommend a minimum of 22AWG wire for zones and 18AWG (minimum) for the transformer and siren
- Read the manufacturers instructions!

 Slide 14-43

43

Excessive Wire Length

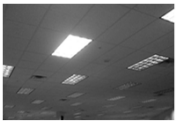
- Verify wire runs over 200' with the installation instructions.
- If there is no chart in the manual - call the manufacturer
- Keep in mind, the electrons have to travel 200' out AND 200' back to the panel

 Slide 14-44

44

Electro-Magnetic Interference

- From Lightning –
  - –can travel great distances over power lines, telephone lines or any conductor
  - –Can be picked up by the zone wiring
  - –Use twisted wire to reduce this effect
- From light ballast's or utility power transformers



 Slide 14-45

45

Radio Frequency Interference

- From nearby radio towers, cellular sites, broadcast antenna's, etc.
- This is a rare problem, but not unheard of

 Slide 14-46

46

Programming

- Keep in mind all of the effects that programming can create in the system
- You must know your equipment - including ALL program options

 Slide 14-47

47

Beware of Telephone Line Options

- Problems can result from the addition or removal of:
  - –Call waiting
  - –Remote call forwarding
  - –Call notes
  - –DSL
  - –VoIP
  - –Any new options

 Slide 14-48

48

Fax or Answering Machine

- If on the same line with the panel, should not be set to answer on the first ring
- Prevents dealer access for downloading
- Some panels will work with it so long as the device does not pick up on the first ring
- Answering machines or fax machines can also hinder downloading

49

Not Installed As Per Manufacturers Instructions

- Keep in mind that if you service this system without correcting the misapplication –
- NOW YOU ARE LIABLE

50

Improper Application

- Violates U.L. listings
- Violates NFPA
- IS AGAINST THE LAW!

51

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Troubleshooting- Identify a Solution

52

Identify a Solution

- A basic part of troubleshooting is to identify a solution

53

Help is Available

- Ask Coworkers, Supervisors
- Read the manuals
- Use manufacturer help lines, web sites

54

Use Past Experience

- Compare the problem to past problems you have experienced
- Remember what worked before
- Look for common sources of problems

55

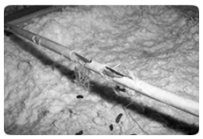
Break It Down

- Break down the problem into smaller parts
- It is often easier to look at a section of a system at a time
- For example, if you are getting false alarms:
  - Determine which zone the false alarm is coming from
  - Check each sensor on that zone

56

Wiring

- Connections inside junction boxes and attics seldom go bad
- Wire seldom goes bad….without a cause
- Check places where wire is exposed first



57

Replace Parts as Last Resort

- Components seldom “just go bad”. Something caused it
- If you just replace the part you may not fix the cause of the problem
- Part may appear to be “bad” because:
  - It’s not getting the right voltage or amperage
  - It’s overheating because vents are blocked
  - It is installed in the wrong place
  - It is not compatible with other parts of the system

58

People & Procedures

- Sometimes how people interact with the system is the problem
- Sometimes you need to change the system or change how people use it

59

People and Procedures

- For example-
  - If people enter thru a back door and the remote is in the front of the building you may need to add a remote.
  - If an alarm goes off every morning when a delivery is made. You either need to change the delivery time or location or change the system

60

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Troubleshooting- Implement the Solution

61

Implement the Solution

- Make sure your solution will address the problem
  - –Use common sense
  - –Use your experience
  - –Ask coworkers and supervisors
  - –Refer to manufacturer manuals, websites and help lines
  - –Observe

62

Verify proper operation

- Test after each fix to make sure it is really fixed
- Make sure that your fix did not break something else

63

Make Sure That Was The Only Problem

- You may fix what you think is the problem and leave another problem uncorrected
- Test the full system before you leave

64

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Troubleshooting- Document

65

Document Problems & Actions Taken

- Record the steps you took to fix or change the system
- This avoids repeating the same steps if the problem happens again

66

Update Programming

- If you change the system make sure to:
  - Update info at the central station
  - Change labels when necessary

67

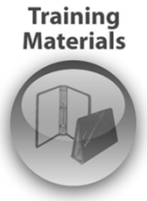
Note Wiring Changes

- If you add a splice or rewire a circuit note the changes on drawings

68

Update Training Materials

- If you change a device and it works differently than the original update the training materials



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Testing & Maintenance

1

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Test New Systems

2

Read the Paperwork

- Instruction Manuals
  - –Guide you on sequence of power up
  - –Tell you how it should work and perform
- Work order
  - –Lets you know what the customer expects
- Blue prints
  - –Tells you where things should be
- Wire Chart
  - –Identifies what is connected to what

3

Verify Operation

- Read the instruction manuals
- Perform tests indicated in the manuals
- Check that wiring and connections are complete

4

Check Power

- Connect power in the sequence specified in the instructions
- Make sure battery is being charged

5

Verify proper operation

- Verify that each device is labeled correctly
- Make sure device is securely mounted
- Verify that sensors cover what they should

6

Verify that the device works as it should

- Use recommended test equipment
- Walk test motion sensors
- Test that sensors activate when doors or windows open

7

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Maintenance

8

Maintenance

A "Check-up"

Recurrent inspections, tests and corrections to keep the system and it's component parts in an operative condition at all times

9

Benefits of Maintenance

- Verify proper operation
- Reduce chance of system failure
- Extend the life of system components
- Catch problems
- Reduce liability

10

Timing of Maintenance

- Standards may set requirements
- Manufacturer's may specify when
- Warranty may require maintenance
- Customer Requirements

11

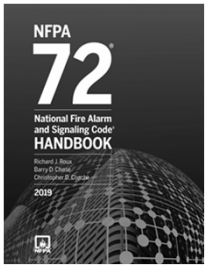
NFPA 731

- NFPA 731 Chapter 10 (20) sets out specific methods to test each device in Intrusion, Emergency, Access Control & Video Systems

12

NFPA 72

- NFPA 72 Chapter 14 (19) sets out specific methods to test each device in Fire Systems



Slide 15-13

13

Common Maintenance Tasks

- Cleaning
- Alignment
- Voltage and resistance tests
- Operation testing
- Check environment for changes that could effect operation
- Replacement of worn out parts

Slide 15-14

14

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Job Planning & Documentation

Slide 16-1

1

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Review Documentation

Slide 16-2

2

Disclaimer

- The forms used in this course are used for examples
- Significant legal language or items specific to you company requirements may not be included

Slide 16-3

3

Reasons for Documentation

- Helps to determine actual job costs
- Helps on future service calls
- Helps to explain system to customer without a visit to the site
- Helps if there is ever a question about what was installed

Slide 16-4

4

Contract or Agreement

- Full agreement on job requirements
- Legal language

Slide 16-5

5

Work Order

Lists specific types of equipment and locations

Slide 16-6

6

Change Order

Makes a change to a contract for a new system

Or

Makes a change to an existing system

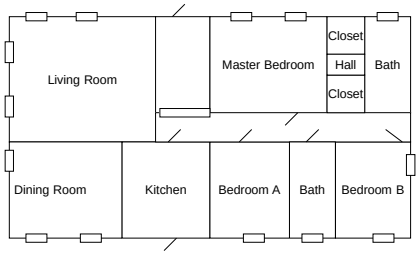
7

Parts List

Lists ALL the required parts

8

Floor Plan



9

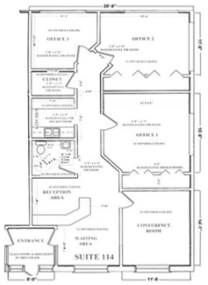
Locate Other Documentation

- Coordinate with all installers to locate:
  - Blueprints
  - Shop Drawings
  - Wiring Legends
  - Schematics
  - Installation & Operation Manuals
  - Related Technical Bulletins And Updates

10

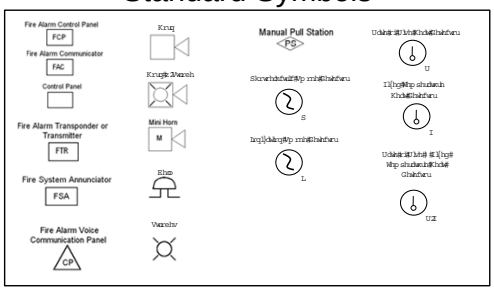
Blueprints or Plans

- Drawing of the relationships between rooms, spaces and other physical features of a structure
- Building Plans will allow you determine:
  - Size of each room
  - Location of sources of interference
  - Likely paths for wiring



11

Standard Symbols



12

Types of Blueprints

- Structural Drawings
  - Engineering of building
- Electrical Drawings
  - Power, lighting, alarm and communications
- Mechanical Drawings
  - Plumbing, heating, air conditioning

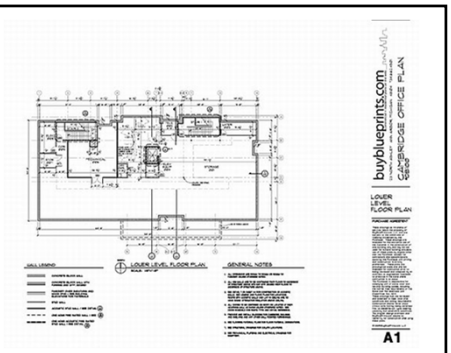
13

Scales

- Drawings for objects are reduced to a manageable size (scale)
- Set of plans may include a variety of different scales, depending upon what objects are being rendered
- Selected scale normally is found in the title block in the lower right-hand corner of the drawings, but may be found anywhere on the plans

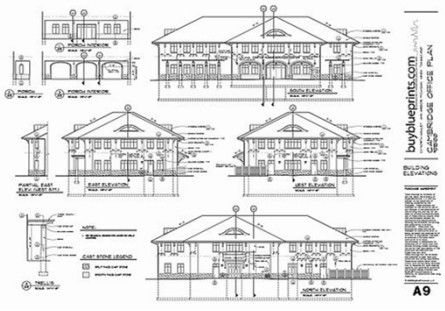
14

Plan Or Floor Plan View



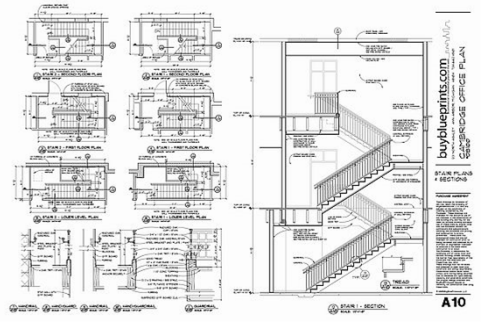
15

Elevation View



16

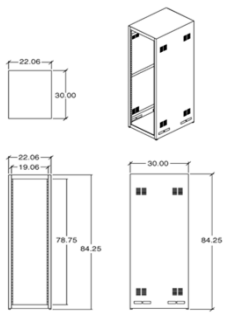
Section View



17

Shop Drawings

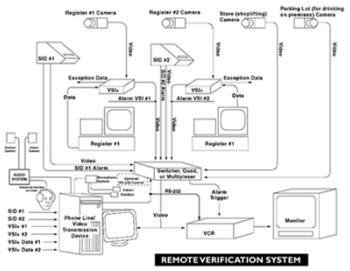
- Drawings, diagrams, schedules and other data specially prepared for the work to illustrate some portion of the work



18

Schematics

- Diagram that represents the elements of a system using abstract, graphic symbols rather than realistic pictures



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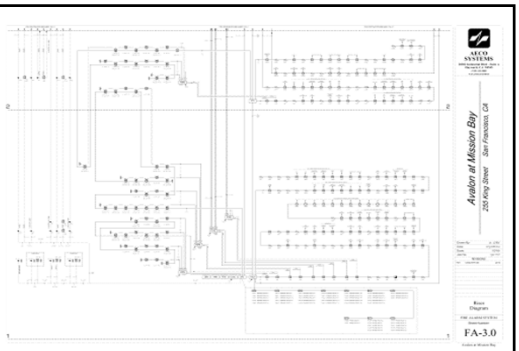
Riser Diagram



20

Installation & Operation Manuals

- Review and follow manufacturers manuals and recommendations to:
  - Improve operation
  - Reduce liability
  - Make the system easier for others to service

21

Related Technical Bulletins And Updates

- Check the web for updates
- Things change
- Bulletins and updates give you the latest information
- Can save you time
- Prevent a problem

22

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Construction Materials and Methods

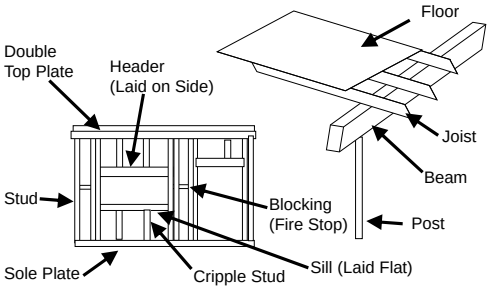
23

Construction Materials and Methods

- Check for
  - Wood or metal framing
  - Brick, paneling, plaster or drywall
  - Paint or wallpaper
  - Drop ceiling, attic
  - Crawl space, open or finished basement

24

Common Terms



Slide 16-25

25

Home Styles


Cape Cod


Colonial


Contemporary


Craftsman


European


Southern


Ranch


Victorian

Slide 16-26

26

Types of Doors


Steel Entry Doors


Patio or Sliding Doors


French Doors


Wood, fiberglass or composite Entry Doors


Overhead or Garage Doors


Pet Doors

Slide 16-27

27

Single Vs Double Hung

- **Single-hung** means that one of the windows sashes is fixed in place and does not move

- **Double-hung** means that both sashes in a frame are operable

Slide 16-28

28

Sliding Windows

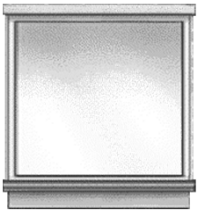
- Have sashes that move horizontally on a track
- Usually only one of the sashes moves and the other is fixed

Slide 16-29

29

Fixed-pane Windows

- Windows do not open, which means they do not permit ventilation or easy cleaning, but their sealed edges protect against air infiltration.



Slide 16-30

30

Jalousie Windows

- Glass louvers that overlap one another form the panes of a jalousie window
- Operated with a crank or turn-screw, the glass louvers tilt to open, permitting air flow

31

Types of Windows

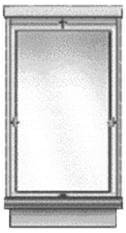
- **Awning Window**: Opens from a top hinge and projects outward

- **Casement Window**:
  - Contains one or more side-hinged openings that open either outward or inward.
  - A conventional casement window has a sash that projects outward

32

Rotating Windows

- Open by pivoting around a central point



33

Types of Windows

- **Dual Action Window**: Operates in two different ways -- typically, the window consists of a sash that may tilt from the top or may swing inward from the side

- **Greenhouse/Garden Window**: Consists of a three-dimensional, five-sided structure generally protruding from the wall in which it is installed. The window may or may not open

34

Hinged Escape / Rescue / Egress Window

- Opens wide enough to allow escape from inside (and entrance for rescue workers).
- Many building codes require egress windows in all bedrooms that do not have doors that exit the building

35

Storm Window

- A glazed window attachment product designed to be mounted to the inside or outside of a window to create an air space between the window and the storm window
- This is sometimes called an “energy panel”

36

Transom Windows

- A non-operable window that is often installed above either another window or a door
- Transoms may consist of a glazed frame or a non-operable sash within a frame

Slide 16-37

37

Tubular Daylighting Device (TDD)

- A non-operable device primarily designed to transmit daylight from a roof surface to an interior ceiling surface via a tube
- The device consists of an exterior glazed surface, a light transmitting tube with a reflective inside surface, and an interior sealing device, such as a translucent ceiling panel

Slide 16-38

38

Skylights

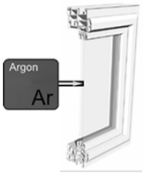
- Skylights may also be flat panels (similar to a regular windows) but designed to perform on an angle or flat (depending on the roof surface), and they may be operable or non-operable
- There are additional designs for skylights, but the purpose of all is to provide additional natural daylighting into the building

Slide 16-39

39

Gas Filled Windows

- To improve the thermal performance of windows with insulated glazing, some manufacturers fill the space between the panes with inert gas -- commonly argon or krypton -- that has a higher resistance to heat flow than air

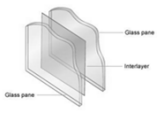


Slide 16-40

40

Laminated Glass

- A type of safety glass that holds together when shattered
- In the event of breaking, it is held in place by an interlayer between its two or more layers of glass



Slide 16-41

41

Common Insulation Methods

Loose fill (Blown in)

Batt

Rigid Board

Blanket

Loose fill (Poured in)

Foamed in-place

Slide 16-42

42

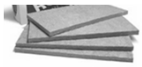
Fiberglass Insulation

- Fiberglass is the most familiar type of insulation
- It is spun from molten glass & is pure white in its virgin state
- Additives and binders often color the fiberglass, with pink and yellow being the most common
- Comes in rolls, batts & as loose insulation which is blown into place

Slide 16-43

43

Rockwool Insulation



- Dirty grey, although the color can range through green & brown as well
- Looks like old wool with dark flecks, & you can often find what looks like sand or small pebbles underneath the insulation
- Is spun, like fiberglass, from the slag from refining metals
- The debris that settles underneath the insulation is remnants of the slag, & condensed droplets of metal

Slide 16-44

44

Cellulose Insulation

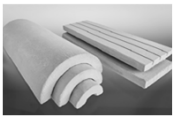
- Cellulose insulation is made from wastepaper, such as used newspaper and boxes
- It is shredded into small particles, and chemicals providing resistance to fire and insects are added
- Cellulose insulation is dusty and brown, with flat particles, on which you can frequently find legible print

Slide 16-45

45

Perlite Insulation

- A white gravelly, yet extremely light material
- It is the same material found in garden centers and used as part of potting mixtures
- Is no longer used as an insulating material, except for the occasional do-it-yourselfer, although it is not uncommon to find it in existing houses



Slide 16-46

46

Vermiculite Insulation

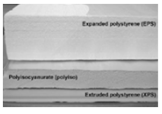
- Vermiculite is made from expanded mica, a mineral
- Vermiculite used as insulation is identical to the material found in garden centers
- Like perlite, it is generally no longer used for insulation, although again, it can still be found in existing houses
- **Can Contain Asbestos**

Slide 16-47

47

Rigid Foam Board Insulation

- Rigid boards are fibrous materials or plastic foams pressed or extruded into board-like forms
- These provide thermal and acoustical insulation, strength with low weight, and coverage with few heat loss paths

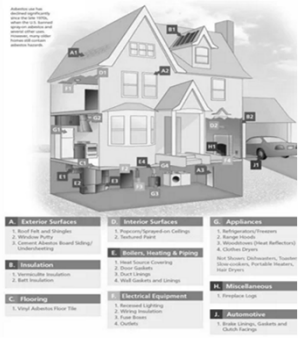


Slide 16-48

48

Asbestos

- Download a free guide
- http://www.asbestos.com/asbestos-guide/



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Conduct Site Survey

50

Burglar Alarm Survey

- Are customers worried about detection while at the location, or away?
  (Motion detectors are usually disarmed while in stay mode)
- Are doors "tight" enough for magnetic contacts?
- Are windows moveable, fixed, or a mix of both?
- Will there be partitions/areas?

51

Fire System Survey

- Who is the AHJ on this project?
- What fire code has been adopted?
- Are their requirements beyond existing local and state fire codes? (insurance?)
- What occupancy classification?
- Is the building sprinklered?
- What if there are existing devices? (electrician installed smoke detectors)

52

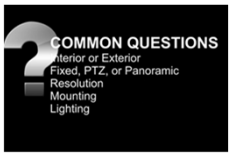
Access Control System Survey

- How many doors?
- How many users?
- What type of doors?
  - Are the doors sturdy?
  - Do they swing in or out?
- What type of computer resources will be available to administer the system?

53

Camera System Survey

- How much light?
- How many cameras?
- How much archival information?
- How many frames/fields per second?
- Will there be remote access?
- What type of networking / IT resources are there?



54

Use Job Documentation to:

- Verify that equipment is appropriate
- Select locations
- Determine wiring requirements
- Select wiring paths

DOCUMENTATION

55

Verify That Equipment Is Appropriate

- Is it possible to get wire between the control and all the devices?
- Will metal used in construction interfere with transmissions between devices?
- Does air flow, size, window placement, etc. rule out some types of sensors?

56

Check Construction

- Drywall, Plaster, Brick, Cinderblock
- Drop ceiling, attics, crawlspaces, unfinished basements
- Check if closets on each level line up
- Look for a utility room
- Hardwood floors or carpeting
- Can molding be removed?

57

How To Find The Construction Type

- Tap on the walls to see if they are hollow
- Remove a switch or outlet plate to see what is behind it
- Check the attic, basement or crawl space
- Ask the site owner

58

Double Check

- Make sure that the system will work for the customer
- Do they have pets?
- Are all areas of concern covered?
- Can they live with the design?

59

Setup the Right Coverage

60

Keep it Simple

- Over complicated systems can lead to:
  - False Alarms
  - Service calls to explain operation
  - Dissatisfied customers

61

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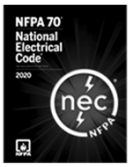
Select Wiring Paths

62

Standards for Wiring

- National Electrical Code
- Manufacturer's instructions for each device



63

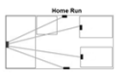
Pre-wiring

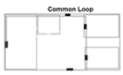
- In new construction it is to your advantage to run wire through exposed studs and framing before walls are closed in with drywalls or other wall coverings
- Wire should be fastened to prevent damage
- Wire should be protected with kick plates or other protection where nails or screws might hit the wire

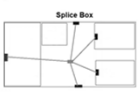
64

Wiring Methods

- Home Run- a wire is run from each device to the control
- Common Loop- wire is run to several locations from the control
- Splice box- wires are run from each device to a splice box where they connect to a common wire or a multiconductor cable





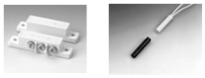


65

Plan Ahead

- If you put only one restorable device on a zone it will be easier to identify which device activated
- Restorable devices like motion or glass break sensors restore when the activity that activated them changes
- Non Restorable device such as door or window contacts stay activated until the door or window is closed

Restorable



Non Restorable

66

Cable Dos

- Keep cables out of contact with hot pipes or any other heat source.
- Keep cable at least 12 inches away from electrical sources such as fluorescent light ballasts or transformers.

Slide 16-67

67

Cable Don'ts

- Do not
  - stretch
  - subject them to sharp bends
  - Staple as a means of support
  - pull cable ties excessively tight as to deform the cable jacket

Slide 16-68

68

Commercial Site Wiring Paths

- Telecom/data closets/spaces can provide a path between levels
- Drop ceilings provide access to walls
  - Ceilings should not be used to support the wiring
- Raised floors
- Interior walls are often hollow
  - Remove a wall plate to verify

NFPA 70 300.11 ['20]

Slide 16-69

69

Commercial Site Wire Splices

- Find areas for splice boxes that will be accessible for service
  - Closets
  - Drop Ceilings
  - Crawl Spaces
  - Basements
  - Utility rooms
  - Phone closets
  - Computer rooms

Slide 16-70

70

Residential Site Wiring Paths

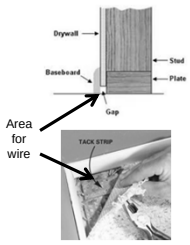
- Closets can provide a path between levels
- Attics
- Unfinished basements
- Crawl spaces
- Interior walls are often hollow
- Drop ceilings
- Area around return vents or plumbing chases

Slide 16-71

71

Existing Residential Buildings

- When wiring can not be fished through walls try:
  - Concealing behind molding or baseboard
  - Concealing under carpet
  - Using surface mounted wire mold to conceal the wiring



Slide 16-72

72

Residential Site Wire Splices

- Find areas for splice boxes that will be accessible for service
  - Closets
  - Attics
  - Crawl Spaces
  - Basements
  - Utility rooms

73

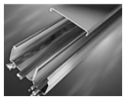
Unacceptable Paths

- Elevator shafts
- Inside vents
- Attached to hot water pipes
- Attached to sprinkler pipes
- Attached to gas pipes

74

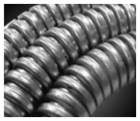
Protecting Wiring

Exposed surface wiring can be protected with:



Wiremold

Conduit



Greenfield

75

Service Loops

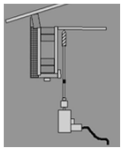
- Allow enough cable after you make your connections to:
  - Remove the device for service or adjustment
  - Replace it with a similar device
  - Eliminate any strain on the cable and connectors

76

Fishing Wires to Attic

Step 1 - Drill

- If door or window lines up toward the center of the attic you should be able to drill straight up
- If door or window lines up toward the outside of the attic, the pitch of the roof may make it more difficult
- Drill the hole with care to avoid going thru the roof
- To avoid drilling through the roof
- Measure the distance from where you enter the wall or jamb to the ceiling beforehand
- Mark it with tape
- Drill carefully after the tape mark is reached
- You should feel a hollow space after you make it thru the ceiling and before you enter the roof

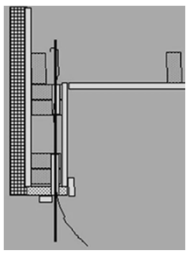


77

Fishing Wires to Attic

Step 2

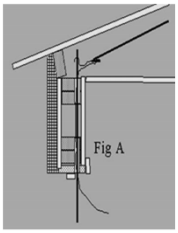
- Once the hole is drilled, use the bit, a fish tape or pull rod to fish the wire
- If you are lucky the tape will follow the roof contour to the center of the attic



78

Fishing Wires to Attic

- Step 3
- If not you will need to use another tape or rod to hook the first tape



79

Fishing Wires to Attic

80

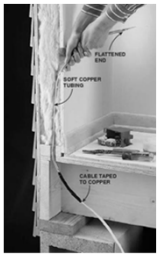
Fishing Down To The Crawl Space

- Use a flexible drill bit to drill down.
- Ream out the hole to make an easy path of the bit.
- Connect the wire to the end of the bit.
- Pull the drill bit up with the wire attached.

81

Fishing Thru Insulation

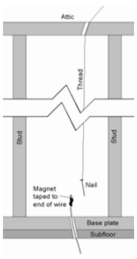
- Use a copper tube to clear a path
- Connect the wire to the tube
- Pull it back



82

Fishing Up from the Basement

- Drill up from the basement thru the subfloor
- Drill down from the first floor or attic
- Drop a pull line with a nail from above
- Push a still wire with a magnet from below to catch the nail



83

Use Chase Between Floors

Space around Ducts may be a path

But Fire Stop may block path

84

Fish thru a Wall

https://youtu.be/NwXAWsp9wps

https://youtu.be/86fM05JtZdo

https://youtu.be/eA4XhdWIqK0

85

Fire Stops

- The horizontal double 2x4s on top of the vertical studs create firestopping in modern wall systems
- When covered with drywall, each wall cavity will be sealed and separate from the one next to it

86

Fire Stops

- Older homes often have blocks of wood in the walls between the floor and ceiling.
- This stops the vertical movement of fire and hot gases

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Develop A Job Plan

88

Job Plan Considerations

- Job documentation
- What you learn on the survey
- Existing building or under construction?
- Permit or inspection requirements
- Access to work site
- Availability of equipment
- Availability of workforce
- Schedule of other trades

89

Job Plan Considerations

- Weather
- Control to be used
- Sensors to be used
- Where control can be located
- How your wiring can be run
- Requirements for mounting equipment
- Sequence -is one item required for another?
- Which devices can be preassembled, pretested or preprogramed?

90

Determine Integration Requirements

- Inventory existing
  - Badging systems
  - Access systems
  - Gates
  - Fences
  - Locks
  - CCTV
  - Alarms
  - Computer networks, etc

Slide 16-91

91

Service Considerations

- Note how you can get to equipment after it is installed in order to service it
- Plan for increased maintenance for outdoor equipment

Slide 16-92

92

Secure Area

- Secure each area prior to commencing work
  - Use a drop cloth to avoid damage to carpet or flooring
  - Ensure that extension cords are taped down or are not in traffic paths
  - Use a safety cone to indicate hazards

Slide 16-93

93

Kids and Animals

- Keep your tools and parts in a secure area
- Kids and pets may be attracted to them
- Unsupervised access may lead to misplaced items or injury

Slide 16-94

94

Construction Sites

- Protect components from dust, dirt and damage if you mount them before construction and cleanup are finished
- NFPA 72 requires any Smoke Detectors protected before clean up or cleaned and sensitivity adjusted or replaced

NFPA 72 17.7.1.12 ['19]

Slide 16-95

95

System Integration

- Some programming will be required to tell the reacting system what to do when the initiating event occurs
- Communications protocol adaptor may be required
- Most common way to integrate is with a direct connection from a relay output of one system to an input of the other system
- Systems can send data over a serial or internet connection to communicate with another device

Slide 16-96

96

Communication

- Is key to coordinate and complete the installation safely and effectively
- Ask for feedback on critical items to verify that they are understood
  - Words can mean different things to different people
  - Incorrect assumptions can be made
  - Poor listening can occur with distractions
  - Not understanding terms or jargon

97

Prepare

- Review instructions
- Assemble devices as much as possible before installation
- Mount back boards
- Install mounting brackets

98

Pre-test Components

- Check wiring for continuity (complete circuit)
- Check for grounds
- Verify available voltage
- Check instructions for applicable tests

99

Before You Connect Power

- Read the instructions
- Perform indicated tests
- Connect power in the specified sequence

100

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Document the Installation

101

"As Built" Drawings

- Mark a set of floor plans or blueprints to:
  - Show the final system as installed
  - Show route of wiring
  - Location of devices
- Make a set for the site and another for the files

102

Zone Diagram

- Do a diagram of what is connected to each zone
- Show the type and location of connected devices
- Make a set for the site and another for the files

103

Equipment List

- Review the list of required equipment to make sure nothing is missing
- List the type and model of installed equipment
- Make a set for the site and another for the files
- Update the list when you add any equipment to
  - Reflect true job costs
  - Help identify replacement options if equipment breaks

104

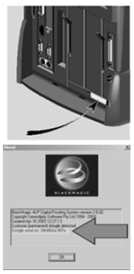
Serial Numbers

- Record serial numbers of installed devices and programs
- Helps to track service issues
- Helps with warranty questions
- Helps to determine eligibility for upgrades

105

Find the Serial Number

- Check underneath product
- Check help screen for software



106

Record Programs

- Record all commands and programs developed to control the system
- Backup programs off site
- USB Drive, Dongle or Security Keys

107

Be Kind

- To yourself and your coworkers by documenting any devices that are mounted in less visible or hidden locations
- Let you coworkers know how to unlock or remove any special devices that you used to securely mount a device

108

Save the Documents

- Save instruction manuals, wire charts, warranty cards and other documentation
- Helps you
  - Make repairs
  - Change programs
  - Enforce warranties

109

User Manual & Training Materials

- Simplify the manual for the customer
- Note any changes from normal operation
- Note any special features

110

Warranty Paperwork

- The warranty is clarified and enforceable with proper documentation that states:
  - What is covered
  - When the coverage begins and ends
  - Demonstrates that the customer accepted the system

111

Change Orders

Written documentation should be signed by the customer to identify any changes from the contract, even if the changes are at no additional charge

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User Training

1

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Prepare to Train

2

Review User Documentation (Manuals & Instructions)

- To properly demonstrate the operation of a system you need to be an expert in how it operates
  - Read the instruction manual
  - Run through the system until you are comfortable

3

Ask Questions

- Ask questions of users to determine
  - What they know about the system
  - Past experience with similar systems existing
  - Who will set up or program the system
  - Who will do periodic maintenance

4

Identify Training Objectives

- Decide which features to cover
- Proper training is a critical part of good customer service
- Get it right -return visits are costly
- Confirm who all the actual users are

5

Procure – Develop Training & User Aids

- Write a script based on user documentation to train a customer
- Have manuals and videos on hand

6

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What to Cover

7

Demonstrate System Functions And Capabilities

- Repeat a pre-developed script to train a customer
- Demonstrate a system
- Try different ways to train customers e.g. demonstration, video, written manual

8

Guide User Through System

- Sequence the customer though the operation of the system
- Use clear & understandable descriptions
- Let the user show you each step
- Involve the customer in the demonstration

9

False Dispatch Prevention

- Explain the impact of false dispatches:
  - Cost to police
  - Danger to responders
  - Cost of alarm fines

10

If You Give Them a Key…

- Stress that anyone with a key needs to be trained
  - **Visitors**
  - **Family**
  - **Child Care Providers**
  - **Cleaners**
  - **Real Estate Agents**
  - **Contractors**

11

How to Cancel

- Explain how to cancel an alarm

12

Train User About Codes

- Explain difference between:
  - Secret keypad entry/exit code (or pin) and
  - Identity code (passcode / password) which identifies the user to their alarm company and helps them prevent false dispatches

13

Train User to Contact Alarm Company

- Notify alarm company
  - When remodeling
  - New furniture
  - Furniture movement in sensor path
  - New pets
  - Decorations in sensor path
  - Changes to phone lines
  - When going on vacation

14

Train User to Train Others

- Always be certain that all persons with a key to the premises:
  - Are trained to use the system
  - Have an entry/exit code to turn the system on and off
  - Have a passcode or password to give the monitoring company, which identifies them as authorized to be in the premises

15

User Training on duress, hold-up or panic alarm

- When NOT to use your duress, hold-up or panic alarm:
  - When you need fire or medical assistance
  - To check to see how long it takes law enforcement officers to respond
  - When someone has shoplifted merchandise
  - To report a fight in the parking lot
  - When an underage person attempts to buy alcohol
  - To report that a vehicle has been stolen
  - Any other circumstance in which you are not in a life-threatening or emergency situation

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Printed User Information

- Leave a packet at the time of sale and/or installation that includes:
  - How to arm & disarm
  - What happens when the alarm activates
  - Procedures for canceling a false alarm
  - How to reach the alarm dealer and the monitoring center
  - Installer False Alarm Prevention Program checklist
  - Customer False Alarm Prevention Program checklist

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Verify and Document

- Ask questions
- Document any problems experienced by the customer during training
- Document when each customer is trained

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NFPA 731

4.7.2 Documentation and User Training.

Documentation delivered to the party responsible for the protected premises upon final acceptance of the system:

- Owner's Manual
- User's Instruction
- Record of completion by installer
- Contact information for company servicing the system
- Contact information for company monitoring the system

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Ongoing User Training

- Create bill stuffers that contain alarm prevention tips
- Add false dispatch prevention info to your web site
- Offer re-education
  - After user error alarms
  - For new users

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Continue the Training

- Add bulletins in invoices or newsletters
- Offer training to new employees or users
- Give refresher training after false alarms


FARA False Alarm Prevention
Information for Alarm Users

Your Alarm System, Its Battery Backup And False Alarm Prevention

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Use a Video

- Available online alarmuser.org or www.nesaus.com

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Best Practices to reduce False Dispatches

- Train the end users and recommend continual training
- Use Enhanced Call Verification
- Use Standards such as NFPA, ICC and ANSI/ SIA
  - CP-01, PIR-01, GB-01 and MSD-01
- Target the worst Abusers on a monthly basis
- Support a legitimate Permitting/ Registration Program

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Resources to help reduce False Dispatches

Free resources available at:

alarmuser.org

nesaus.com

siacinc.org

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