



**PDHonline Course E202U (3 PDH)**

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# **Electrical Engineering for Jail Design (Audio Version)**

*Instructor: Thomas Mason, PE*

**2020**

**PDH Online | PDH Center**

5272 Meadow Estates Drive  
Fairfax, VA 22030-6658  
Phone: 703-988-0088  
[www.PDHonline.com](http://www.PDHonline.com)

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# Electrical Engineering for Jail Design

**Thomas Mason, P.E.**

## Course Content

### Course Introduction

Jails are a relatively new phenomenon. Up until about 150-years ago, persons found guilty were executed, publicly punished and released or, occasionally, fined. Incarceration was too expensive. Even today, the United States situation is somewhat unique. We house 725 persons per 100,000 population, as compared to England, Canada, and Germany who report about 100 persons per 100,000 population (<http://en.wikipedia.org/wiki/Prison>). Many jails and prisons (prisons are larger State and Federal facilities for long-term sentences) are overloaded and do not comply with guidelines or regulations. There is a lot of renovation and new construction taking place and expected to take place for the next decade.

This course presents concepts and examples of use of electrical engineering in the design of jails and jail renovations.

narrative	At times, I will share material which is not directly electrical design, but which I feel is important to understand what is going on. I will use boxes like this. The content will not appear on the quiz.
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narrative	<p>For electric power distribution, we look at the continuous load and the peak demand load. I apply this principle to electrical design for jails. Peak demand is the violent felon picked up one night and housed in the local jail until he gets a hearing. This person cannot be expected to be placid and cooperative. He may anticipate a much more unpleasant situation in the near future. All systems in the jail must be designed to keep him safe, keep the other Clients safe (possibly from him), keep the staff safe (from him) and keep the public safe (from him).</p> <p>This is not to say that all clients require provisions of maximum security. There will be drunk drivers, waiting only until the judge sets them out on the streets again. There will be drug users, small time dealers and prostitutes awaiting near-term release. There may be children guilty of nothing except that both parents have been arrested.</p>
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### Course Content

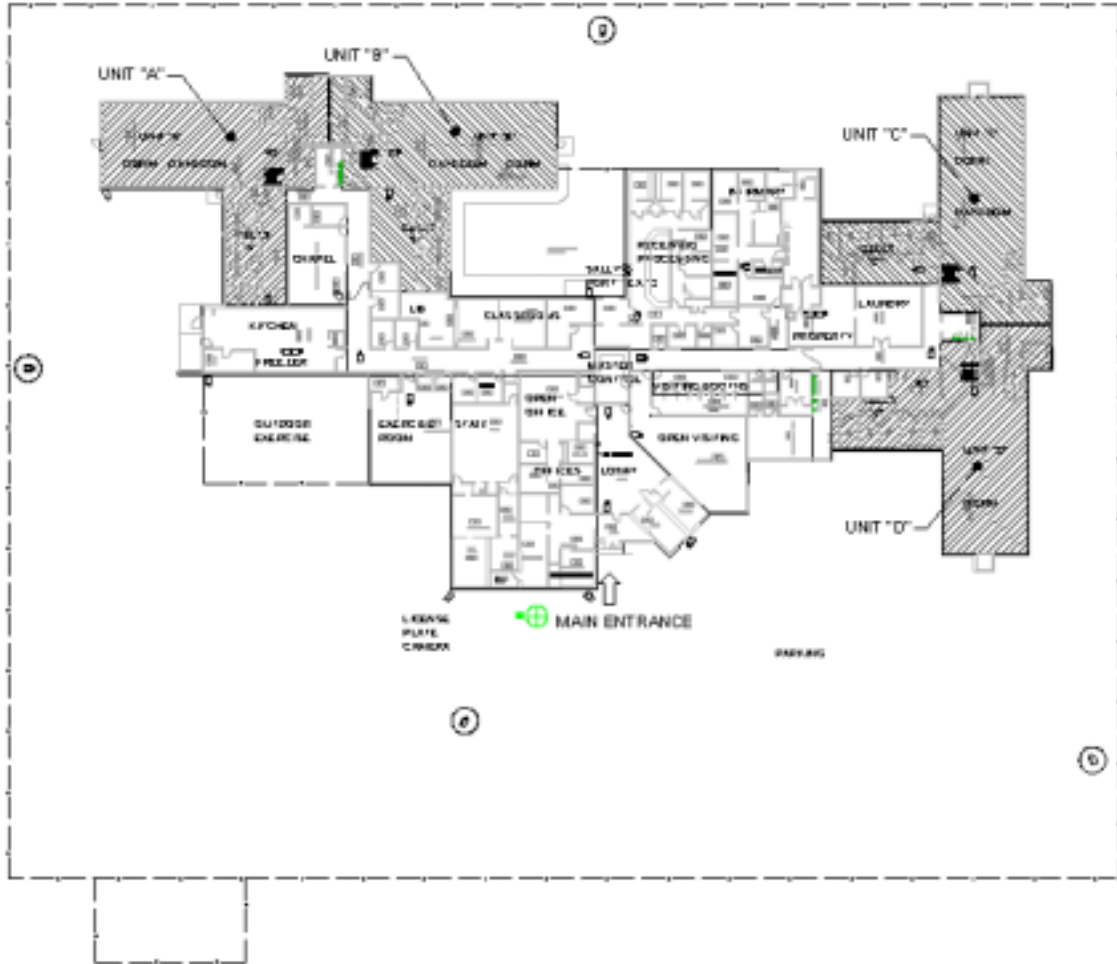
The course begins with exploration of a typical jail on a “walk-thru” basis. You will find that all jails satisfy the same set of criteria - either manually or through automation. For the most part, electrical design focuses on the automation of the essential tasks.

In the next section, we look much more closely at the electrical systems used to perform the tasks and how they are installed. It is sometimes surprising to discover the requirement for plaster ceilings in client areas as opposed to drop ceilings in the lobby and administrative areas.

In the third section, each electrical system will be presented in terms of sketches, specifications and narration.

**Walk-Thu, Jail Areas**

This is a 156-bed facility in the northeastern US. It was built in 1978. Electronic security systems were replaced in 2004 following a lightning event.



It is impossible to read most of the text at this scale. We will zoom-in to identify the spaces we are traversing. At this level, though, notice the perimeter fence, the vehicle air-lock into the fenced space and each of the entrances to / exits from the building. The circles some distance from the facility are pole-mounted CCTV Pan-Tilt-Zoom (PTZ) cameras.

narrative	<p>Jail terminology is critical, in order to communicate with the corrections personnel, the judiciary personnel and the funding personnel. A suggestion is to listen carefully to what they say and use their words whenever possible. It looks like a jail to me, but they may think it is a detention facility or a justice center.</p> <p>The individual client housing units look like pods to me, but the sample facility called them units and halls and wings are common terms used.</p> <p>A critical tool in every jail is what I call the air-lock. It is a space with a door-in and</p>
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	a door-out. The door-in must be locked before the door-out can be opened. This is a very basic plc (programmable logic controller) function which is greatly appreciated by control personnel who must operate these doors hundreds of times each day.
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When I visited this facility, the yard cameras were focused on their own roof. Several air conditioners were being replaced and the guards wanted to be sure there were no clients up there with the workers.

The driving lanes and parking spaces are not shown on this drawing. Vehicle entrance is through the sliding gates of the airlock at the lower left. The roadway goes straight for paddy wagons that deliver prisoners thru the sliding gate at the top of the walled-in space and thru the sally port airlock.

Staff and visitor vehicles enter through the same sliding gates at the bottom left, but turn right to the parking area.

This facility had trouble with the sliding gates since it was built and desperately needed CCTV observation of the entry gate.

We park and enter the vestibule to the lobby.

You are here.



Again, the fine text is unreadable, but it should be clear that there are visitor areas, staff areas and prisoner areas. The vestibule at the entrance is not outfitted as an airlock in the security sense. The lobby usually contains visitors inquiring about the visiting schedule or waiting for a

visit. There is an administrative staff area off the lobby, with no access to the prisoner area except through the airlock to the right of Master Control.

Approved visitors can enter the prisoner area through the airlock, but such passage is usually staff and sometimes vendors or technicians. Screening exists, but is perfunctory. It would not be termed high security. Visitors can enter the open visiting area by passing scrutiny of the guard station and from the open visiting to the visitor side of the visiting booths. There is a guard stationed in the open visiting area during visiting hours.

Not prominent on this drawing are the attorney visiting booths to the right of the visiting booths. They have privacy doors on the visitor side and the prisoner side.

Note that Master Control is located in the center of the facility with direct sight of critical areas, as the visitor entrance, the sally port, the processing area and the main halls. Master Control operates the visitor access airlock and the airlock entrance on the sally port. We will see later that Master Control also has supervisory control of all pod doors and the cctv system.

The north arrow is becoming more important as Federal Courts are enforcing requirements for sunlight for prisoners. Outside light sources wreak havoc on video motion detection systems.

Master Control permits us passage and we step forward into the congestion space where all halls converge. We are interested in Receiving Processing. **You are here.**

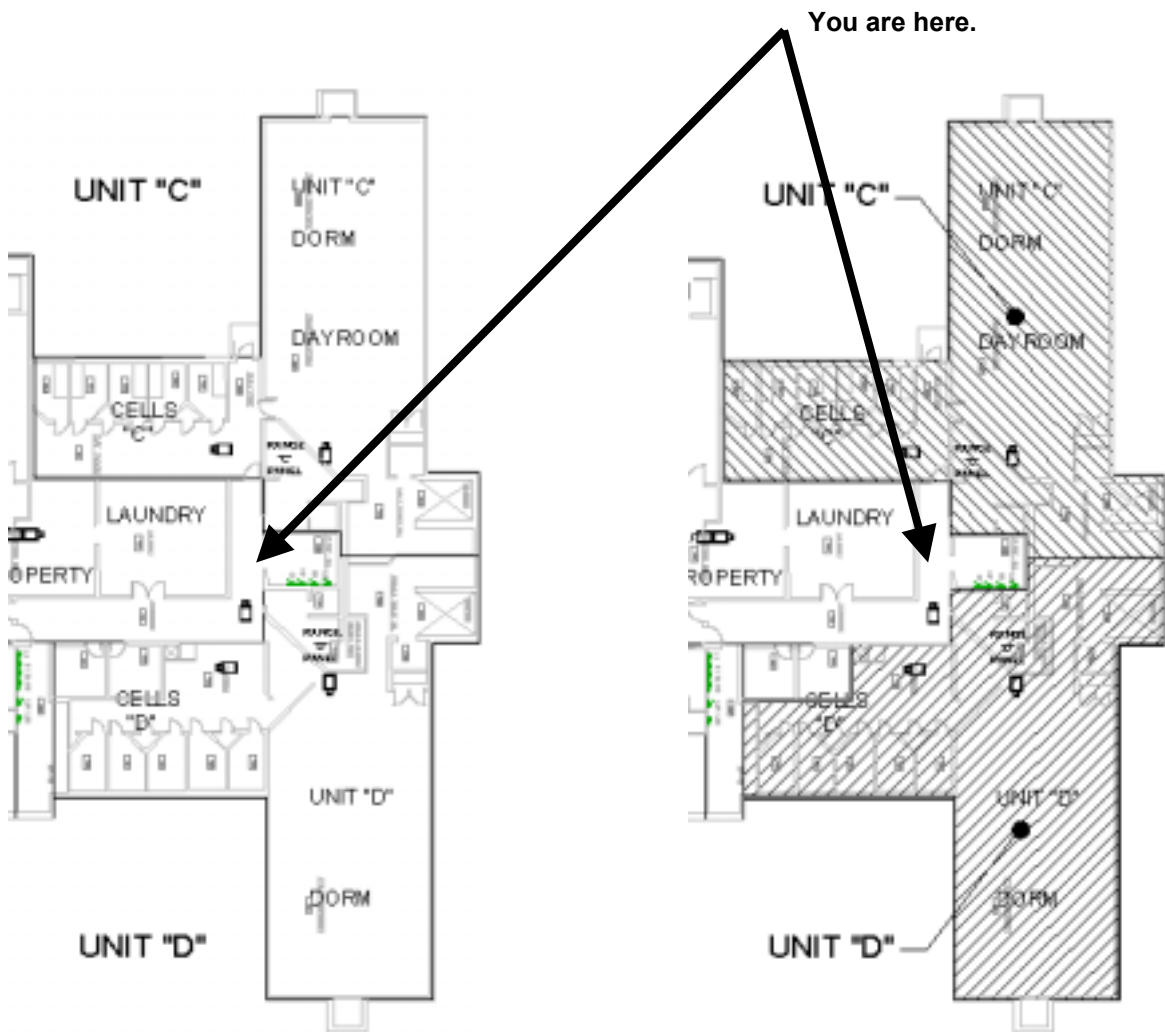


This is a very busy detail of the plan drawing. It correctly reflects the busy nature of the halls that converge on Master Control. The purpose of this view is to identify the hotel functions provided by a jail. Receiving / processing may be the most dangerous area. Some clients are new to the experience and cause delays. Some clients are very unhappy about the outcome of their recent hearing. And, of course, groups of prisoners are passing through on their way to exercise, library or chapel.

Property storage is critical to operation of the facility. In addition to evidence there are constant accusations over missing stuff. The fact that personal possessions at time of processing may become evidence means that rules of chain-of-custody apply. This means

that the lawyer who presents the evidence to the judge must be able to demonstrate that it was never left available for modification by unknown persons. The laundry is not exciting, but necessary. The classrooms will be addressed in detail later in discussions of distance learning and video arraignment. There are holding cells and examination cells for incoming processing. The infirmary has a small control room, examination rooms and a suicide-watch room.

Our guide leads us to the right, towards Units C and D.



In this facility, Unit "D" is considered high security. I was advised never to enter the area without a guard, stay back from any prisoners and not engage in conversation. I believe that there is a drafting error. Shown is a dorm, but no dayroom. The dayroom is required by detention guidelines and the dorm is considered an excessive hazard for high security areas,

due to the impaired visibility of all spaces. I believe the drawing should show DAYROOM and no DORM.

To the right of the arrowhead is a utility closet, containing locking controls electronics, cctv electronics and electric panels. Just up and to the right of the arrowhead is a pod control room, called "Range "C" Panel". It contains a locking systems panel and desk

Just down and to the right of the arrowhead is "Range "D" Panel". It is the second of 4 identical pod control rooms.

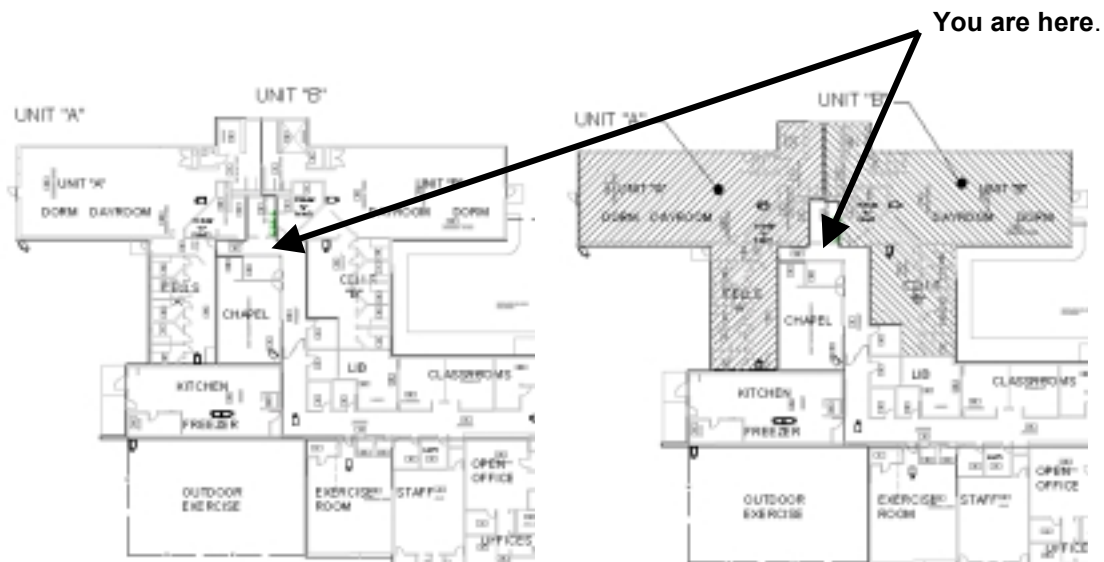
If a dorm is present, it contains bunks, similar to a barracks. The dayroom has a few extra-heavy-duty tables and chairs.

The cells are to the left, out of direct sight of the guard station. The shower and toilet are to the right of the guard station

Not apparent on the plan drawing is ceiling finishes and firewalls that extend to the roof deck. These are very important when it comes time to fish cctv, power and data cables. By detention guidelines, all prisoner areas must have solid ceilings. That means that there are locked access panels every 40-ft.

narrative	<p>Because of the difficulty of fishing cables through the ceiling space, because of the hazards inside the facility, because of the chronic funding problems and time constraints, it is common for contractors to lay cctv cables on the roof and snake them into utility rooms through HVAC roof penetrations.</p> <p>Don't do this.</p>
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We turn around, go past Master Control, and turn right toward Units "A" and "B".



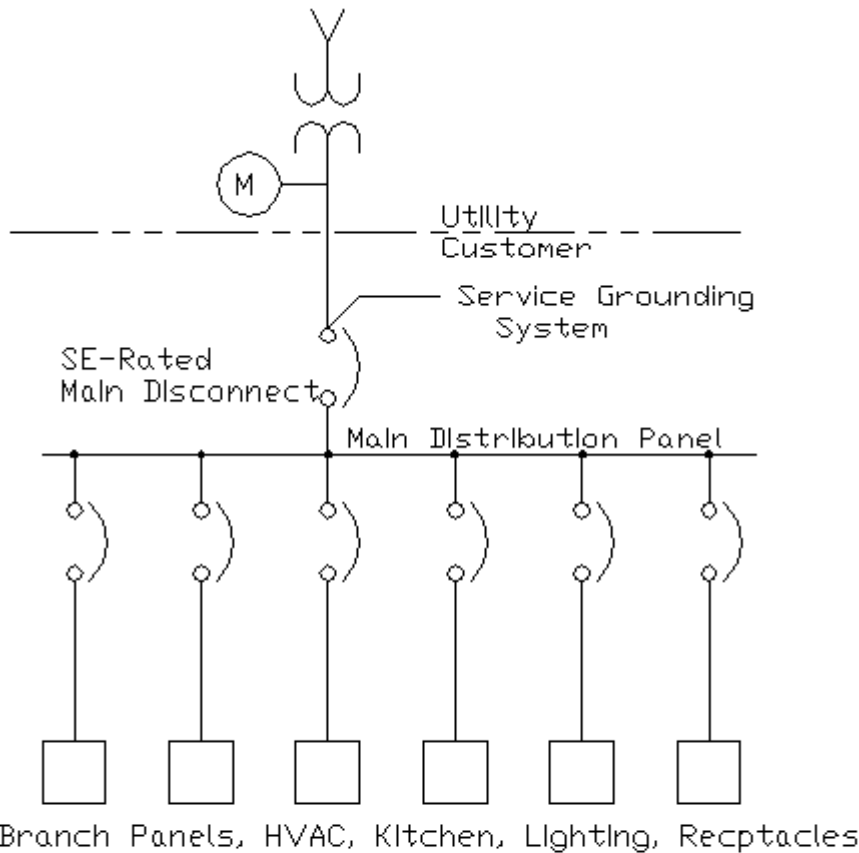
The layouts of Units "A" and "B" are very similar to "C" and "D", discussed above. Unit "A" presently houses female offenders, considered light-security. Unit "B" houses mail light-security offenders. CCTV cameras were installed in all four dormitories for the lightning renovation project, but the camera in Unit "A" has a switch. It is turned on only when the guard enters the dormitory.

This plan detail shows the Library, Chapel, Kitchen and Exercise Room. Exercise areas tend to be sites of confrontation which may lead to violence if no intervention is made. The Library and Chapel had drop ceilings, but had been used for emergency overflow housing. CCTV cameras were installed in 2004 and plans were in place for a solid ceiling.

The kitchen and freezer are shown because of the common problem of large losses of meat and food from public kitchens. Inside cctv cameras were installed in 2004 but the recommended outside camera was deferred.

### **Electrical Design Tasks**

Electrical power service for a jail closely follows the standard service for a large facility, as shown below:



Emergency Egress Lighting Provided by Local Battery Packs

### Typical Electrical Service One-Line Diagram



The electric utility brings in power at a distribution voltage, commonly 13.2kV, but sometimes 4.16kV or another value that they commonly use. The utility provides a transformer. Today, the utility normally requires the customer to provide the secondary conductors and meter box, but the revenue meter is owned by the utility. If there are current transformers for the metering, they are provided by the utility, but the contractor provides the CT enclosure.

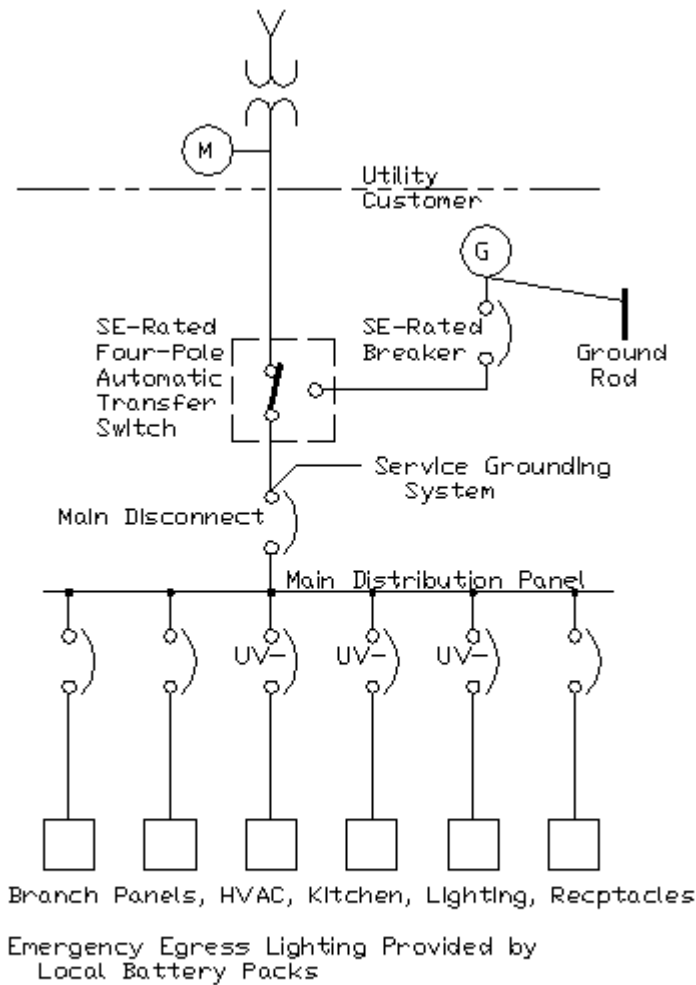
The transformer secondary voltage may be 480Y277V with additional transformation within the facility for 208V120V or the utility may deliver 208Y120V directly. Large HVAC chillers can operate on 480V or 208V with little difference in cost or performance.

The customer must provide a service-entrance-rated disconnect switch, mostly for fire department use, but also to isolate the building during maintenance. The main distribution panel protects the wiring to each of the branch panels. The branch panels provide electricity to the circuits which power devices in the facility.

The grounding system connected to the service entrance conductors and building distribution system at the main disconnect is a safety item. It is becoming more complicated with each issue of the National Electric Code, but is not a discussion topic here.

Note that emergency egress lighting is provided by local battery packs, that is, battery-operated lights which are recharged by normal power and come on automatically on interruption of normal power.

For a jail, however, the service and distribution one-line diagram should be modified as follows:



Jail Electrical Service  
One-Line Diagram

In this representation, there is no change in the utility side of the electric service. Some customers feel that they receive better electric reliability by having two different utility sources. The recent northeast power failure suggested, however, that power failures may be regional rather than narrowly local. If standby power service is obtained from the utility, then utility connection requirements must be met. They will probably not be much different that the standby generator connection shown on this sketch. There are extremely high fees for standby power service.

The automatic transfer switch and generator are essential for a jail. The generator is tested monthly (per regulations) and the transfer switch connects it to the jail main panel when utility power is lost. The design shown utilizes a ground rod at the generator for safety and a four-pole transfer switch. Each independent power source must have a service-entrance-rated disconnect. I prefer to require a SE-rated breaker on the generator because the generator suppliers try to avoid the breaker. It argues better when the SE requirement can be referenced. Of course, having both incomings of the automatic transfer switch SE-rated also meets the requirement.

UV-trips have been added to the HVAC, kitchen and general lighting panel feeders. This results from sizing calculations for the generator. Yes, you want to run the whole facility off the

generator, but a lightly loaded generator has special maintenance problems and a huge storage tank of fuel oil tends to varnish and must be treated as hazardous waste.

By having the HVAC, kitchen and general lights trip off with a power interruption and not come back until manually reset permits a smaller generator while maintaining locking systems and cctv without massive battery banks.

Electrical power distribution within a jail is identical to that for a shopping center, or school or church, with three exceptions. Locking systems, cctv and communications are life-safety items within the meaning of NFPA 70, Article 700. What this means is that serious hazard to human life results from loss of power to these systems. NFPA 70 is the National Electrical Code and is enforced by the local Building Standards department through building permits and inspections during construction. The provisions of Article 700 include totally separate wiring from non-life-safety systems and provision for a second power source when normal power is lost.

Note that emergency lighting is not included in this discussion. Emergency lighting is always a life-safety item and is installed per Code in shopping centers, schools, churches and jails. The required second power source is the battery pack.

Normal lighting for a jail environment is a special concern. There are four essential requirements. First, that it be vandal resistant, 8 or 10 gage steel with security screws, as pin/allen head. Mounting must be extra-secure, which is aided by the no-grab form. Second, that it provides no hold points for sheets to be used for suicide. (Prisoner suicide is a continuous concern. Special handicap handrails are used that are closed so sheets cannot be tied to them.) Third, lighting levels are defined by national jail standards. There is some leeway in interpretation. Fourth, that maintenance be rapid. Some units permit swap-out of a sub-panel containing the ballast and lamps with a single connector and two twist-nuts. One precinct house insisted on lamp change without entering the cell.

The catalog sheets for two manufacturers of security lighting follow:

# FAIL-SAFE®

**DESCRIPTION**

The Fail-Safe FCC Series combines maximum security construction features with energy saving technology. This corner mounted luminaire utilizes a one-piece clamshell housing, security lensing and tamper resistant fasteners to maximize impact resistance and prevent contraband concealment and unauthorized fixture penetration. U.L. listed and C.S.A. certified for wet locations.

**APPLICATION**

The FCC Series is ideal for confinement/security applications. Suitable for use in inmate cells, psychiatric wards, secure corridors and general population areas.

**SPECIFICATION FEATURES**

**A---Lens**

Choice of prismatic acrylic, prismatic polycarbonate or prismatic tempered glass on fixture side, clear polycarbonate or clear tempered glass on environmental side.

**B---Housing**

Clamshell design combines die-formed 12 ga., 14 ga., 16 ga., or 18 ga. CRS body with continuous welded and ground ends to form a one-piece, seamless, doorless housing which maximizes impact resistance and prevents contraband concealment and unauthorized fixture penetration. Standard white high reflectance polyester powder coat finish. Glass: 85%; Reflectance: 92%; Hardness: 2H; Salt Spray: 500 Hours.

**C---Fasteners**

Stainless steel tamper-resistant TORX® screws are standard. Allen-head screws with center reject pin are optional.

**D---Lamps**

(By Other)

**E---Lens Retention**

Lens secured by thru-studs and vertically adjustable internal CRS hold-downs.

**F---Hinge**

Continuous, concealed piano hinge (1/8" dia. knuckle) with welded pin end to prevent removal.

Catalog #	Type
Project	
Comments	
Prepared by	Date

**G---Backplate**

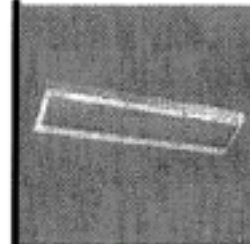
Die-formed CRS backplate forms an in retrievable blade trap to prevent contraband concealment (gauge to match housing.)

**H---Ballast**

Standard Class P, CIMMETL ballast.

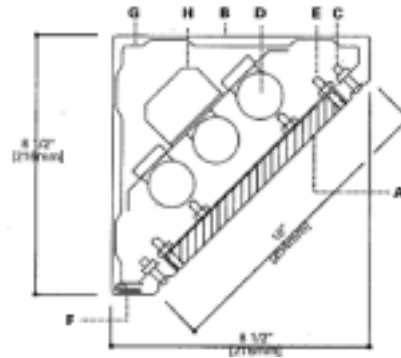
**Labels**

U.L. listed, C.S.A. certified, standard wet label.



**FCC**

**13 W - 120 W**  
Fluorescent  
**ULTIMAX CORNER LUMINAIRE**



Jail Lighting Fixture, see <http://www.cooperlighting.com/specfiles/productinfopdf/FCC.pdf>

## Mighty Mac®

CC Series  
 Corner Mount/Surface - Compact/Linear Fluorescent  
 Nominal 9"X12", 9"X24", 9"X48"



### Lighting for Security Detention Applications

#### Specifications

**Housing:** One-piece die-formed prime grade material as specified – see ordering information. Corners continuously seam welded and smooth with no post grinding (TIG). Clamshell housing resistant to penetration and contraband concealment.

**Baseplate:** Prime grade material as specified – see ordering information. Die-formed blade trap (1/4" minimum) prevents contraband concealment and access. Embossed standoffs prevent distortion.

**Hinges:** Continuous heavy gauge piano type hinge (1/2" knuckle/1/8" diameter pin). Pin secured to knuckle. Hinge welded to housing and mounts to baseplate via keyholes.

**Lens:** As specified – maximum thickness .875" – see ordering information.

**Lens Retention:** Vertically adjustable continuous "Z" brackets – prime grade material. Secured to housing via thru-studs.

**Fasteners:** Hardened security screws as specified – see ordering information. Fully recessed.

**Finish:** Urethane powder coat – 5-stage iron phosphate pre-treatment. Reflectance: 92%; Gloss: 85% (minimum) at 60°; Hardness: 2H; Salt Spray Test: 1,000 hours.

**Lamps:** Quantity and type as specified – see ordering information. Lamps supplied by others.

**Ballast:** Quantity and type as specified – see ordering information. All ballasts UL listed class P and ETL/CBM certified. Optional removable reflector/lamp/ballast tray with quick disconnect.

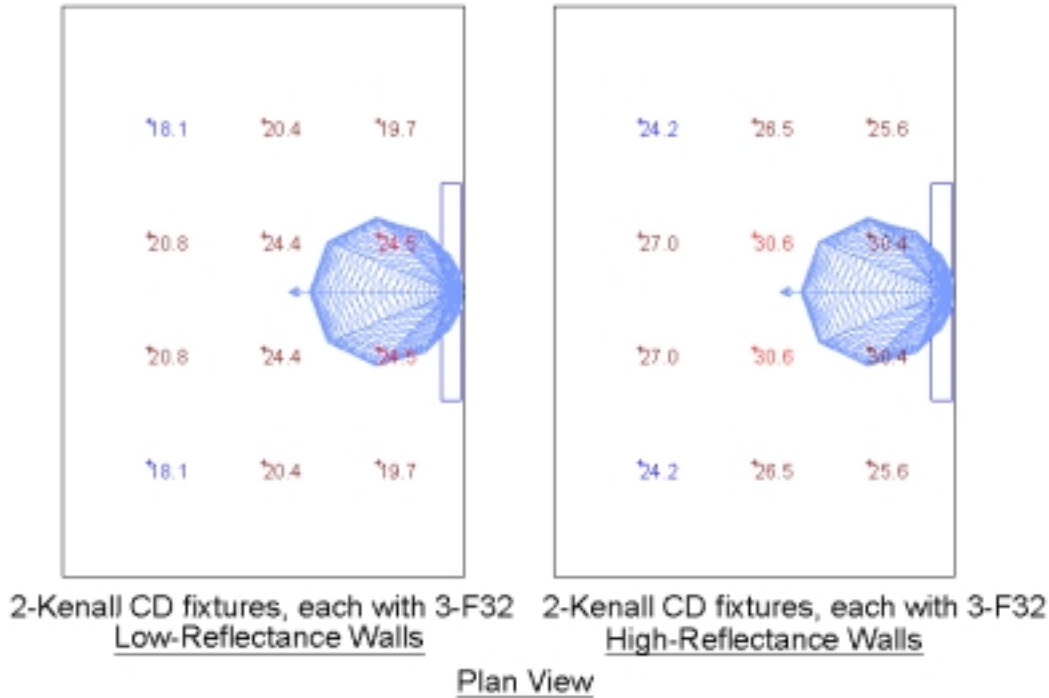
**Luminous Seal:** Polyurethane foam prevents light leaks from luminaire base.

**Listings:** UL listed for damp locations. See ordering information for wet location applications.

**Installation:** Fixture not suitable for Surface Conduit or Continuous Row Mounting.

**Jail Lighting Fixture, see <http://www.kenall.com/catview.asp?pn=&cid=50&pid=302&bc=Off>**

There is very little choice in type and location of cell lighting. Center-ceiling, Corner-wall-ceiling and corner fixtures are available. I like the Corner-wall-ceiling because they are extremely robust and give acceptable light levels and distribution. Below are the distributions for an installation of two fixtures per cell, each with 3-32 watt linear fluorescents. Compact fluorescents are very popular to this application, as well. The particular fixture shown has a speaker grill option which simplifies the overall design.

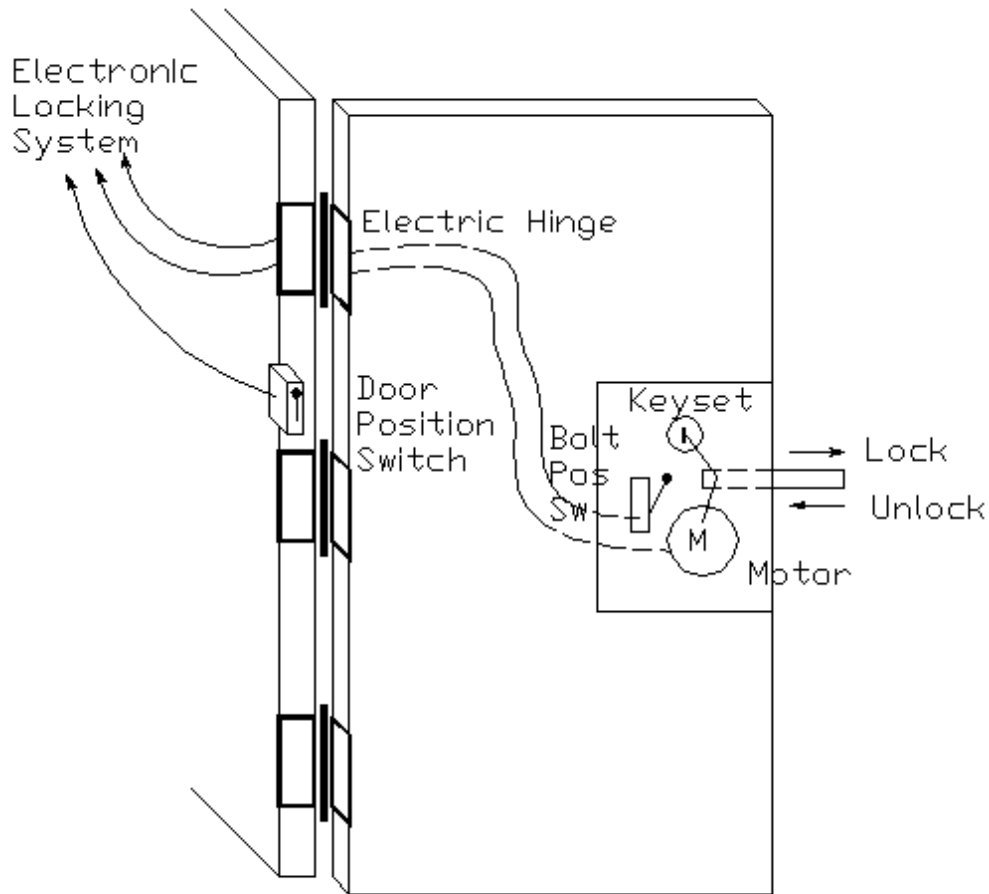


Today, almost everyone is aware of the problems of a momentary interruption of power, such as when the jail is transferred from utility source to generator source. Every computer re-boots, unless it has an uninterruptible power source (UPS). Locking systems have a computer; new cctv systems have a computer. Communications systems may have a computer.

Locking systems provide the best control at the facility. While they are intact, problems stay within the jail. Locking systems should be designed for primary mechanical locking and supervisory electrical locking. That means that the right key will always lock or unlock the door. The motor can be used to lock or unlock it from a control room. Motorized locks fail in their last position, but fail-safe and fail-secure options are available. The bolt position switch will not report status without power and the computer and the door position switch will not report status without power and the computer. The prisoner areas should be safe, from the mechanical side of the locks, but the Control Room(s) will not have indications of status. Also, it has been observed that the mechanical locking may not be reliable, making the status indicators more critical, if that is possible.

Selection of mechanical locks is an architectural responsibility and there are many other forms and options than indicated here. To follow-up, see the Folger Adam catalog at <http://www.southernsteel.com/catalog-form.shtml> .

The form discussed is illustrated below:

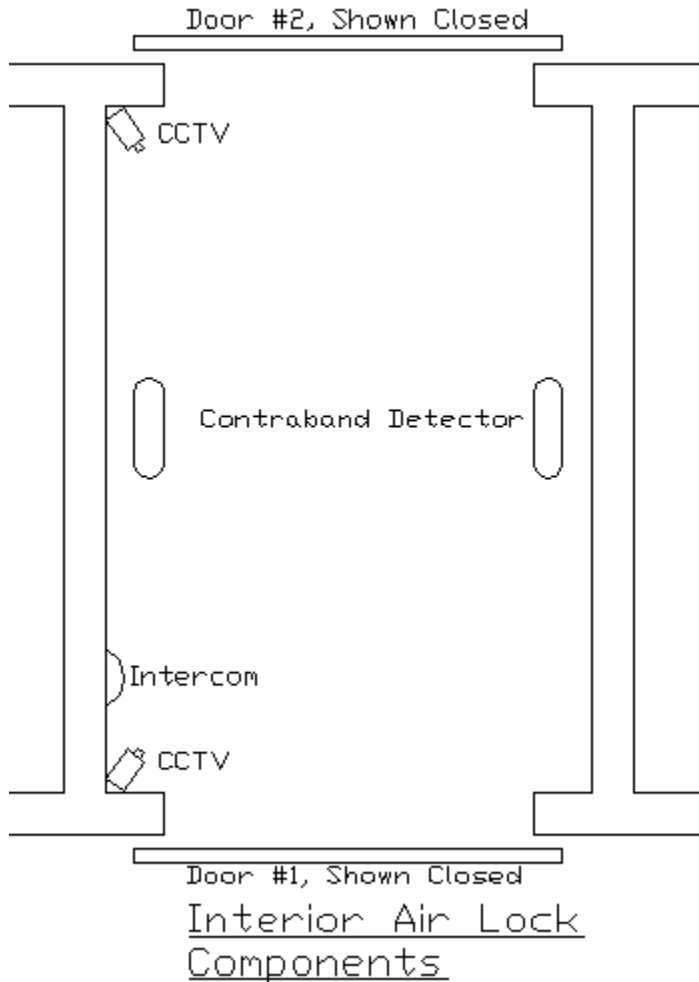


### Motorized Lock Components

Application of life-safety egress rules is an architectural responsibility. However, it is common to have an electrical renovation without an architect on the team. First choice is to consult an architect to make sure that the immediate job complies with current rules and interpretations. Second choice is to replace existing system in a way that duplicates original design intent.

Common interpretation of life-safety egress rules by architects I have spoken with and the interpretation of high-level administrators in correctional institutions is that we keep the doors locked during an emergency. If prisoners must be evacuated, it will be a conscious act of control room officers and local officers with keys. There will be no automatic release of locks. This is consistent with the design basis that locking systems are life safety systems and an officer will be on duty 24/7.

Airlocks have been mentioned previously, but now is the time to discuss the components and sequence of operation.



In this simplified sketch, the drives for the doors are not shown, nor the position switches nor safeties. Each door has an independent drive. The cctv cameras are to permit the operator to proceed with providing passage or to interrupt the procedure if something appears amiss. The intercom speaker permits the guard to communicate with the visitor.

The contraband detector may be as simple as a metal detector, or may incorporate the newer drug and explosive sniffing devices. (There are government grants available for the more advanced devices.)

#### Air Lock - Sequence of Operation

- 1) The visitor requests entry. The guard requires identification and sign-in.
- 2) The guard presses the "Door #1 OPEN" button. Door #1 opens. Door #1 status light goes RED.
- 3) The visitor enters through Door #1.
- 4) The guard presses the "Door #1 CLOSE" button. Door #1 closes. Door #1 status light goes GREEN.



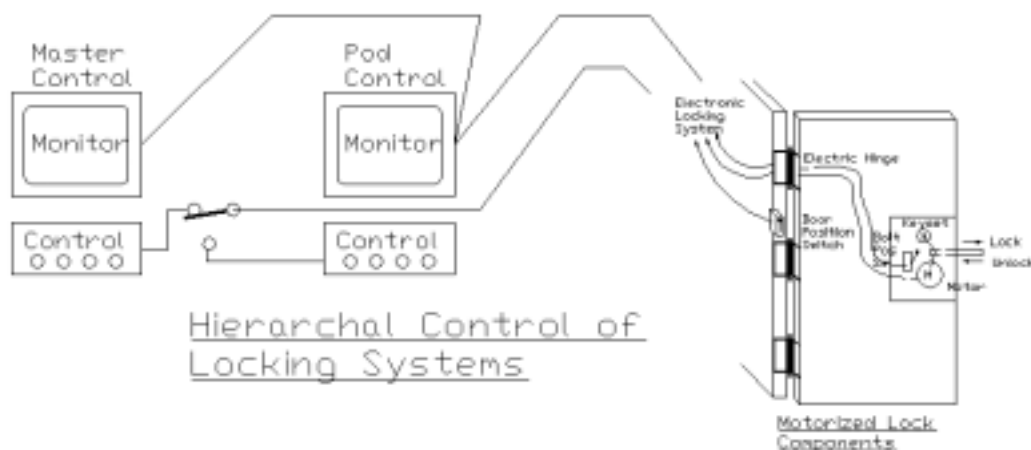
- 5) The visitor passes through the contraband detector and no alarm rings.
- 6) The guard presses the "Door #2 OPEN" button. Door #2 opens. Door #2 status light goes RED.
- 7) The visitor exits the air lock through Door #2.
- 8) The guard presses the "Door #2 CLOSE" button. Door #2 closes. Door #2 status light goes GREEN.

When there is one door and one guard booth, it is simple. But, when there are multiple doors, some cell doors, some to connecting halls and some outside. And when there are individual pod control rooms and a master control room. Things become complicated.

A simple, obvious and very functional approach is hierarchal control, with only one panel in control at a time. For our example, the local pod control panels normally operate the cell locks and the connecting doors to the halls. They do not have control of the outside doors, but there are keys available which can override the electric locks (and initiate an alarm to the master control room). The local panel has a green light to indicate that it is in control

The local pod can initiate transfer of control to master control by hitting a prominent DURESS button. This sounds an alarm in Master Control. Local buttons no longer work. Master Control can open or close the cell hand hall door locks. Master Control can transfer operation back to the pod after communicating with the pod. All transfers are logged on the event recorder function of the plc/hmi system (programmable logic controller / human-machine interface).

Without pod control participation, Master Control can take operation. Local buttons no longer work. A local alarm is shown. Master Control can open or close the cell hand hall door locks. Please review the following graphic which demonstrates the concept. In fact, all physical switching is performed via logic in the plc.



What happens when there is an alarm has been pretty much codified over the years. An alarm switch closure is received. The event is logged to the archive for later review, it is displayed on the console, it may, or may-not sound an alarm.

The operator presses an ACKNOWLEDGE button. The alarm indication goes from flashing to solid-on. The sounder stops. The action is logged.

The operator presses a RESET button. If the alarm contacts have returned to “not alarm”, then the solid light goes off and the system is ready to receive another alarm. The action is logged.

If the contacts are still in “alarm”, then the solid light stays on. It is considered bad form to have anything in alarm when operation is turned over at shift change.

It may not be obvious what is an alarm. Obviously, if someone in the pod presses the EMERGENCY CALL button that is an alarm. But, also, when the locking system command is given to lock a door and the BOLT FULLY EXTENDED limit switch does not make within 5-seconds, that is also an alarm. The HMI should have built-in routines which can be invoked for this type of logic failure. This course is not directed towards details of system programming, but rather towards aiding the writing of performance specs and acceptance testing.

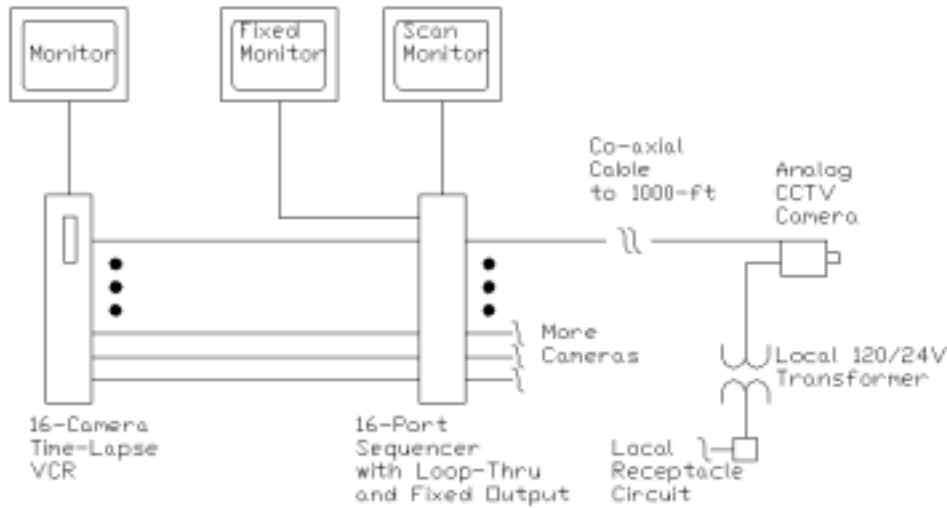
Until very recently CCTV meant analog cameras, analog signals and mechanical and electronic switches. There were three specialized devices for jails - video sequencer, video multiplexer and time-lapse video tape recorder. Analog signals are inherently low-resolution, to be compatible with commercial tv standards. The sequencer stepped through a series of cameras, with adjustable dwell time for the picture and a hold button to stop the stepping or select a single camera.

The multiplexer, called a quad, put multiple images on the screen at the same time. Four images were available at first, hence, the name quad. Today, nine, sixteen and twenty-five images can be displayed. As with the sequencer, the screen can be used for a single image by pressing a button.

The time-lapse videotape recorder (vcr) has been around for twenty years and people are buying new ones daily. Record a little; wait a little; record a little; wait a little. it works, but, as the tape wears, the picture deteriorates. 24/7 operation gives a tape a six-month life, at most.

Analog cameras require power, which has been supplied from local receptacle circuits near the camera. Typically, all cameras are brought back to a common point, then a sequencer and time-lapse vcr make an economical archive. For jails, controlling access to the vcr is critical so that images can be used with a judge, if needed. This is called chain of custody. The person who presents the tape to the judge must be able to swear that the tape was never left lying around so that unknown persons could erase or modify it.

The following sketches graphically represents surveillance analog cctv.



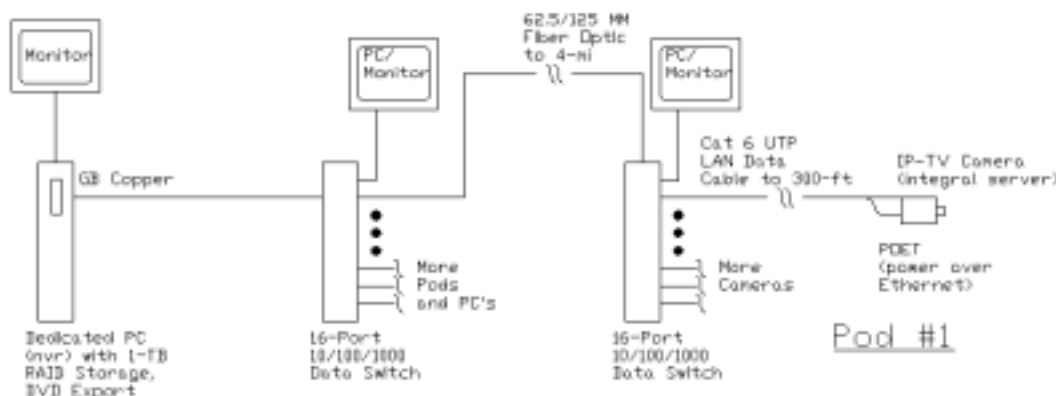
### Obsolete Analog Surveillance CCTV System

narrative	<p>There is a very strong component of personal preference in the annotation “obsolete” above. All products shown have evolved to very reliable, functional items. The camera is now digital, with a digital-to-analog convertor to transmit the signal down the co-ax. The Sequencer is a digital switch, often incorporating quad function, as well and, often, 8 individually controllable monitor lines. The VCR is a DVR, with computer hard drives over 1TB.</p> <p>There is a separate PDHonline course which compares analog and IP-TV systems.</p>
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The VCR is a DVR, with computer hard drives over 1TB.

Pelco offers a complete range of analog and a good entry selection of IP-TV gear, along with excellent tutorials. See <http://www.pelco.com/support/vsi/> .

A considerably less-expensive IP-TV digital system is graphically presented below:



### 2006 Digital Surveillance CCTV System

A criticism of the analog cctv system is the local power source. The digital system, shown here, sends power from the data switch directly to the camera, over the same data cable. Reliable power must be supplied to the data switch to achieve the reliability improvement, of course.

Copper LAN cable is shown between the camera and the data switch. This is reasonable for pod and main building internal surveillance, but fiber optic (with separate power conductors) is used for distant cameras, up to 4-mi, without special effort.

A sixteen-port 10/100/100 data switch is shown. They are available in 8-port, 24-port and 48-port sizes and can be stacked, if needed. Cost, today is about \$100 for the 16-port. A fiber-optic convertor costs \$50 or can be incorporated in the data switch for about the same cost.

62.5/125um multi-mode fiber optic is almost standard. Every thing about it is off-the-shelf. Use a 6-strand cable. Two are required for a LAN data channel and 4 are spare.

The PC/monitor is an off-the-shelf pc, usually Dell. The only question is, "How many can you buy for \$1,000?" The cameras can be monitored with Internet Explorer and sequencer and quad functions are available via no-cost utilities. Several products will deliver usable images to a wireless personal digital assistant (PDA). In order to view archived images, client software compatible with the particular nvr must be used. It can be \$250 per seat.

The network video recorder (nvr) costs about \$5,000. Present models are limited to 16 cameras, so you will need multiple units. The nvr functions as a complete monitoring station, but this is normally limited to set-up and maintenance. The nvr is usually locked away and accessed only for exporting large quantities of data. Reasonable quantities of images and recorded sound can be exported to any pc on the network which has full-capability client software and user password of the appropriate level. Note that high-end surveillance software applies a watermark to images so that they cannot be manipulated without alarm. This aids chain-of-custody procedures, as discussed in the time-lapse vcr section and in the incoming processing / property storage section of the facility tour.

By the way, because of the 16-camera limitation presently in effect, you will need a rack of nvr's. Current client software permits simultaneous access to all units and it takes about 5-minutes to swap a failed unit for a spare.

Connection of the cctv surveillance data network to an administrative data network or to the internet is not recommended.

The reason we must discuss motion control of surveillance recording is that this function brings us valuable documentation of persons being where they should not be. Also, the technology has some limitations, which should be recognized.

Time-lapse video works. It takes a still picture about once a second. You can rapidly go through recordings from a camera and identify when someone passed a door, used an ATM or broke a window. The problem is that time-lapse recording uses a lot of space when no one is in the picture. Also, the time scanning through 24-hr of photos to find a person in one or two is tedious and prone to error.

One solution is to hook up a motion detector to the recorder and take pictures only when there is someone there. This is commonly done and will be discussed in the next section. However, as

both the cameras and recorders evolved into computers, it became easy to detect light level changes in critical parts of the image.

This feature is today a commodity. IP-TV cameras can identify when motion is present and send an alarm or send an e-mail to a stored address, with a copy of the picture.

Computer-based digital video recorders and network video recorders can identify when motion is present and start high-speed recording of the events, note the action in the event log and send and e-mail to a stored address, with a copy of the picture.

The problem is false alarms. A cloud passing in front of the sun will trip an alarm in an empty room with a window. Sometimes air from a register can trip an alarm. You probably don't want e-mails and photos of these events. There are sensitivity and critical area adjustments on some units, but there are many false alarms on video motion detection. Video is just too precise to do the screening for you. The goal of reduced storage, however, is easily met. 1TB of storage will hold 16 cameras for 30 days of 24/7.

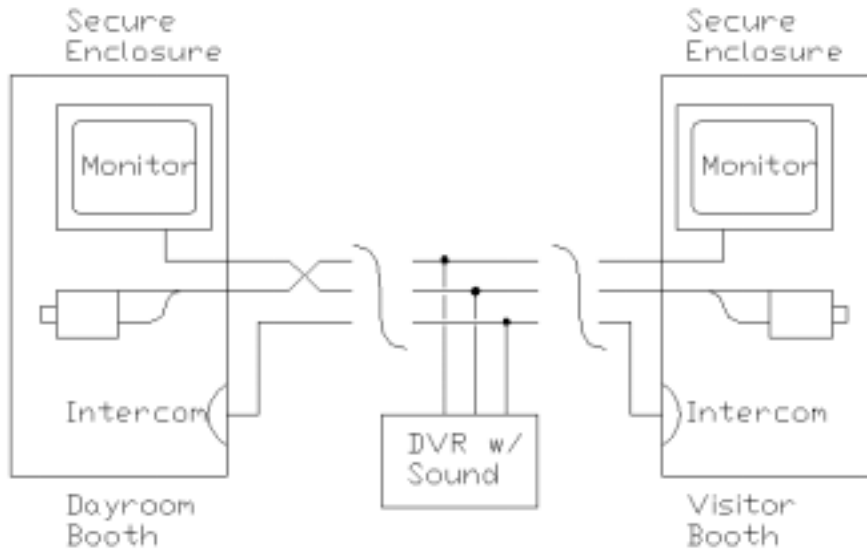
The concept was just introduced of using a stand-alone PIR motion detector to trip the dvr or nvr into high-speed recording. Works well. In addition, the contact-closure alarm can be used to swing a PTZ camera to look closely at whatever is in front of the PIR detector. As with motion detection, the dvr or nvr can e-mail the alarm and a copy of the photo.

The problem is the basic problem with all PTZ cameras. They give you an excellent photo of what they are pointed at. They show you nothing of the other 359-degrees in their field of view. If you have two motion detectors and one PTZ, you may get a picture of one of the events, or you may get a picture of the other event or you may get a picture of a bedroom in the apartment house 2-mi away that the guards normally look at. A fixed, wide-angle camera will show both events, but not give you identification features if it is a person, not a raccoon (read "armadillo" for southern states).

Some localities provide distance learning for prisoners. This used to entail special telephone connections and equipment. Today, any pc on the internet is a distance learning station. All of the caveats on using the internet apply along with special warnings for jail situations. Distance learning works well when there is a guard present. Nothing beyond and internet connection is required from the electrical design. By the way, the almost universal connection scheme for data lines is to plug the remote line into a switch in the data closet. When the distance learning is not being used, the line can be disconnected from the switch and no damage will be done to the network until use of distance learning is again attempted.

Video arraignment is an option of the judge. Many judges feel that the resolution of standard analog video is satisfactory to permit the prisoner and the judge to adequately communicate. Two IP-TV cameras with audio provide a very easy, inexpensive means of providing this service. The camera costs about \$1000. The session on the judge's end is initiated by his bailiff, who accesses the jail camera over the internet. The session on the jail end uses a space with a permanently installed camera and pc, initiated by a guard. When it is working, the judge talks to the prisoner. The session can be recorded by a surveillance nvr or by low-cost nvr software on one of the pc's.

Video visiting is normally handled by visiting booths in the pod dayroom. This eliminates travel through the facility and releases one or more guards. Analog hard-wired cameras and monitors can be used or IP-TV cameras and pc's. Both can be recorded. The following graphic illustrates the concept.:



## Analog CCTV Video Visiting

Federal law limits audio recording when the persons involved have reason to expect that their conversations will remain private. Some corrections officials interpret the basic jail situation to be that no one should expect their conversations to be private. On the other hand, a low-key but prominent sign, "Video and Audio Recording in Effect" solves the problem unequivocally.

Most dvr's and nvr's include audio recording capability. Often extra pc cards must be purchased. In addition, there are firms specializing in correctional institution audio, who offer both simple and sophisticated audio recording systems. See <http://tskcom.com/pages/8/index.htm> .

Lawyer-client conversations should not be recorded unless you have clear direction otherwise, legibly signed and dated.

Vandalism is always a concern in jails. If a malefactor can sufficiently damage the light in his cell, he can knock out all the lights on that circuit in the pod. It is desirable to be able to remotely turn off individual lights and isolate them from the power panel. Modular cell manufacturers can include this feature in their products, or individual control relays can be installed in the utility space behind the cell. A very nice general-duty control relay that mounts on an electric box can be found at [www.functionaldevices.com/](http://www.functionaldevices.com/) . Their RIB (relay in a box) product is available with multiple contacts, multiple voltages and external override/test switches.

If a malefactor can sufficiently damage the water supply line(s) in his cell, he can cause considerable damage and may require operation of a pod shut-off valve to interrupt the damage. As with the lights, it is desirable to remotely turn off the water to a cell and isolate it from the distribution system. Again, modular cell manufacturers can include this solenoid valve or it can be installed in the utility space behind the cell. a very nice general-duty control solenoid valve can be found at [http://www.ascovalve.com/products\\_detail.asp?detail=solenoid\\_data](http://www.ascovalve.com/products_detail.asp?detail=solenoid_data) . Use with an RIB permits override and testing with little complication.

Cell lighting and water control are usually handled by a supplementary page on the locking systems HMI. Similar to tabbed spreadsheets or drill-down user interfaces, the controls are always available, but do not intrude on daily operations.

The electrical designer may be the only representative of the courts system and the jail administration and the IT department to talk to the Architect about the need for data entry, local database and access to the courts data base. This is important because it can be central to the incoming processing area of the facility. Space must be reserved for terminals, Prisoner delivery can be expected to stop completely while forms are filled out and, of course, power and data lines and receptacles must be made available.

The interface to the courts database is becoming more important and may require a lot of attention and coordination with IT administrators and technicians. Judges don't like to lose prisoners. They want to be able to find out where they are, especially when in transit. On the other hand, judges are very protective of their databases. Again, lots of attention and coordination with IT administrators and technicians by someone.

The essential network requirements are terminals a local database server and interface with the courts database. The essential local database requirements are prisoner identification, property identification, status and location. It can be extremely valuable to have access to state databases which report the prisoners criminal record.

A related topic which should be addressed is remaining data networks. The internet or a closed governmental network may be used for video arraignment. The locking system requires a data network to connect remote input/output clusters with the processor and with the HMI screens. CCTV surveillance is a dedicated data network, even if the present system is analog, the new high-resolution digital PTZ cameras are going to be installed to handle special needs. E-mail for internal distribution of information works very well in almost all employment situations.

Should these networks converge to become a single, common network? In 2006, we say, "No." We want locking systems to be 100% reliable and untouchable by anyone except the guard stations. We want video surveillance to be very secure. Governmental bodies are reluctant to share internal e-mail access because of the distractions from core business (complaints and information requests intended, but malicious and simply irritating spam exist). Only a very sophisticated common network could combine these needs. Sophisticated means you can't find anyone to fix it.

Visitor management means identifying and tagging everyone who enters the facility. It is a turn-key function, usually costing about \$20,000 plus supplies. It requires additional staff or more duties for existing reception staff. As applied to true visitors, it makes very good sense for a jail, especially if combined with an airlock with contraband detection equipment. For the prisoners, it

makes some sense and is being widely discussed, especially by vendors. For staff, it makes very good sense.

The result should be a real-time display of who is where and archived information of who was where, when.

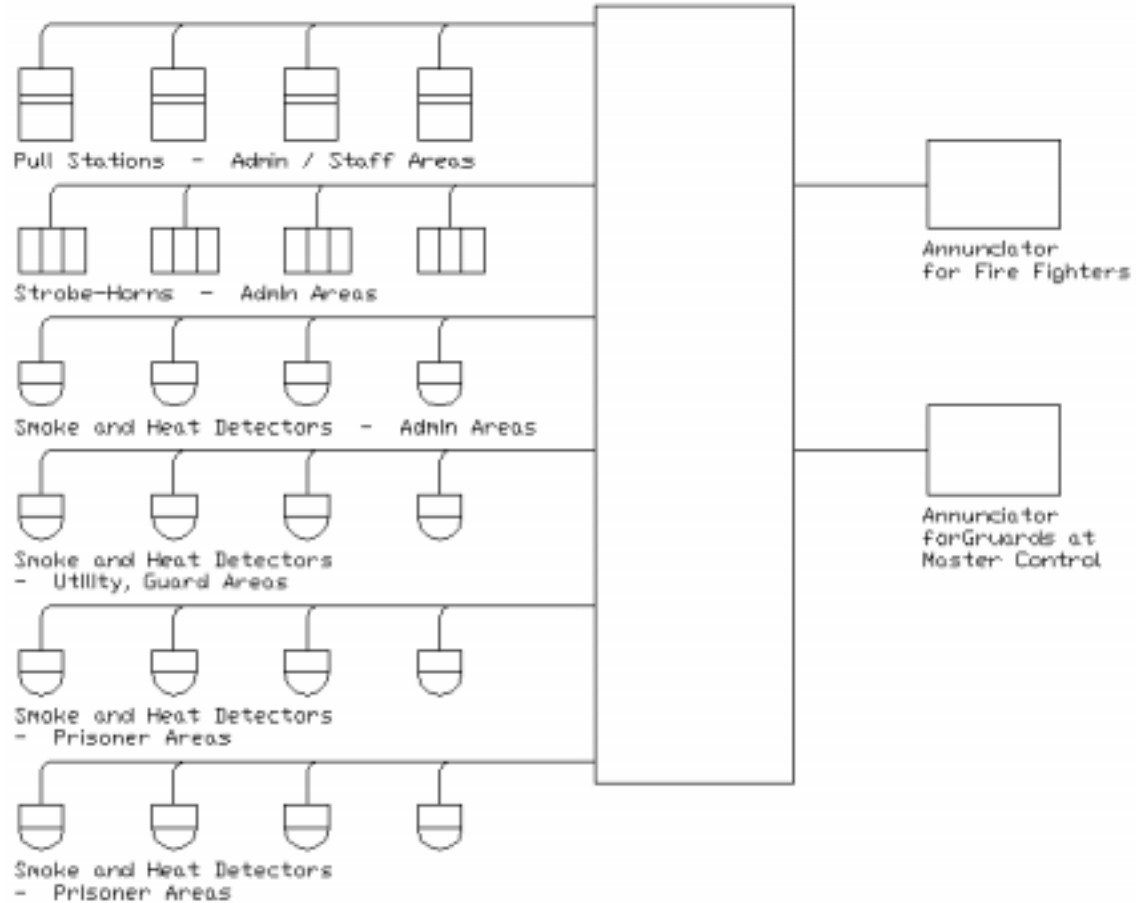
narrative	Rest homes hate to lose their residents in much the way jails hate to loose prisoners. The rest homes are adopting RFID bracelets. The rest home residents fight diligently to remove them or destroy them. At this moment in time, the residents are wining. This does not bode well for jail RFID bracelets.  The UPS delivery man and Simplex repair man have not objected.
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A jail fire alarm system is almost identical to a commercial fire alarm system. All the components are the same. The differences are in the connections and the programming of the controller. Firstly, commercial fire alarms unlock egress doors. Jail fire alarms do not.

Secondly, commercial fire alarms go into alarm in zones and for the entire facility. Jail fire alarms may do this in administrative and office areas, but not in prisoner areas. The guard rooms and intercoms deliver and evacuation information, at the same time as they unlock the outside doors. It is most common to evacuate to another area of the jail rather than to outside.

Some localities like to have smoke and heat detectors of the fire alarm display on the locking systems graphic. Since this is the normal focus of the guards, it makes good sense, but may make the graphic busy. A good alternative is to have a remote annunciator for the fire alarm next to the locking console. I like LCD text annunciators but salesmen like LCD graphic displays. They hate engraved plastic graphics with LED indicators.





Jail Fire Alarm System

narrative	<p>True story. Kid knocks down a cook and runs into the kitchen at the juvenile detention center. Kid pulls trip on chemical fire suppression system over the grill. Dumps nasty powder in the kitchen.</p> <p>Kid runs down the back steps to the loading dock and out the building. He made it out of the facility because the back gate was open and the guard was watching a truck trying to back in.</p> <p>Now, the cook has to lock the kitchen door when he goes into the dining room.</p>
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Return to PDHonline to take the quiz.