



PARTICIPANT HANDBOOK



Electronics

Language:
English

CCTV INSTALLATION TECHNICIAN

CCTV INSTALLATION TECHNICIAN



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Preface

This book has been written with the idea of assisting trainees with proper knowledge of CCTV installation. As a profession, a CCTV Installer needs to know different types of tools and cables for proper CCTV installation. A theoretical knowledge of the installation precautions as well as team coordination can ideally provide a strong support to the trainee in this sector.

This book includes concise knowledge of different tools, cables, safety rules and procedures that applies to CCTV installation in India.

All of these mentioned above, and more have been covered in the book.

General Instructions to Trainee

1. Greet your instructor and the other participants when you enter the class.
2. Always be punctual for every class.
3. Be regular. Candidates who fall short of the required attendance will not be certified.
4. Inform your instructor if, for any reason, you need to miss class.
5. Pay attention to what your instructor is saying or showing.
6. If you do not understand something, put up your hand and seek clarification.
7. Make sure you do all the exercises at the end of each module in this book. It will help you understand the concepts better.
8. Practice any new skills you have learnt as many times as possible. Seek the help of your Trainer or co-participant for practice.
9. Take all necessary precautions, as instructed by your Trainer, while working with electricity and with tools.
10. Make sure you are neatly attired and presentable at all times.
11. Participate actively in all the activities, discussions and games during training.
12. Always take bath, wear clean clothes and comb your hair before you come to class.
13. The three most important words you must always remember and use in your daily conversation are PLEASE, THANK YOU and SORRY.

Chapter - 1

Visit Site and Understand Customer Requirement

(ELE/N4609)

Learning Outcomes:

After attending the session, the trainees would be able to:

- Analyze about CCTV Camera requirement
- Evaluate the types of CCTV Cameras
- Analyze the preparation of field and site for camera installation
- Analyze the digital criteria for camera installation
- Evaluate the precautions to be taken while handling field calls

Pre Session Activity:

- This activity is in the form of “Group Discussion” session.
- The Trainer will ask trainees to share their idea about surveillance and how CCTV camera can help in this.

Unit 1.1: CCTV camera installation requirement

Unit Objectives:

At the end of this unit, students will be able to:

- Evaluate the equipment/ basic requirements for CCTV set up
- Analyze operational requirements
- Segregate the tools needed for CCTV installation

CCTV cameras are used extensively since these are highly effective in preventing crime. These cameras are like perfect spies that are able to capture and show more than what meets one’s eyes. Often the nitty-gritty of a crime site is revealed by investigators due to these CCTV cameras that provide all important clues to get hold of the culprits. However, a CCTV setup is actually required to prevent crime. The very presence of a CCTV camera and it being noticed by a stranger convey a message to the person.



Equipment, system, tools, applications appropriate for a particular site

The following are the basic necessities for setting up CCTV:

- **CCTV Connectors:** These are used for the need of terminating CCTV cables in installation for surveillance camera. High-end connectors are used to obtain weatherproof service without any trouble.



- **CCTV Wire and Cable:** Used in different CCTV applications in order to have the CCTV cameras connected to the Digital Video Recorder. The use of CCTV Wire and Cable will depend on the type of application.



- **CCTV Ground Loop Isolators:** This is a device, has a Ground Loop Interference reduced with the help of CCTV signals and also it can be easily installed in a new system or one of the existing systems.



- **CCTV Camera Housings:** These are required for internal as well as external CCTV camera installations, though the use for exterior installation is more, in order to protect from elements. These are required for encasing the CCTV setup for both internal and external installations.



- **CCTV Mounting Brackets:** CCTV Mounting Brackets are used for a wide array of products like the CCTV camera housing, CCTV cameras and CCTV monitors.



- **CCTV Power Supplies:** Along with the CCTV Power Supplies, Converters and Battery Packs are used for the purpose of CCTV Camera installation as well as mobile cameras, hardwiring and also for converting a camera of 12 VDC to 24 VAC of power supply.



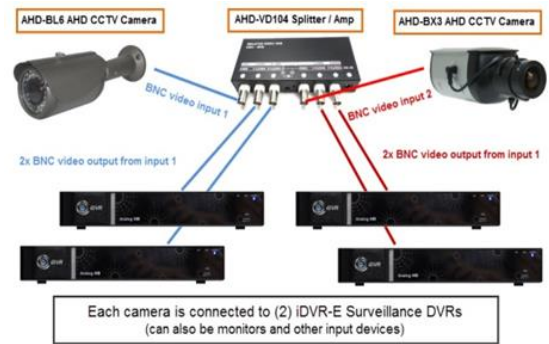
- **CCTV Surge Protector:** A key element for safety and protection of assets is the CCTV security system during CCTV operation. Unpredictable disruptions such as electrical surges and lightning strikes can cause serious disruptions to the otherwise proper functioning of a security system. The currents that occur due to surges can get carried over to the metallic conductor which may include the electrical and plumbing wiring. The surge protection should be thus, installed properly in order to protect the CCTV system.



- **CCTV Twisted Pair Baluns:** A balun (an acronym for BALanced/UNbalanced) changes one medium of transmission to another medium of transmission, using defined impedance (which, 75 ohms coaxial) for the first and another impedance for the transmission to another medium (of 120 ohms twisted pair, i.e., CAT5e).



- CCTV Converters, Splitters and Amplifiers: The Splitters enable display of two cameras within one monitor. The same image gets recorded with the help of one VCR. A single camera image is then displayed on the full screen of the monitor. Converters are able to take one connection type and then convert the same to another type, like from VGA to RCA type. Amplifiers amplify the signals that they amplify. These are used mostly when the cable run will be too long and it causes the signal to not be very clear to the receiving end.



There is no limitation on the use of cameras and monitors for the need of a CCTV installation. However, in practice the limitation is decided by the right combination of control as well as the display equipment. It majorly depends on the ability of the operator for managing the system.

Location Survey: The location survey of a site is a determining factor for the type of CCTV installation for a site. The location survey, in turn depends on the following factors:

- Contents,
- Risk
- Supervision levels
- Building

Location survey must have at least one detail that is sufficient for addressing the security requirements of the site and client. This leads to the site plan prepared in a manner which has all the optimal positioning points for indicating the cameras on the site plan.



The location survey's purpose will be to identify the cameras' best places, natural light's directions, knowledge of actual and the potential environmental issues.

System Design: The system design stage can help in determining the CCTV system extent, have the right equipment selected and also to prepare a proposal for the system design. The system design also can be informed by the user or the client's needs for observing the camera images.

During system designing, the installers must have a risk assessment conducted in order to determine the levels of risk and also have the system designed in a manner to pay attention to the surveillance or observation's function, as described or desired by the user or client. The observation or surveillance function can include the following:

- Theft
- Crowd control
- Unauthorized entry

Operational Requirements:

While designing a CCTV surveillance or observation installation, the given criteria must be taken into serious consideration under 'operational requirements'. The requirements need to be documented in a clear and comprehensive format.

- Purpose of the observation and installation
- The potential activity or threat which is to be monitored and recorded
- The total number of cameras along with their locations which are required for monitoring the decided zones as well as the objects
- Determination of the areas or zones along with the objects which are to be observed
- The surveillance's target along with the frame rate that will be appropriate to match with the speed of the target which will be under the surveillance
- The response or action needed once an event has been detected
- The manner of viewing and recording images
- The manner in which the data will be exported to permanent record from the system
- Individual's list who are to access the recorded data
- Camera and equipment selection should be done on the basis of the environmental conditions
- Control of the centre configuration which also includes the location which is secured
- The supply of Power, for instance the use of a mini UPS system for a place where power is lacking
- The operating and functional procedures
- Repair and maintenance

- Evaluating the existing lighting condition and also consideration of the additional or new illumination, which also includes the use of Infra Red lamps or cameras
- The image resolution applicable for the project
- Determining the most applicable method of transmission for the CCTV installation
- Appropriate compression technique in the recording of the objects
- A CCTV must be installed with detectors, according to the requirements of the user or the client
- The detector's range must not exceed the decided field of view for all the associated cameras
- There should be audible alarm, text message or clicking and sending of the image of the threat or target along with a visual alarm

Tools needed for installing CCTV

<p>MultiMeter: An electronic device used for measuring voltage, resistance and current. It is used for checking voltage and continuity in the CCTV field.</p>	
<p>Hammer: Used for hitting, especially for cable clipping works.</p>	
<p>Pliers: Used for holding objects firmly and also cutting wires and cables.</p>	

Wire cutter: Used for cutting as well as stripping wires.



LAN Tester: This is a tool for connectivity measurement, which is used for CAT5 and CAT6 cable testing. This will check every connection of the cable to assure if it is perfect or not.






LAN Crimping Tool: Used for crimping and cutting a RJ45 connector to a LAN cable.



Screw Driver: To drive screws in any type of material.



<p>Aligner: A type of small screw driver which is needed for electronic devices and has a small screw place for calibrating.</p>	
<p>Drill Bit: This is used along with drilling machines in order to have holes drilled out of walls, to mount a camera, conduits along with different operations.</p>	
<p>Hexa Blade: Used for cutting conduits in order to fit these as per the site need.</p>	

<p>Drill Machine: Drill machines are two types – a hand drill while the other is a bench drill machine. These are used for camera mounting and also installing cable in conduits.</p>	
<p>12V 1A Power Supply: This needs to be kept along with the tools and then be used for checking the field issues for a CCTV.</p>	
<p>Measuring Tape: Ideal for any installation, it is used for measuring first. It can be used for measuring the length of cable.</p>	
<p>Cleaning Brush: Often dust causes a lot of disorder in the CCTV system and hence it is required to carry a cleaning brush.</p>	

<p>CCTV Tool Monitor: It is a small monitor which has the required video inputs and used for checking the field anytime needed.</p>	
<p>Tool Bag: All the tools mentioned must be neatly arranged in a tool bag, otherwise the required tool may not be found at the time of need.</p>	

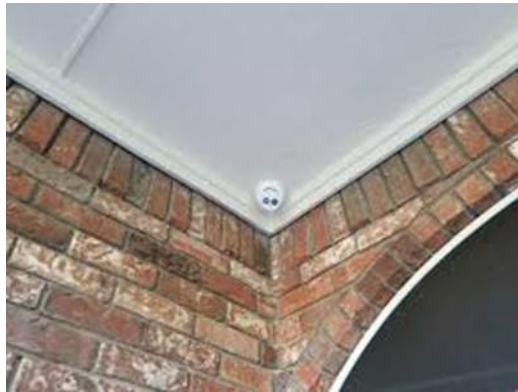
Understand the basic layout of site where the CCTV system to be installed

1. CCTV Installation for a house:

- **Front Door:** According to a survey, nearly 34% of burglars use the front door to enter one's house. It is therefore highly required to have a surveillance camera installed there. In order to prevent any intrusion, the camera should be placed at a level equal to the second floor or even at the eaves of the house and have its focus on the front door. If the home has only one level, the front door camera should be enclosed in mesh wiring in order to have it protected from the sticks, errant rocks or any other such weapon.



- **Back Door:** Burglars may also choose to enter using the side and back doors. To prevent this, the entry doors should have a camera. The camera should be kept out of human reach. Also the intruder should not be able to throw anything at it or damage it. It is ideal to have a camera installed which will have excellent night vision and will be weatherproof.



- **Off-Street Windows:** Often, a choice of entry is the rear window of a house. A window which is not in the direct view of a street would mean less chances of getting caught. Therefore the rear windows should have cameras installed at the right angles to them. A wireless security camera is said to be a good option for this, which must have a remote control.
- **Backyard plus Side Gate:** Houses with expensive lawns or with costly bikes or cars can be a huge attraction for intruders. The yard should be armed well with floodlights which must have motor-sensor feature and also a night vision camera for surveillance. In case the backyard has fence, the camera must have the entrance gate view. A camera in plain sight must be placed. In most of the cases, the intruder moves on to another home, once he notices a surveillance camera.
- **Basement Stairs:** A number of basements have doors or access hatches or even small windows which are of enough size for someone to crawl through it. Thus, a camera should be placed on staircase which will lead up from the basement to the home. This will record any intrusion which may occur through the basement. A motion sensor camera can be used for security, which also must have night vision.

2. CCTV Installation for Commercial Purposes:

- **The Entrances and Exits:** It is important to install cameras at the entry and exit doors for maximum surveillance. The person in control will be aware of the people entering or exiting the business premises and if that is authorized or intrusive in nature. During the day, dull or blackened image can occur whenever a door is opened or closed. Thus, the camera must face inside and away from the outside light. Also the CCTV cameras must be easy to view. The intruder will be able to view it and will avoid any plan of burglary.

- **Reception Area:** This area is a high-traffic area which needs surveillance. A covert camera will be ideal in this, which will effectively merge with the décor of the office.
- **Store Room and Office Supply:** Every office has confidential documents which are to be kept away from outsiders. Surveillance in such places is of utmost importance.
- **Places of Customer Interaction:** Areas which include cash register, transaction points and other teller stations need strict surveillance and thus the use of CCTV cameras.

Exercise

1. Give one word for the following:

- a) These are used for the need of terminating CCTV cables in installation for surveillance camera.
- b) This is a device, passive by nature which is able to have the Ground Loop Interference reduced with the help of CCTV signals and also it can be easily installed in a new system or one of the existing systems.
- c) A key element for safety and protection of assets is the CCTV security system during CCTV operation.
- d) A determining factor for the type of CCTV installation for a site.
- e) Can help in determining the CCTV system extent, have the right equipment selected and also to prepare a proposal for the system design.

1. Identify the tools:





Unit 1.2: Different types of CCTV cameras in the market

Unit Objectives:

- Evaluate the types of cameras, housing types
- Practice how to take right selection

Types of Security Cameras:

- Pan/Tilt/Zoom (PTZ)
- Fixed
- Virtual PTZ or 360 degrees.

Security Camera Housing Types:

- Dome
- Outdoor
- Discreet
- Bullet

Extra features:

- Infrared
- Resolution
- Varifocal
- Day/Night
- Thermal Imaging
- Auto-focus
- Remote Zoom
- Wireless

Popular and Common Types of CCTV Camera Features:

	Fixed	PTZ	Virtual PTZ
Indoor/Outdoor models	Yes	Yes	Yes
Dome Housings	Yes	Yes	Yes
Bullet Housings	Yes	No	No
Covert/Discreet	Yes	No	No
Analog	Yes	Yes	No
IP	Yes	Yes	Yes
Infrared/Night Vision	Yes	No	No
Remotely Positionable	No	Yes	No (digitally)
Wireless	Yes	Yes	Yes
High Definition	Yes	Somewhat	Yes
Varifocal	Yes	Yes (zoom)	No (digital)
Day/Night	Yes	Yes	Rarely

(Reference: https://www.cepro.com/article/12_common_types_of_security_cameras)

Selecting the right type of camera

- **Fixed Camera:** This is positioned in order to have an image captured and also it could be optimized for various housing application as well as features.



FIXED CAMERA

- **PTZ Camera:** These are remotely positionable cameras which are used for their ability to tilt, pan and zoom on specific object. This type of camera is designed in different manner and can be put inside gears or motors and have an operator to move it remotely. Cameras in this category with higher range will have greater zoom range as well.



PTZ CAMERA

- **360-degree Camera:** The virtual PTZ or the 360-degree camera is like a number of high resolution fixed cameras put together in a housing. The images here are put together and zoom in is enabled. Also it can face every direction and this is a powerful tool for forensic requirements.



360-DEGREE CAMERA

Selection of Housing

Once the camera type is selected, the type of housing needs to be selected immediately.

- **Outdoor:** The outdoor cameras are said to be more weather resistant and they will include a lot of blowers and heaters in order to enable environmental variances.
- **Bullet:** The cameras which look like a box which is on a post of bullet is called for the same cylindrical sleek shape which it has.
- **Dome:** These are used for concealing the camera orientation and some of these do a better task at it than others.
- **Discreet:** This is used when someone wants to have the camera hidden completely. The camera can look like a smoke detector or a motion sensor or a similar device, which will seem to be of less importance or no importance.

Unit 1.3: Preparation of field and site for camera installation, tools and equipment for installations

Unit Objectives:

- Demonstrate the different system monitoring requirements
- Evaluate how CCTV monitoring works

Understand the system monitoring requirement (viewing, recording and replay)



DVR Recording and Video Management for CCTV:

The use of DVRs make it easier to convert CCTV video to digital form and it enables remote monitoring as well as easy and fast searches. This also facilitates greater storage advantage. DVR can be a less costly option for the customer who would not be ready for a complete IP surveillance setup for a given site. Digital video recorders or the DVRs will be still an improved stage for the analog CCTV cameras.

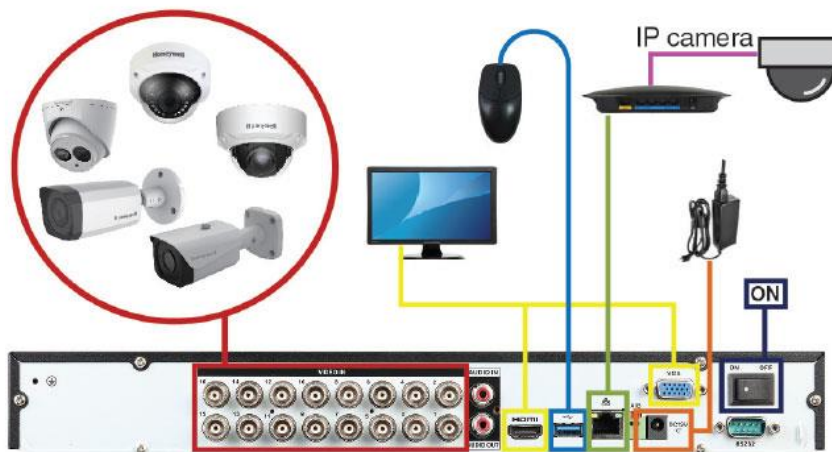
A **Digital Video Recorder** includes video storage, software and also a computer hard disk – all put together in one unit. This will accept analog video feeds to convert these to digital mode. This works quite like an IP video.

Its advantages are:

- **Remote monitoring:** Conventional CCTV systems were able to transmit the video to one monitoring station earlier, however with the DVR system it is possible to gain camera footage in remote manner all over the digital media. Through connecting analog cameras to DVR, video feeds can be monitored using any computer with only internet access and it is possible to access the same with cell phones as well as handheld PDA.
- **Digital storage:** DVRs allow the footage to be converted to digital from analog, in a manner that more video can be stored without any issue. Also it becomes easier to sort through the footage within archive.
- **Video compression:** The DVRs are known to provide with many compression technologies. Some of the common formats for compression are Motion JPEG, H.264 and MPEG-4. Video compression also allows to reduce file size without compromising with the quality of image.

From Analog to IP Surveillance:

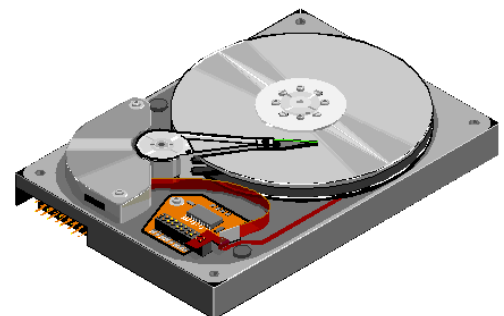
IP based solutions are deemed to be the best for video surveillance in these days. However, this does not mean one has to discard analog cameras, during the transition stage. The hybrid DVRs along with video encoders will help in building an IP surveillance network which is excellent and also allow the customer to have analog security cameras that exists already.



- **Hybrid Analog or IP Systems:** A standard DVR setup will limit the user to CCTV cameras while the hybrid system enables use of both analog cameras as well as IP network cameras. All of these will operate using the same network. This gets done by the use of video servers and encoders or just a hybrid DVR.
- **Video Encoders and Servers:** Also called a server, a video encoder will digitize all analog video signals in a manner that they are sent in a direct manner over an IP network. It helps the users in viewing the live video images with the use of a web browser or the use of a video management software on any remote computer or a local option along with network access.
- **Hybrid DVRs:** These can support both the IP network as well as the analog CCTV cameras. Such flexibility is not possible with the traditional DVRs.

How Components of CCTV Cameras Work

- **Security Camera:** This device captures the source's video and is an opened aperture at the camera's front. It captures the light stream via the camera lens. The light stream will be then captured with the use of a digital chip which is fitted in the camera and is then converted to continuous images streaming. The camera will record the signal which will be transmitted wirelessly or with cables.
- **Infrared Light Emitting Diodes (IR LEDs):** These are sensing devices. The light sensor in them is used for detection of the light level, its brightness and then receives and also transforms into a particular numerical value that reveals the brightness percentage. The digital technology incorporated in data recording and also processing will help in receiving sharp images along with clear audio. This camera type is known as the IP camera.
- **Cables:** These are the wires that are needed to connect various equipment like the monitor, CCTV camera, modem, recorder, etc. in the setup. The cables used are either RJ59 or RJ45 cables.
- **Video recorders:** Video signals sent by a CCTV camera can be used at a later period. For this facility, the signals need to be recorded and documented at a place. The digital and analog recorders are used for this purpose.
- **Hard disk:** This is a storage device which is used for storing the captured video with the use of a security camera to have it used later. These devices can be fitted within the video recorders and can be viewed by connecting to the DVR monitor directly.



- **Display Unit (Monitor):** This is a device which will take the video image and the outputs of it on the screen. A captured video or an image can be thus viewed on the monitored. The monitor can be a colored screen or a monochrome screen. These days, HD (High Definition) and colored LED monitors are used commonly for watching videos.

Use of CCTV to View Footage on Computer:

- Double click the surveillance icon on the desktop and click OK on the option to Login.
- The user name and password should be entered and after a few seconds the programme will start to display.
- The programme screen should be maximized by clicking on the square symbol which is usually on the right hand top most corner of the screen.
- Once the device option is shown, below it a list will be displayed. From this, the name of the CCTV should be double clicked.
- The step will display a list of all the cameras that are allotted to the device list.
- The Playback button will be clicked on the lower left hand of the screen and a series of fields with further drop down boxes will appear in the device panel which will be on the screen's right hand side.
- The next field should be selected (it is the channel) by the down arrow being clicked which will be next to the channel box. The camera needed for viewing a particular place will be selected from the list of cameras which will be displayed.
- The desired date can be selected or entered in the date box.
- The time period should be selected next either by entering manually or by scrolling up and down within the options given.
- The user can then select the required video from the list of videos that were recorded within the given time period.

Exercise

Fill in the blanks:

- Through connecting analog cameras to _____, video feeds can be monitored using any computer with only internet access and it is possible to access the same with cell phones as well as _____.
- A _____ includes video storage, software and also a computer hard disk – all put together in one unit.
- The hybrid DVRs along with video encoders will help in building an _____ which is excellent and also allow the customer to have analog security cameras that exists already.
- _____ is a storage device which is used for storing the captured video with the use of a security camera to have it used later.
- _____ is positioned in order to have an image captured and also it could be optimized for various housing application as well as features.
- _____ are remotely positionable cameras which are used for their ability to tilt, pan and zoom on specific object.