TVET CERTIFICATE IV in ELECTRONIC SERVICES

CCTV CAMERA SYSTEM REPAIR

ELOCR401

Repair CCTV camera system

Competence

Credits: 7

Learning hours: 70

Sector: Technical Services

Sub-sector: Electronic Services

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Purpose statement

This core module describes the skills, knowledge and attitudes required to repair CCTV camera system. The learner will be able to select and arrange different materials, equipment and tools used when repairing CCTV camera system. Moreover, he/she will be able to diagnose and troubleshoot CCTV camera system including software and hardware faults.

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Learning Unit 1 – Prepare for CCTV camera repair

Introduction to the CCTV camera system

1. What does CCTV camera system means?

CCTV (closed-circuit television) is a TV system in which signals are not publicly distributed but are monitored, primarily for surveillance and security purposes. CCTV relies on strategic placement of cameras and private observation of the camera's input on monitors.

CCTV plays a huge part in today's society, and with cameras all around us, our day-to-day lives are experiencing higher levels of security each day. What many people don't know, however, is that there are a variety of different types of CCTV camera which suit different situations or premises, and that selecting the proper camera for the right application really is vital. Here, we run through these types of camera and what makes them unique and more suitable for some venues over others.

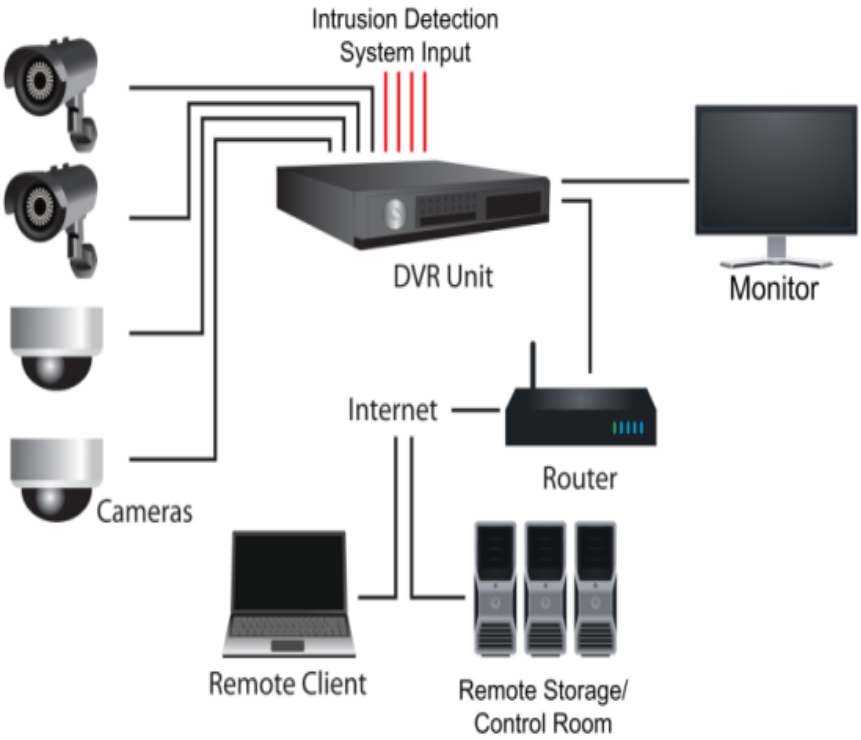
2. Some definition of common terms used in CCTV camera system repair

- **OPERATOR:** authorized individual (a user) using a CCTV system for its intended purpose.
- **RESPONSE:** every control command, change of system conditions or information to external devices or persons driven by alarms, faults, messages or triggers.
- **RISK:** potential negative impact to an asset or value that may arise from some future event respecting the probability of loss.
- **SURVEILLANCE:** observation or inspection of persons or premises for security purposes through alarm systems, CCTV systems, or other monitoring methods.
- **SYSTEM COMPONENTS:** individual items of equipment which make up a CCTV system when configured together.
- **EXPORT:** transfer of data from the original location to a secondary storage location with a minimum of necessary changes.
- **FAULT CONDITION:** condition of the system which prevents the CCTV system or parts there of functioning normally.
- **FRAME RATE:** numbers of frames per second.
- **ILLUMINATION:** level of illumination on the area to be kept under surveillance.
- **IMAGE:** visible representation of a frame as a rectangular grid of pixels.
- **INTERCONNECTIONS:** means by which messages and/or signals are transmitted between CCTV system components.
- **LENS:** an optical device for projecting an image of a desired scene on to the photo-sensitive surface of the imaging device.

- **NOTIFICATION:** passing an alarm or a message of the CCTV system to an external system.
- **CAMERA HOUSING:** An enclosure to provide physical and/or environmental protection of the camera, lens and ancillary equipment.

3. Description of components (element) of CCTV camera system

The following pictures represent the main components that made CCTV System and their proper connections. Each component has owned specific function and the combination of all elements Interconnected together make a complete CCTV camera system



Identification of Elements of CCTV Camera System

4. Description of main parts of camera

Camera is an optical Device that use lens to capture to record moving images, or other visual images. it is the most important element that made CCTV System because it is used to collects the images and send them to the DVR or NVR. it is very important to describe properly the all external and Internal Parts of the camera as used In CCTV Camera System repair

4.1. External parts of camera

External parts of CCTV Camera

4.2. Internal parts of camera

Internal parts of CCTV Camera

LO 1.1 – Identify PPE according to the work to be done

- Content/ Topic 1: Types of PPE

PPE is defined in the Personal Protective Equipment at Work Regulations as: 'All equipment (including clothing affording protection against the weather) which is intended to be worn or held by a person at work which protects them against one or more risks to their health and safety'.

Types of PPE and their uses

- **Gloves is** a covering for the hand worn for protection against cold or dirt and typically having separate parts for each finger and the thumb.

a piece of clothing that is worn on the hand and wrist for warmth or protection, with separate parts for each finger

Gloves

- **Helmet** is a hat made of a strong material which you wear to protect your head.

Helmet

- **Safety shoes/a steel-toe** boot (also known as a **safety** boot, steel-capped boot or **safety shoe**) is a durable boot or **shoe** that has a **protective** reinforcement in the toe which protects the foot from falling objects or compression, usually combined with a mid sole plate to protect against punctures from below.

Safety shoes

- **Overall is** a piece of clothing that covers both the upper and lower parts of the body and is worn especially over other clothes to protect them

Overall

- **Overcoat is a**n **overcoat** is a type of long coat intended to be worn as the outermost garment, which usually extends below the knee.

Overcoat

- **Glasses is** a special pieces of strong glass or plastic in a frame that fits tightly to a person's face to protect their eyes from dangerous chemicals or machines

Glasses/Goggles

- **Nose mask is** a flexible pad held over the nose and mouth by elastic or rubber straps to protect against dusts encountered during construction or cleaning activities, such as dusts from drywall, brick, wood, fiberglass, silica (from ceramic or glass production), or sweeping.

Nose mask

- **Earmuff is** a pair of soft fabric coverings, connected by a band across the top of the head, that are worn over the ears to protect them from cold or noise.

Ear muff

- Content/Topic 2: Use of PPE

PPE is equipment that will protect the user against health or safety risks at work. It can include items such as safety helmets, gloves, **eye** protection, high-visibility clothing, safety footwear and safety harnesses. It also includes respiratory protective equipment (RPE).

The use of PPE can be considered in the following categories, based on the type of protection afforded by the equipment:

1. **Respiratory protection** - for example, disposable, cartridge, airline, half or full face
2. **Eye protection** – for example, spectacles/goggles, shields, visors
3. **Hearing protection** – for example, ear muffs and plugs
4. **Hand protection** – for example, gloves and barrier creams
5. **Foot protection** – for example, shoes/boots
6. **Head protection** – for example, helmets, caps, hoods, hats
7. **Working from heights** - for example, harness and fall arrest devices
8. **Skin protection** – for example, hats, sunburn cream, long sleeved clothes

LO 1.2 –Select tools, equipment and materials according to the work to be done

- Content/Topic 1: Definition of tools, material and equipment

1) **Tool:** a device or implement, especially one held in the hand, used to carry out a particular function.

A tool is any instrument or simple piece of equipment that you hold in your hands and use to do a particular kind of work.

Tools can perform a variety of functions such as cutting and chopping, moving, shaping, fastening, guiding, enacting chemical changes, fastening, information and data manipulation, etc. There can be specific tools designated for specific purposes whereas most tools can serve a combination of uses.

Some **examples of tools** that are often used today are the hammer, the wrench (also called a spanner), saws, shovel, telephone, and the computer. Very basic things like knives, pens, and pencils are also **tools**.

2) **Materials** are the **matter or substance that objects are made from**.

A **material** is a chemical substance or mixture of substances that constitute an object.

Electronic materials are the materials used in electrical industries, electronics and microelectronics, and the substances for the building up of integrated circuits, circuit boards, packaging materials, communication cables, optical fibers, displays, and various controlling and monitoring devices.

We use a wide range of different materials daily; these might include:

- Metal, plastic, wood, glass, ceramics, synthetic fibres, composites (made from two or more materials combined together)

3) **Equipment** is defined as the necessary items for a particular purpose.

The idea of equipment represents all sorts of machinery, functional devices or accessories which serve an individual, household or a community purpose.

Usually, a set of tools that are designated for a specific task is known as equipment. This could be a small set of functional items in a finished product. For example, equipment of a car may be

alternators, absorbers, optical, electronic boxes, etc. Equipment of a house may be appliances while equipment may also include all sorts of devices needed for a specific task.

Examples of equipment include devices, machines, tools, and vehicles.

- Content/Topic 2: Types of tools and their use

There are hundreds of tools for CCTV Camera System repair available in the market. It is important to select the best tool that enables you to repair the device easily and comfortably.

Factors to Consider When Choosing CCTV Camera Repair tools.

When selecting tools and equipment for repairing CCTV Camera System, you should consider the following factors:

1. Cost
2. Brand
3. Quality/ Durability
4. Availability
5. Suitability

i.1. Screwdrivers

Screwdrivers are tools with a flattened or cross-shaped tip that fits into the head of a screw to turn it.

i.2. Pliers

Pliers are pincers with parallel, flat, and typically serrated surfaces, used chiefly for gripping small objects or bending wire.

i.3. A hammer

A hammer is a tool that consists of a heavy piece of metal at the end of a handle. It is used, for example, to hit nails into a piece of wood or a wall, or to break things into pieces.

i.4. Allen keys

An Allen keys is an L-shaped metal bar with a hexagonal head at each end, used to turn bolts and screws having hexagonal sockets.

i.5. Soldering irons

A soldering iron is a hand tool used in soldering.
It supplies heat to melt solder so that it can flow into the joint between two work pieces. A soldering iron is composed of a heated metal tip and an insulated handle

i.6. di- soldering pump

A **di- soldering pump**, colloquially known as a **solder sucker**, is a manually-operated device which is used to remove **solder** from a printed circuit board. ... (An electrically-operated **pump** for this purpose would usually be called a vacuum **pump**.)

i.7. **Crimping tools:**

A **crimping tool** is a device used to conjoin two pieces of metal by deforming one or both of them in a way that causes them to hold each other. The result of the **tool's** work is called a **crimp**. A good example of **crimping** is the process of affixing a connector to the end of a cable.

- Content /Topic3: Types of equipment and their use

a. Digital Multimeter

A **Digital multimeter** (DMM) is a test tool or measuring instrument that has ability to measure two or more electrical values—principally voltage (volts), current (amps) and resistance (ohms).

It is also used to test and check the readings of various parts and components of electronics devices.

b. PPE

PPE is equipment that will protect the user against health or safety risks at work. It can include items such as safety helmets, gloves, eye protection, high-visibility clothing, safety footwear and safety harnesses. It also includes respiratory protective equipment (RPE).

c. IP camera test

IP camera test monitor uses WIFI to connect and scan a network for IP cameras. It will detect all compliant IP cameras on the network and display them in a list. it also allows security system installers to view video from IP cameras so that they can test video, adjust focus, and adjust the angle of view.

d. A cable tester

A *cable tester* is a device that is used to *test* the strength and connectivity of a particular type of *cable* or other wired assemblies. There are many different types of *cable* testers, each able to *test* a specific type of *cable* or wire (some may be able to *test* different types of *cables* or wires).

e. Drilling machine and accessories

Drilling machine can be **defined** as a **machine** which makes a circular hole in the job by removing volume of the metal from it with the help of a cutting tool called **drill** bit. When **drilling** is performed by the **drilling machine** the **drill** bit i.e. the cutting tool is rotated along its own axis into the job.

f. Screwdriver machine

Screwdriver machine is machinery equipment or powered equipment that used for screwing and unscrewing (inserting and removing) screws when it's connected to electricity. It has motor that convert electrical energy into mechanical energy to rotate the shaft.
A typical simple screwdriver has a handle and a shaft, ending in a tip the user puts into the screw head before turning the handle.

g. Air blowing gun

Blowing machines are sometimes referred to as blast blowers (in the iron and steel industry) or draft blowers (in boiler units).

- Air blowing machine is used for compressing and delivering air to remove the dust inside the electronic device parts, or used for compressing and delivering some other type of gas. ...

- Content/Topic 4: Types of materials and their use

1. Soldering tin

Soldering is a joining process used to join different types of metals, usually made of ***tin*** and lead which is melted using a hot iron and cooled to create a bond. **Soldering tin is** a **metal** or metallic alloy used when melted to join metallic surfaces especially an alloy of lead and **tin** so used.

Solder is a fusible metal alloy used to create a permanent bond between **metal** workpieces.

2. Glue

Glue is a sticky substance used for joining things together, often for repairing broken things.

Adhesive, also known as **glue**, **cement**, **mucilage**, or **paste** is any non metallic substance applied to one or both surfaces of two separate items that binds them together and resists their separation.

3. Silicon

Silicone glue is a type of **adhesive** that contains **silicon** and oxygen atoms, making it a good water-resistant solution. It is used in many areas because of its stability, both chemically and thermally. **Silicone glue** is also resistant to weathering and moisture, unlike many other adhesives.

4. Insulator tape

Electrical tape (or **insulating tape**) is a type of pressure-sensitive tape used to insulate electrical wires and other materials that conduct electricity. It can be made of many plastics, but vinyl is most popular, as it stretches well and gives an effective and long lasting insulation.

5. Screws

A **screw** is a type of fastener, in some ways similar to a bolt typically made of metal, and characterized by a helical ridge, known as a male thread (external thread). Screws are used to fasten materials by digging in and wedging into a material when turned, while the thread cuts grooves in the fastened material that may help pull fastened materials together and prevent pull-out. There are many screws for a variety of materials; those commonly fastened by screws include wood, sheet metal, and plastic.

6. RJ45

RJ45 is a type of connector commonly used for Ethernet networking. The "RJ" in RJ45 stands for "registered jack," since it is a standardized networking interface. The "45" simply refers to the number of the interface standard. Each RJ45 connector has eight pins, which means an RJ45 cable contains eight separate wires.

7. BNC connector

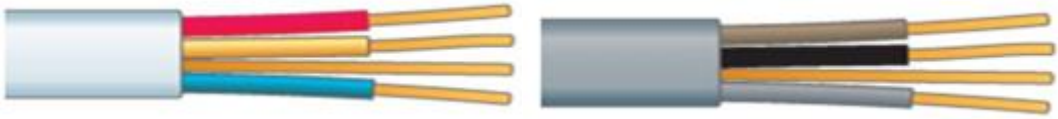
The **BNC connector** (initialism of "Bayonet Neill–Concelman") is a miniature quick connect/disconnect radio frequency connector used for coaxial cable.

8. Universal anchors

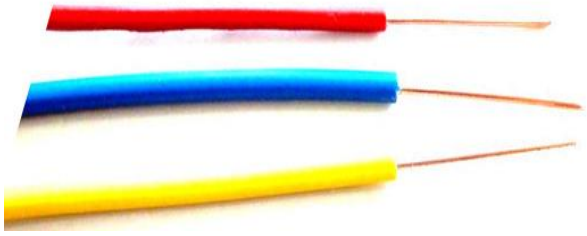
It is a plastic used to put in hole before you insert screw to make sure screw is very ties.

9. Cable and wires

A cable is a thick wire, or a group of wires inside a rubber or plastic covering, which is used to carry electricity or electronic signals.

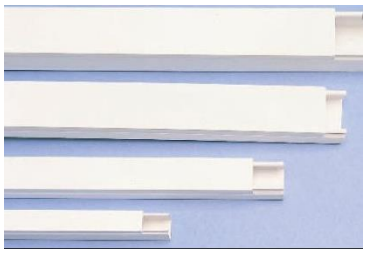


A **wire** is a single conductor (material most commonly being copper or aluminium) while **cable** is two or more insulated **wires** wrapped in one jacket. Multiple conductors that have no insulation around would be classified as a single conductor.



Wire is a single electrical conductor, whereas a **cable** is a group of **wires** swathed in sheathing. The term **cable** originally referred to a nautical line of multiple ropes used to anchor ships, and in an electrical context, **cables** (like **wires**) are used to carry electrical currents.

10. Trunks



Trunk is used to protect cables from damage and to hide unsightly cables from view. It can be used in almost any location including homes, hotels and hospitals. Trunking is available in many materials, sizes and forms to suit the location and requirements of the installation.

Trunking is usually square or rectangular in shape, whilst providing easy access to the cable when needed via a hinge or slide system.

- Content/Topic 5: Difference between tools, materials and equipment

a) **Tool:** a device or implement, especially one held in the hand, used to carry out a particular function.
b) **Material:** the substance or substances of which a thing is made or composed.
c) **Equipment:** the set of articles or physical resources serving to equip a person or thing.

The differences between materials, equipment, and tools are in the way they are used, acquired, and maintained. Materials are consumed constantly, while tools and equipment require periodic repair or replacement.

Equipment and materials are similar as they are both essential inputs in the manufacturing process. Materials are, however, quite distinct from equipment as materials form the actual product. They are the parts, components, ingredients and raw materials that become a part of the product. Equipment, on the other hand, are the tools, machinery, devices that help create the product.

In other words, materials are molded, fixed, glued, and fastened together by the use of equipment and machinery to create the final product. Equipment are durable assets that have a long-term use, whereas materials have a short-term use, and may also be perishable in nature.

LO 1.3 Prepare the workplace according to the work to be done.

- Content/Topic 1: Arrangement techniques of tools, materials and equipment in the workplace

Organization or arrangement of tools, materials and equipment is one of the keys to an effective workplace. It seems like such a simple thing, but the fact is that when we take the time to organize our workplace, we become more efficient.

One reason for this increase in efficiency is the decrease in "search time" that results from an organized work area.

Planning and organization makes efficient use of your time by keeping you focused from beginning to completion of a project.

Arrangement is an act of arranging; state of being **arranged**. The manner or way in which things are **arranged**.

It is achieved by the following settings:

1. Arrangement by types: the tools, materials and equipment of the same type are put on the same level, this facilitate the user to locate easily the tools, materials and equipment when servicing.

2. Arrangement by manufacturer instruction: this is the setting where the user arrange the tools, materials and equipment suit on the recommendations described by the manufacturer and most of them are written on the catalogue or datasheet.

- Content/Topic 2: Setup of workplace trespassing signs/ notice

To trespass is to illegally enter someone's property or overstep your bounds in another way.

A "No Trespassing" sign means exactly what it suggests: If to trespass is to enter without permission, no trespassing means **"do not enter without permission**."

To setup the workshop trespassing signs is to warn or to notice, the customers and other persons who enter in your working place, something they should not do by writings or using signs.

Learning Unit 2 – Rectify the fault

LO 2.1 – Identify the fault according to their types

- Content/Topic 1: Classification of faults.

CCTV Camera system Faults Can be classified as 2 main types:

- **Software faults:** this consist of the fluctuation that occur in set of instructions that instruct the CCTV System what to do and how to do it. Most of software are processed and Stored in DVR/NVR
- **Hardware faults:** are occur in physical parts or tangible parts of CCTV Camera System that you can see and touch. Examples of hard ware parts: DVR, CCTV Camera, Coaxial, cables, Power Cable, Hard disk, monitor, keyboard, mouse, …

- Content/Topic 2: Identification of Frequent software faults

✓ Video latency

In the video world, latency is the amount of time between the instant a frame is captured and the instant that frame is displayed. Low latency is a design goal for any system where there is real-time interaction with the video content, such as video conferencing or drone piloting.

Video latency refers to the degree of delay between the time a transfer of a video stream is requested and the actual time that transfer begins. Networks that exhibit relatively small delays are known as low-latency networks, while their counterparts are known as high-latency networks.
Fundamentally, video latency refers to the amount of time it takes for a single frame of video to transfer from the camera to the display.

✓ Un-upgraded NVR firmware

Firmware is programming that's written to a hardware device's nonvolatile memory. Nonvolatile memory is a form of static random access memory whose contents are saved when a hardware device is turned off or loses its external power source.

Firmware is held in non-volatile memory devices such as ROM, EPROM,
or EEPROM (including NOR flash memory). Changing the firmware of a device was rarely or never done during its lifetime in the past but is nowadays a common procedure; some

firmware memory devices are permanently installed and cannot be changed after manufacture.

Un-upgraded NVR firmware is the deterioration the quality of firmware, or change it for something older or of a bad standard.

Common reasons for updating firmware include fixing bugs or adding features to the device. This requires ROM integrated circuits to be physically replaced, or EPROM or flash memory to be reprogrammed through a special procedure. Firmware such as the BIOS of a personal computer may contain only elementary basic functions of a device and may only provide services to higher-level software. Firmware such as the program of an embedded system may be the only program that will run on the system and provide all of its functions.

✓ **Abnormal NVR video:** deviating from what is normal video or usual, typically in a way that is undesirable Video or worrying.

✓ **IP address conflict:** An IP address conflict happens when two (2) or more devices in a network have the same IP address. This results to one or both of the devices not being able to communicate with the wireless network.

✓ **Unreachable IP camera**

An Internet Protocol camera, or IP camera, is a type of digital video camera that receives control data and sends image data via an IP network. They are commonly used for surveillance but unlike analog closed-circuit television (CCTV) cameras, they require no local recording device, only a local area network.

Unreachable IP camera means that the IP camera doesn't reach the destination where stores the images or videos as NVR.

- Content/Topic 3: Identification of Frequent hardware faults

  ✓ **Poor lighting: Poor lighting** can cause several problems such as: **Insufficient light** – not enough (too little) **light** for the need. Glare – too much **light** for the need. Improper contrast. Poorly distributed **light**.

Poor lighting can cause several problems such as:

- Insufficient light – not enough (too little) light for the need.

- Glare – too much light for the need.
- Improper contrast.
- Poorly distributed light.
- Flicker.

✓ No camera image

One of the most common causes for no picture on the CCTV monitor is *power supply disruption.* If you have a loose power connection or a multi-power splitter, then you could be facing a power drop which results in weak function and stability of data transmission. Moreover in case of power spikes, your power supply cord could face damage due to which you may not be receiving picture on the cameras.

Another reason for no CCTV camera feed could be a loss of internet connection or radio signal. The PoE switch or injector may be cut or loose and this could be resulting in transmission disruption and video loss. PoE switch is basically Power over Ethernet switch or network switch that has power over Ethernet built in. Also, BNC connector may be causing signal loss due to which you may not be receiving video on your monitor. In some cases, Wifi signal drop may also be the reason behind the issue.

✓ Camera image distorted

Image distortion is generally referred to an optical aberration that deforms and bends physically straight lines and makes them appear curvy in images, which is why such distortion is also commonly referred to as “curvilinear” (more on this below). Optical distortion occurs as a result of optical design, when special lens elements are used to reduce spherical and other aberrations. In short, image distortion is a lens error.

✓ Loss of connection

In general, the issue of “video loss” on CCTV security cameras or DVR/NVR, in many cases, comes down to several factors: poor design, insufficient power supply, unstable network, wiring problems, hardware (cameras, NVR/DVR or monitor) failures, outdated firmware and IP address conflicts.

✓ Detection triggered by foliage

Foliage is a representation of leaves, flowers, and branches for architectural ornamentation. When a camera sensor as PIR detects sufficient movement of these warm “objects” and/or a significant temperature differential between the object and the background scene, it signals the camera to start recording and send an alert to the user.

With more accurate motion detection, you get more reliable notifications & recording by eliminating false triggers due to bugs, falling leaves, rain & more, saving you HDD space & playback time.

True Detect is a step up from the traditional motion detection technology. The camera has a PIR sensor, the same technology used in alarm systems, to detect moving heat-generating objects, such as people, large animals & cars, to trigger recording and alerts.

True Detect eliminates false triggers from traditional motion detection, such as falling leaves, small birds & plants moving with the wind.

✓ Detection triggered by overspill

Motion detection can be a puzzling and frustrating feature. Too many alerts is annoying (and a waste of time), while too few leave you wondering if the camera is working at all. Some motion sensors get tripped by events that aren't even motion, such as a change in the lighting.

✓ Insufficient power

The insufficient power supply is, very often, the culprit of the video loss on one or all security cameras, CCTV video loss at night, video signal loss on screen, camera going black at night, or camera video flickering on and off.

Here are some common reasons for insufficient power supply to CCTV cameras:

• Loose cable connection

• PoE switch or PoE injector

• Cable is too long, or one cable is supplying too many cameras at once

• Faulty power cables (old, damaged, degraded or cut)

Loose cable connection, for example, between DVR/NVR with cameras, between CCTV cameras and monitor or screen, power adapter, or any possible loose connection in camera power supply could cause video loss.

L.O. 2.2 - Troubleshoot software faults according to the technical specifications

These are techniques that can be used solve the technical problem, after identification of the CCTV Camera System faults, for purpose of correcting and fixing the faults according to the type of faults and its proper causes.

Troubleshooting IP cameras can be tricky and frustrating. Despite everything looking correct, it can still take some extra effort to bring IP cameras up and operational. As IP video matures, the

technology gets easier to configure, but it is still far from "plug and play". Every technician should have a few basic troubleshooting techniques up their sleeve to get IP cameras online and working.

- Content/Topic 1: Rectification of frequent software faults

1. Video latency

Reboot the camera: Some consider the 'Golden Rule' of IT troubleshooting to first reboot the device before proceeding. Simply restarting the camera gives the chance for cache to flush, settings to recalibrate, and connections to be renegotiated. This step is the least difficult and cheapest to perform, one only has to remove power, wait 10 or 15 seconds, and then restore power.

Factory Default the Camera: Some consider this the most drastic troubleshooting step to take. Unlike reboot the camera that restarts the camera, factory defaulting removes all setting and configuration and returns the device to it's 'factory default' settings. Most IP cameras have a pin hole / reset button on the back of the device that enables factory defaulting the camera (note: not all).

Unfortunately, camera operating systems can sometimes become corrupt, or errors in the configuration can cause a camera to 'become lost'. Defaulting a camera takes it back to a fixed reference point where reconfiguration can begin. However once you default it, the camera loses all settings and history which may be vital for further troubleshooting. It may be best to wait until after calling tech support before trying this step.

2. Un upgraded NVR firmware

Upgrade Firmware: If the camera is powered up, online and you can reach the camera's web page but you are having other problems (like not being able to connect to the VMS), check the firmware of the camera against the current firmware available. If out of date, you may want to consider upgrading the firmware. This sometimes solves problems but upgrading firmware can other times cause problems so be careful with this.

3. Abnormal NVR video

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4. IP address conflict

Confirm IP Addresses are not conflicting: Take care that two devices are assigned the same address, because this often has the result of 'cancelling out' network access to either device. A simple "fat finger" while inputting the camera's address, gateway or subnet can cause all kinds of havoc. The ARP command can help with this.

5. Unreachable IP camera

Ping the camera and discover it: Type "cmd" into the Windows search box to open a DOS command prompt and the use the "ping" command to see if you can connect to the camera. For example, if your camera's address is 192.168.2.150, use "ping 192.168.2.150 -t" at the command prompt, if you receive "Destination Host Unreachable" or "Request Timed Out" replies that means you are not connecting to the camera via the network. There can be many reasons for that, the most basic being that the camera and the computer are on different networks or subnets. If you are receiving proper connection replies, use a web browser or the manufacturer's discovery utility to connect to the camera.

If you need help with this process, review this IPVM Basic Networking Tutorial on using manufacturer's camera discovery utilities, pinging cameras and setting your PC's IP address to be on the same network as the camera.

Know the password: If you can ping the camera, but cannot connect to it with the VMS, web browser or discovery tool, it might be because of an incorrect login or password. IPVM maintains a list of camera manufacturer's default passwords that might help. If the defaults do not work, someone probably changed them and you will need to find out what they were changed to in order to connect.

Increasingly, IP camera manufacturers are forcing users to change the default password upon first login. This increases security but increases the risk of troubleshooting issues as looking up the default password will not work. If you suspect the issue is forgetting the password, either factory default the camera or contact the manufacturer.

L.O. 2.3 Troubleshoot hardware faults according to the technical specifications

- Content/Topic 1: CCTV Camera disassembling process (User manual)

Based on the types of CCTV Camera and manufacture specification, it very important to consider the user manual as guide during disassembling. The following as main disassembling steps:

- ✓ Switch off the CCTV system
- ✓ Disconnect the defected component of CCTV System
- ✓ Unscrews and open the cover.
- ✓ Un screws and Remove the internal parts
- ✓ Disconnect the internal connectors and ports
- ✓ Remove the Circuit Board

- Content/Topic 2: Rectification of frequent hardware faults

1. Poor lighting

Customize the settings and make sure that CCTV camera system, receives the appropriate wattage.

Images and Videos Are Too Dark

- If videos or images from CCTV cameras are too dark, then you can resolve the issue by customizing its settings. Adjust its brightness and contrast levels or install it to another location where it can capture brighter images. If the camera has an adjustable sunlight, slide it backward to let in more light.

Resolution settings of CCTV cameras also affect the quality of videos and images. If your camera is equipped with a low-quality lens, it won't be able to record clear videos or images. If you're using a lens of 4-megapixels or more, the resolution settings should be at least 1920×1080.

2. No camera image

Verify Camera Power and connection: If possible, look at the camera to make sure it is powered up. Most cameras have LED's that indicate the camera's power status, and if it is connected to and transmitting data to the network. Many times these LED's may be concealed inside the camera's housing. If the camera is externally powered (non-PoE) check the power supply if no LED's are lit.

If it is a PoE camera and not powered, check to see if it is plugged into a PoE switch or midspan. Verify that the camera is receiving the proper wattage of PoE power, outdoor cameras with heater/blowers and PTZ cameras often require High-PoE or PoE+ 30W or 60W of PoE power that is higher than most standard 15W PoE switches provide, often requiring different wattage midspans. Some cameras that require >15W of power will boot up and connect with 15W, but not transmit images or respond to PTZ commands.

Another pitfall may be the PoE network switch itself. Some PoE switches do not have enough power to supply 15W to every port and will not supply power to another camera if it is already overloaded. To troubleshoot, connect the camera into a suitable PoE injector or midspan to see if that is the problem. An IPVM report on network switch PoE power problems illustrates this problem in more detail.

3. Camera image distorted

The LEDs Aren't Lighting Up: LEDs on IP cameras indicate the transmission of data across the network. If the LEDs aren't lighting up, it can
be due to a disconnected lead or the network may be temporarily down.

Whether the camera is powered by a battery or works with electricity, make sure it receives the appropriate wattage.

4. Loss of connection

Check the Cabling: If the camera's link and/or activity lights aren't blinking, it's likely a cable. A high frequency of connection issues center around cabling problems. Basic IT troubleshooting places a huge emphasis on checking transmission cables. Since the final assembly is only as robust as it's weakest link, checking data cables for kinks, frays, shorts, and bad terminations is a very basic troubleshooting step. Cable and patch panel connections made in a hurry by hand can get crossed wires or connectors come loose.

Sometimes the power wires to a PoE camera in the cable may be powering the camera up, but the data wires may be crossed or not connected preventing network connection. To troubleshoot, use a cable tester to test the cabling or use a known good cable to connect to the camera and see if it connects. If a patch panel is used, check the patch cable, that often gets overlooked.

5. Detection triggered by foliage

In general terms, we can expect the PIR thermal & motion sensor cameras to detect thermal radiation from human-sized and larger subjects within a human temperature range, and it should not detect smaller subjects, such as cats or birds or other foliage.
With PIR Motion Detection Cameras, movement means the detection of a warm moving object within the image, optimized for humans, on both temperature range and size. PIR detection range is 10m (32ft).

6. Detection triggered by overspill

Camera manufacturers offer a number of ways of reducing the incidence of false alarms, each with varying degrees of success. Camera's using PIR motion detection usually allow you to adjust the sensitivity level within the companion app, so that more- or less-pronounced motion triggers

the sensor. Reducing the sensitivity level could require a moving object to be warmer or closer to the camera to trip it, for example.

CV offers more options for mitigating false alerts. One of the more popular is the ability to set motion detection zones. This feature lets you mask out parts of the camera's field of view to tell the camera to ignore activity in those areas, or conversely to mask in specific areas to be monitored, effectively telling the camera to ignore activity everywhere else. It's a fairly effective and user-friendly solution as it allows your camera to focus on locations where movement would most likely indicate a breach—windows and doors, for example—without getting confused by whatever other activity is going on in your home.

CV can also make quick judgement calls based on the geometric properties of a moving object. Something very small relative to the field of view is either a small object, like a floating dust mote, and deemed "uninteresting," or it's a larger object very far away and also not notable.

Increasingly, CV-based cameras are also including features like person detection and facial recognition as a way to cut down on false alerts. These go beyond the basic detection of a moving object and actually classify the object as a way to filter "important" from "unimportant" motion events.

7. Insufficient power

What's the fix?

- Double-check all power connections, power splitters, cable connectors to exclude connection issues
- Switch ports to make sure the DVR/NVR port is providing power to the cameras
- Connect the cameras directly to the NVR instead of via a PoE in case the PoE switch could be supplying insufficient power. This is because PTZ cameras and IR cameras require more electricity.
- Try using shorter BNC or Ethernet cables to power cameras and avoid using low-quality extension cables or extension cords.
- If you are using battery-powered cameras, make sure the battery is not dead or the solar charger is blocked.

Make sure it receives the appropriate wattage and use the UPS or voltage Stabilizer to get regulated and sufficient power.

LO 2.4 – Test the CCTV camera system according to testing techniques

- Content/Topic 1: Testing the functionality of CCTV camera system

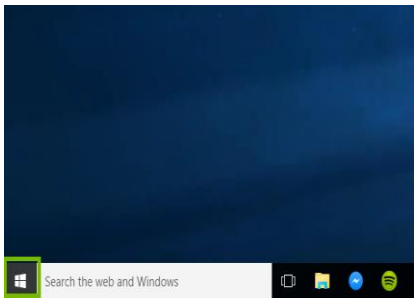
For testing the functionality of CCTV camera, check the following staffs:

1) Checking of the network availability

Network availability is the amount of uptime in a **network** system over a specific time interval. Uptime refers to the amount of time a **network** is fully operational. **Network availability** is measured as a percentage and is monitored to ensure the service being provided is consistently kept running for end-users.

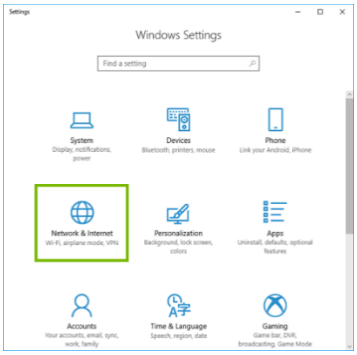
Steps to check the network availability:

1. Select the **Start** button.

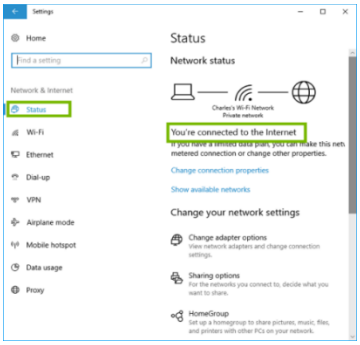


2. Select **Settings**.

3. Select **Network & Internet**.



4. Select **Status**. Your current connection status will be displayed on the right side of the screen.



2) Scanning the available of the camera on the monitor

Scanning is quickly looking over a vast area at all parts of something. When your eyes dart over a whole crowd in a room, this is an example of a situation where you are **scanning** the crowd.

Look the availability of camera on the screen. The screen is sprit into different parts depending on the number of camera connected into the system.

3) Checking the quality of image

Image quality can refer to the level of accuracy in which different imaging systems capture, process, store, and compress, transmit and display the signals that form an image.

Camera resolution is defined as the amount of detail that a **CCTV camera** can capture. **Resolution** is measured in pixels. A higher number of pixels, means more detail and larger images without blur or being grainy. **Resolutions** are measured in Megapixels, which is just over one million pixels, 1,048,576 to be precise.

To **check a photo's resolution**, flow these steps:

a) Select the file you want to use.
b) Right-click on the **image** and then select "Properties."
c) A window will appear with the **image's** details.
d) Go to the "Details" tab to see the **image's** dimensions and **resolution**.

4) Checking the auto recording and video saving

Automatic recording is an option that allows the host to start local **recording** or cloud **recording** automatically when the event starts.

Steps to be followed:

a) Double click the **camera** device you want to **view** into full screen and message box appear,
b) Right click on “Main Menu” and enter the password,
c) Click record control,
d) Click all or click any particular channel you want to record,
e) Click “Ok”

LO 2.5 – Clean the working area according to the cleaning techniques

- Content/Topic 1: Tools, materials and equipment used to clean the workplace

1. Vacuum cleaner

It is an electrical apparatus that by means of suction collects dust and small particles from floors and other surfaces.

2. Lags or cotton waste

These are the scraps of waste cotton yarn, used typically to clean machinery.

3. Cleaning solutions

Cleaning agents are substances used to remove dirt, including dust, stains, bad smells, and clutter on surfaces. Purposes of cleaning agents include health, beauty, removing offensive odor, and avoiding the spread of dirt and contaminants to oneself and others.

4. **Brush**

Cleaning brushes is something bristles, wire or other filaments. It generally consists of a handle or block to which filaments are affixed in either a parallel or perpendicular orientation, depending on the way the brush is to be gripped during use.

Brush (countable and uncountable, plural brushes) An implement consisting of multiple more or less flexible bristles or other filaments attached to a handle, used for any of various purposes including cleaning, painting, and arranging hair.

- Content/Topic 2: Collection and arrangement of tools and equipment

Collection is the accumulation of tools and equipment in their correct location, especially for storage or as a result of some process after work.

Arrangement of tools and equipment is to move and organize tools and equipment into a particular order or position to avoid the disorder in the working place.

- Content/Topic 3: Arrangement of non-used materials (consumables)

Consumables are products that consumers use recurrently, i.e., items which "get used up" or discarded. For example **consumable** office supplies are such products as paper, pens, file folders, Post-it notes, and toner or ink cartridges.

- Content/Topic 4: Cleaning of working area

Cleaning is the most important and primary aspect of **workshop**. It is a process of removing dirt, dust and grime by using **methods** such as dusting, shaking, sweeping, mopping, **washing** or polishing.

- **Cleaning techniques**

The following are the cleaning techniques used while cleaning the working place:

a) **Blowing:** cleaning using blower/blowing air on surface remove dirty,

b) **Brushing:** remove (dust or dirt) by sweeping or scrubbing

c) **Toweling:** wipe or dry with a towel.

Towel an absorbent cloth or paper for wiping and drying something wet, as one for the hands, face, or body after washing or bathing.

- **Tools used in cleaning**

Here are the best cleaning tools you need to have in your workplace today:

1) Broom, dustpan and mop,
2) Scrub brush,
3) Spray bottle,
4) Microfiber cleaning cloths,
5) Vacuum cleaner.

- Content/Topic 5: Waste materials management

Waste (or **wastes**) are unwanted or unusable materials. Waste is any substance which is discarded after primary use, or is worthless, defective and of no use. A by-product by contrast is a joint product of relatively minor economic value. A waste product may become a by-product, joint product or resource through an invention that raises a waste product's value above zero.

Types of waste materials

a) Recyclable waste

Recycling is the process of converting waste materials into new materials and objects. The recyclability of a material depends on its ability to reacquire the properties it had in its virgin or original state.

Recyclable rubbish includes all waste items that can be converted into products that can be used again. Solid items such as paper, metals, furniture and organic waste can all be recycled.

b) Bio-degradable waste

A biodegradable material can be defined as a material which can be decomposed by bacteria or other natural organisms and not be adding to pollution.

Biodegradable wastes are such waste materials which are and can be degraded by natural factors like microbes (e.g. bacteria, fungi and few more), abiotic elements like temperature, UV, oxygen, etc. Some examples of such wastes are food materials, kitchen wastes, and other natural wastes. Microorganisms and other abiotic factors together break down complex substances into simpler organic matters which eventually suspend and fade into the soil. The whole process is natural which can be rapid or slow. Therefore the environmental issues and risks caused by biodegradable wastes are low.

Biodegradable waste is a type of waste, typically originating from plant or animal sources, which may be degraded by other living organisms.

Biodegradable waste can be commonly found in municipal solid waste as green waste, food waste, paper waste, and biodegradable plastics. Other biodegradable wastes include human waste, manure, sewage, slaughterhouse waste.

c) Non-bio-degradable waste

Non-biodegradable substances are materials which do not degrade easily. As they are synthesized and do not occur naturally, degradation is impossible with these products. Therefore, when they stay in the ecosystem for a long period and do not decompose, they harm our environment.

For instance, plastics, chemicals, rubber, paints, batteries, metals and all fall in this category. The drawback is that in place of returning to the environment, they transform into solid waste which poses a great threat to the environment and health. This does not make it eco-friendly and we must avoid using it at all costs.

Treatment of waste materials

Waste treatment refers to the activities required to ensure that waste has the least practicable impact on the environment.

Whether it is biodegradable or non-biodegradable, they harm human life and ruin other organisms and their environment. Thus, a proper treatment of wastes has to be done. This is

not only the responsibility of Government, and each can contribute. The three Rs- Recycle, Reuse, and Reduce are simplest steps which can take by each person. This can save energy and other resources as well. Another step is separate biodegradable from non-biodegradable at home and disposes of them separately.

Hazardous waste can be treated by chemical, thermal, biological, and physical methods. Chemical methods include ion exchange, precipitation, oxidation and reduction, and neutralization.

Learning Unit 3 – Report the work

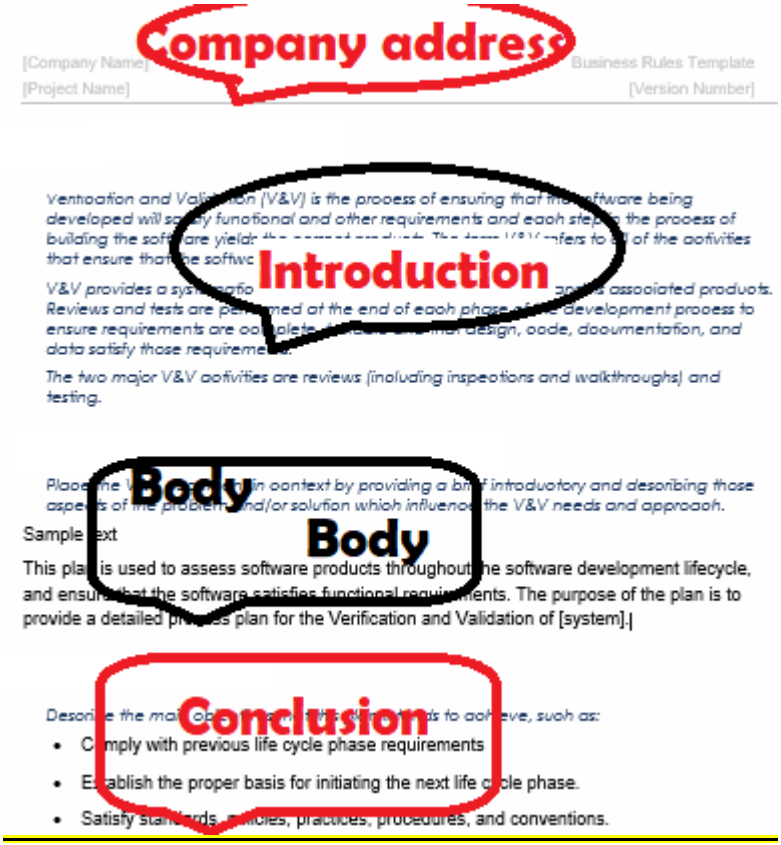
LO 3.1– Elaborate the installation report according to reporting techniques

- Content/Topic 1: Elaboration of the installation report

Elaboration is the process of developing or presenting a theory, policy, or system in further detail.

An installation report is a document that describes in detail the correct installation procedures. This can involve a machine, a device or an appliance. When you write an installation report, it must be kept organized and detailed. While there is no proper format required for an installation report, you should include the basic installation steps, safety concerns and installation checklists sections to help the reader understand what the installation requires and why. Organize the sections in the order they are needed, so give an introduction of the device being installed and the safety precautions before the installation process.

- Content/Topic 2: Format of the installation report



The installation report should be have the following information:

a) **Business full address:** is the official location of a company's premises. It could be anything from someone's home **address** right up to a multi-million-pound campus, such as those big tech companies favour and everything in between.

b) **Introduction:** is a beginning section which states the purpose and goals of the following writing. This is generally followed by the body and conclusion. The introduction typically describes the scope of the document and gives the brief explanation or summary of the document.

c) **Body of your report:** is a detailed discussion of your work for those readers who want to know in some depth and completeness what was done. The **body** of the **report** shows what was done, how it was done, what the results were, and what conclusions and recommendations can be drawn.

d) **Conclusion/recommendation/way forward:** The conclusion enables you to reinforce the main messages of the document. A conclusion summarizes the report as a whole, drawing inferences from the entire process about what has been found, or decided, and the impact of those findings or decisions.

The Conclusions section sums up the key points of your discussion, the essential features of your design, or the significant outcomes of your investigation.

LO 3.2 – Provide the invoice according to the work done

- Content/Topic 1: Types invoices

  - **Definition of invoice**

An **invoice** is a document issued by a seller to the buyer that indicates the quantities and costs of the products or services provider by the seller. Payment terms indicate the maximum amount of time that a buyer has to pay for the goods and/or services that they have purchased from the seller.

  - **Types of invoice**

Typical types of invoice are as follow:

1) Proforma invoice
2) Invoice

- Content/Topic 2: Difference between invoice and proforma invoice.

1. Proforma invoice

A pro forma invoice is an estimated invoice that a business sends to a client before providing their services. A pro forma invoice provides the client with an estimated cost of the work to be completed. Pro forma invoices may have to be altered once a project is complete to accurately reflect the hours worked.

Pro-forma invoice can be simply termed as an invoice that gives a rough idea to the buyer about the cost of products and services.

Pro-forma invoice is basically referred as estimation or a quote.

This billing method is sometimes used as a seller's declaration stating his commitment to deliver certain goods or services at the estimated price.

It can also be an advance payment against the estimated project amount. Since it is not a true invoice format, it is neither recorded as account receivable nor account payable.

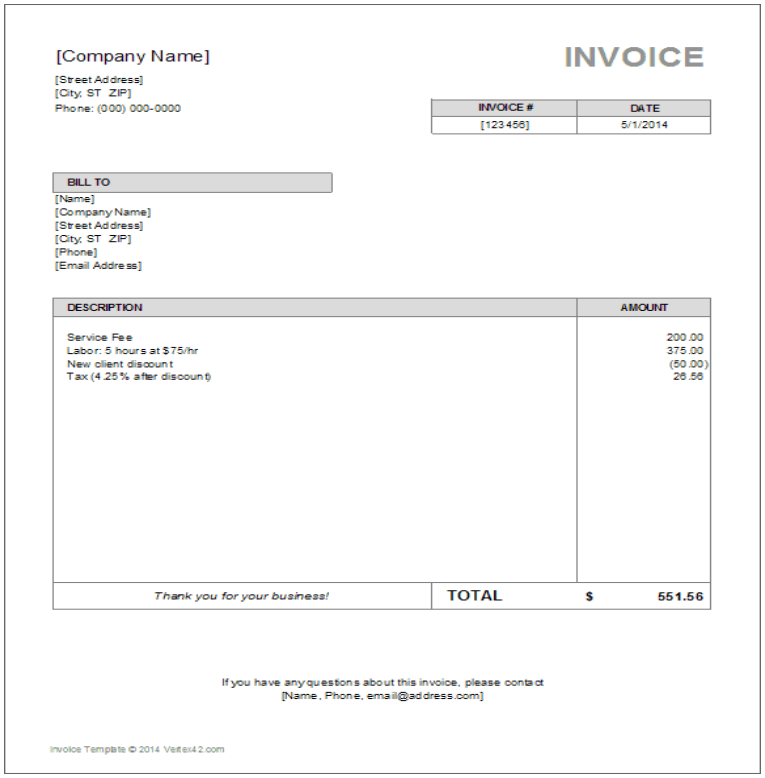
2. Invoice

A standard invoice is issued by a business and submitted to a client. This is the most common form of invoice that small businesses create and the format is flexible enough to fit most industries and billing cycles. Standard invoices include the following details about the sale:

- The business's name and contact information
- The client's name and contact information
- An invoice number
- The amount of money the client owes the business for its services

- Content/Topic 3: Elaboration of invoice /Pro-forma

3.1 Format of the invoice



[Company Name]
[Street Address]
[City, ST ZIP]
Phone: (000) 000-0000

INVOICE

INVOICE #	DATE
[123456]	5/1/2014

BILL TO
[Name]
[Company Name]
[Street Address]
[City, ST ZIP]
[Phone]
[Email Address]

DESCRIPTION	AMOUNT
Service Fee	200.00
Labor: 5 hours at $75/hr	375.00
New client discount	(50.00)
Tax (4.25% after discount)	26.56

Thank you for your business!	TOTAL	$	551.56

If you have any questions about this invoice, please contact
[Name, Phone, email@address.com]

Invoice Template © 2014 Vertex42.com

An invoice may include the following information's:

1) Business name,
2) TIN number of the company,
3) Company name and address,
4) Customer bank account,
5) Item number,
6) Item name,
7) Item specification,
8) Item quantity,
9) Item unit price,
10) Item total price and
11) Total amount due

LO 3.3 – Suggest the maintenance contract according to manufacturer instructions.

A **maintenance contract**, defined as the contract between 2 parties which creates the agreement that one party will maintain an asset owned by another party, is common across many industries/fields.

A maintenance contract, explained as an agreement which supports many service businesses, is simply an agreement to maintain something.

Contracts are legal agreements between two parties or more. Legally binding contracts must have essential elements in order to be enforced in court. Some contracts that are missing one or two of these essentials will still hold up in a court, but it's best to have them all covered.

Contract Classification

Usually, the types of contracts you'll come across in the business world are classified as simple contracts. These can be made:

- In writing
- Verbally
- With action

- Content/Topic 1: Manufacture's recommended maintenance activities for different types of CCTV camera system.

The technical **meaning** of **maintenance** involves functional checks, servicing, repairing or replacing of necessary devices, equipment, machinery, and supporting utilities in industrial, business, governmental, and residential installations.

- Content/Topic 2: Suggestion/negotiation of the maintenance contract based on manufacturer's recommendations.

A negotiation is a strategic discussion that resolves an issue in a way that both parties mentioned in the contract find acceptable. In a negotiation, each party tries to persuade the other to agree with his or her point of view. By negotiating, all involved parties try to avoid arguing but agree to reach some form of compromise.

Parties involved in negotiations can vary. They can include talks between buyers and sellers, an employer and prospective employee, or between the governments of two or more countries.

- Content/Topic 3: Elaboration of maintenance contract.

A **maintenance contract**, defined as the **contract** between 2 parties which creates the agreement that one party will maintain an asset owned by another party, is common across many industries. **Maintenance contracts** can exist for equipment, a building, landscape, computers and other information technologies, and more.

Elements of the contract

The maintenance contract should have the following information's:

1) **Obligation agreements of both parties:** are those duties that each party is legally responsible for in a **contract** agreement. In a **contract**, each party exchanges something of value, whether it be a product, services, money, etc. On both sides of the agreement, each party has various **obligations** in connected with this exchange.
2) **Job description:** a description of the goods and/or services that your business will receive or provide, including key deliverables

It is a written narrative that describes the general tasks, or other related **duties**, and **responsibilities** of a position.

3) **Job timeframe**: a period of days, weeks, months, etc. within which an activity is intended to happen.
4) **Allocation of risks**: refers to contract provisions that determine which party assumes the **risk** of certain events occurring (or failing to occur).
5) **Insurance**: required insurance and indemnity provisions
6) **Price review and adjustments when amendments is required: renegotiation** or renewal options
7) **Full contact of contracting parties**
8) **Stamps and signature of contracting parties**
9) **Termination of contract:** ending the **contract** before both parties have fulfilled their obligations under the terms of the **contract**.

References

1. https://alselectro.wordpress.com/2013/12/01/cctvstep-by-step-guide-to-remote-view-dvr/ (Retrieved on 20 October 2020)
2. https://www.farsight.co.uk/blog/cctv-fault-finding-guide/ (Retrieved on 23 October 2020)
3. https://dir.indiamart.com/impcat/cctv-repairing-service.html (Retrieved on 20 October 2020)
4. https://reolink.com/security-camera-picture-problems-and-solutions/ (Retrieved on 28 September 2020)
5. https://network-data-cabling.co.uk/blog/12-cctv-problems-and-fixes/ (Retrieved on 19 October 2020)