Exploring The Elements of The Grounding Problem of Video Surveillance System

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Abstract: The analysis of the grounding problem of video surveillance system and the study of its corresponding design methods are the key to ensure that such systems fully play the expected role. This paper will first discuss the role of system grounding, and then analyze it on this basis. The classification and design principles of the grounding of the video surveillance system are the last part which mainly combines these contents, and proposes the construction strategy corresponding to the system grounding.

1. Introduction
With the continuous development of computer technology and network technology, video surveillance systems have also been widely used in the security field. For the problems discussed in this paper, can the design and layout of system grounding be scientifically and reasonably meet the requirements will directly affect the safe operation of the system equipment [1]. In this context, it is necessary to study the design and layout of the system grounding in combination with the characteristics of the video surveillance system. Under normal circumstances, the hardware structure of the video surveillance system is mainly composed of front-end information collection equipment, transmission equipment, control equipment, display equipment, etc., and with the continuous improvement of the level of automation and intelligence in this system, the complexity of the video surveillance system has also increased significantly. In order to ensure the stable operation of this system, the relevant units must be able to consider the impact of weather and human factors on the safety of the system during the design and construction of the system, and on this basis, avoid the safety protection measures. Lightning, interference, etc. affect the realization of the expected functions of the video surveillance system. This paper mainly studies the grounding technology corresponding to this system, in order to provide theoretical reference for relevant units and technicians.

2. The Role of Grounding in Video Surveillance Systems
First of all, the possible impact of lightning on video surveillance systems is as follows: When lightning strikes outdoor cameras or overhead cables, the operation of these devices or lines will inevitably be affected, and in serious cases will directly lead to the overall system. It is not working properly; when the monitoring equipment or transmission line is in the transient electromagnetic field generated by lightning, these devices and lines will induce a large electromotive force, which will cause damage to the connected equipment; when the building is in a charged thundercloud underneath, then the route around the building will induce the opposite charge to the thundercloud. This situation may not be serious damage to the appearance of the device, but without reliable protection, the device chip will directly destroyed, eventually leading to the video surveillance system front-end equipment not working properly [2].

Combined with the above content, through the effective layout of the system grounding, the impact
of lightning strikes on the overall safety of the system equipment and the system can be effectively reduced, and the instantaneous increase of the potential of the lightning current is prevented from being too large, resulting in the system equipment not functioning properly. In addition to lightning protection, grounding can still be anti-interference in video surveillance systems. Interference between circuits due to parasitic capacitance, circuit radiated electric field, sensitive to external electric field, etc. may affect the normal operation of the system as a whole, and the interference problem will be effectively restricted by the effective setting of system grounding.

3. Classification of Grounding in The System And Common Grounding Methods

3.1. Classification

①Protected land. This type of grounding is mainly set to avoid the accumulation of static charge in the equipment casing and affect the personal safety of the surrounding workers. In combination with the composition of the video surveillance system, the operator station, the field control station, the printer, etc. should be protected by the setting of the protection ground.

②Logical land. During the operation of the system, the current of each stage of the electronic equipment, information conversion, etc. need to have a reference potential, while preventing the intrusion of external electromagnetic field signals, that is, "logically." As the name implies, this type of grounding is not necessarily a physical grounding. It can also refer to the metal casing of an electronic device, the total grounding terminal in a building, and the like. In the actual system construction process, it can logically not contact with the earth, and the ±5V of the CPU, the negative terminal of ±12V, the output of the +5V power supply, etc. all belong to the logic ground.

③Shielding ground. This type of grounding is mainly designed to reduce the capacitive coupling noise in the signal, so as to accurately detect and control the signal [3]. In the actual application process, depending on the purpose of shielding, there are certain differences in the layout methods corresponding to the shielding ground. Combined with the characteristics of the video surveillance system itself, the shielding layer of the signal cable should be set in the form of shield grounding to avoid the occurrence of closed loop interference.

④Intrinsically safe. This type of grounding is mainly used in video surveillance systems with safety barriers. The intrinsically safe ground should be independent of other grounding systems to ensure that the relevant safety barriers can operate normally in an emergency and ensure the safety of the relevant industrial sites [4].

3.2. Grounding Method

①Communicate with the electrical grounding grid. This grounding method may have some difficulties in the design stage and the laying stage. However, under the mode, the demand for steel for the grounding grid can be effectively reduced, the overall construction cost of the system is low, and the management personnel only need to manage the single grounding network. And maintenance, the reliability of the grounding system can be better guaranteed, thus ensuring that the grounding system can play the expected role in the video surveillance system.

②Set up an independent grounding network for the video surveillance system. Although this grounding method can well realize the requirement of the grounding network of the video monitoring system, in the actual application process, this method also has the defects of large occupied area and high cost. At the same time, because the dedicated independent grounding grid is difficult to be directly installed in the building, and the distance between the grounding grid and the building is too far, the system maintenance cost and management difficulty will increase greatly [5]. In combination with these contents, the grounding designer should try to avoid the design of a separate dedicated grounding grid.

③On the basis of setting up a dedicated grounding grid, connect it to the electrical grounding grid. In combination with the above, although the dedicated grounding network of the video monitoring
system is connected to the electrical grounding network, the defects of the dedicated grounding network cannot be effectively improved, and the overall maintenance cost and management complexity of the system cannot be controlled. The grounding designer should also consider this grounding method in depth and try to avoid the setting of the dedicated grounding grid if conditions permit.

4. The Principle That The Video Monitoring System Grounding Device Should Be Laid

4.1. Signal Cables Should Be Selected And Laid In Accordance With Existing Regulations
In order to improve the resistance of the video surveillance system to external influence factors on the basis of ensuring the normal operation of the grounding system, relevant personnel should be able to attach importance to the selection of the signal cable model. In the actual application process, the flame-retardant twisted copper mesh shielded computer cable can effectively guarantee the security of signal transmission. In addition, the laying of signal cables should be done in strict accordance with the existing national regulations to avoid interference problems due to unreasonable cable layout.

4.2. Signal Cable Shield Grounding Should Be Completed According to Existing Specifications
In combination with the contents of the existing technical specifications, the shielding of the signal cable of the video monitoring system should meet the following requirements: when the signal source is floating, the shielding layer should be grounded on the computer side; when the signal source is grounded, the shielding layer should be When the shielding layer is connected to the junction box, the connection between the cable shielding layers at both ends should be completed in the junction box to ensure the effective function of the cable shielding layer, and to minimize the static induction, electromagnetic induction, etc. in the video monitoring system. The normal operation will affect various equipments.

5. System Grounding Method
In order to ensure that the scope of monitoring can meet the requirements, the video surveillance system usually performs a wide range of security work by means of distributed control stations. For the problems discussed in this paper, most of these control sites use multimode fiber. Category 5 twisted pair or the like is connected. The grounding methods for these cables are as follows:

If fiber-optic connection is used, the grounding method in each station should be synchronized with the deployment of monitoring equipment; if Category 5 twisted pair or dp twisted pair cable is used, these cables should be connected to the monitoring equipment through the signal lightning arrester. Under such a layout mode, even if there is a phenomenon such as lightning strikes, the signal lightning arrester can well avoid the influence of the potential difference between the two sides of the line on the equipment in the system, and finally achieve the safety of the system equipment and complete the expected security work.

For the connection of various ground wires in the control room, these lines should be connected to the common connection board, and then these lines are connected to the common grounding pole under the action of the common connection board. From the perspective of the overall grounding grid, such a connection is equivalent to a star structure, and this structure has good security and stability. Even if there is a problem with the same part of the grounding line of the system, the rest will not be affected. It can still operate normally to ensure the safety of the corresponding equipment.

5.1. Grounding Device Installation
If grounding body. The grounding body is essentially a kind of conductor, and under the action of the device and the grounding line, the current will be effectively introduced into the earth to avoid damage caused by lightning and other phenomena in the system. In the process of setting the grounding body, the relevant personnel should pay attention to the following problems: the grounding body is driven into the ground and starts to operate, and the connection between the grounding body and the
grounding main trunk should be completed by brazing and should be set. Certain anti-corrosion measures are taken to avoid the influence of the underground environment on the electrical conductivity of the grounding body, and to ensure that the grounding grid can effectively cope with the large amount of current generated under lightning strikes.

② Construction of the grounding body network. The normal operation of the video monitoring system grounding network is based on the grounding resistance can meet the requirements, and in order to ensure the scientific nature of the grounding grid, the relevant staff can connect multiple grounding bodies to form a grounding body network, and then achieve The goal of controlling the grounding grid resistance is to ensure that the grounding system can meet the requirements of the video surveillance system in various physical parameters. The connection between the grounding bodies is mainly done by the grounding grid trunk. In this process, the relevant staff should be able to control the length of the overlap between the two. In general, this value should be flat steel. Double the width or 6 times the diameter of the round steel.

5.2. Reduce Soil Resistivity
The core of grounding system design and layout is to introduce current into the earth. If the soil's own resistivity is high, the overall conductivity of the grounding system will naturally be affected. Based on this, the relevant personnel are ensuring a reasonable grounding system structure. On the basis of sex, it should be able to consider the soil resistivity and analyze the method of reducing the soil resistivity in the current environment to ensure the normal operation of the grounding network of the video surveillance system. The commonly used methods for reducing soil resistivity are as follows:

① Improve the soil structure around the grounding body. In combination with the above, the grounding body is the core device for introducing current into the earth. If the soil resistivity around the grounding body is high, the effect that the grounding body can exert is naturally limited. In response to this problem, substances that are insoluble in water and have good water absorption, such as slag and charcoal, can be incorporated within 2-3 m around the grounding body. Under the action of this method, the resistivity of the soil in this range will be reduced to 1/5-1/10 of the original level, thereby ensuring the effective function of the grounding body.

② Select the resistance reduction material. The soil resistance can be reduced by using salt and charcoal layered and compacted. First lay a layer of charcoal, the thickness is about 10-15cm, and then lay a layer of salt, the thickness is about 2-3cm, the total number of layers is 5-8 layers, and finally tamping. This method can reduce the soil resistivity to 1/3-1/5 of the original level, but since the salt will continue to lose with the water, in order to ensure that the soil resistivity can be within the expected level, the relevant personnel should regularly treat the salt. Add it. In addition, in order to avoid the cost of reducing the resistance of the material and the manpower and material resources consumed, the long-acting chemical resistance reducing agent can also be used to reduce the soil resistivity. Chemical resistance reducers generally reduce soil resistivity to less than 40% of the original level.

5.3. Selecting The Grounding System to Lay Out The Raw Materials
First of all, for the choice of grounding body and grounding grid trunk material, the relevant staff should choose the combination of on-site conditions and existing standard specifications. If the steel does not meet the requirements in terms of resistance, then the copper can be used to complete the video monitoring system. If there is a problem of strong soil corrosion during the grounding grid laying process, then the section of the line should be increased by hot-dip galvanizing to improve the corrosion resistance of the wire.

Secondly, if there is a problem that the connection distance is long or the video monitoring system has high resistance requirements during the construction of the grounding grid, then the wire and cable with a large cross section should be selected to ensure that the function of the grounding grid is not affected by the resistance. In addition, the protective ground and shielding ground in the video surveillance system should be connected by copper core insulated wires. This is mainly to ensure that
these types of grounding can better ensure the safe operation of equipment and shield external interference.

6. Conclusion
In summary, this paper first analyzes the role of grounding in video surveillance systems. Based on this, several grounding methods commonly used in such systems are introduced. The last part is grounded from the distributed arrangement system. The method of installing the grounding device and reducing the soil resistivity has deeply explored the construction method of the grounding network in the video surveillance system. In the subsequent development process, the relevant units and designers must be able to further attach importance to the grounding problem, and combine the video monitoring system application requirements, the national existing specifications, etc. to ensure the scientific and rationality of the grounding network settings, to ensure that the video surveillance system can meet the requirements, such as safety, stability, reliability and other aspects meet the requirements.

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