

# Cause Analysis and Solution of False Alarm in Coal Mine Safety Monitoring System

Xuwei Feng

Hebei University of Architecture, Zhangjiachou, Hebei, China

**Abstract:** *With the continuous development of social economy, coal mining industry has made great progress. In the coal mine safety production, its safety monitoring system is becoming more and more perfect, in the face of a variety of potential accidents, can provide timely warning information to the relevant personnel, to avoid casualties and property losses. But in the actual work of mine safety monitoring system, the phenomenon of false alarm often occurs, which affects the reliability of mine safety monitoring system data. Therefore, this paper mainly analyzes the causes of false alarm in coal mine safety monitoring, and puts forward targeted technical solutions, aiming at improving the accuracy of coal mine safety monitoring data and laying a solid foundation for coal mine safety production.*

**Keywords:** Coal mine; Safety monitoring system; False alarm; Reason analysis; Solution measure.

## 1. INTRODUCTION

In the coal mine safety monitoring system, false alarm will have a great impact, directly related to the reliability of coal mine safety production data. Through practical analysis, it is found that in the process of coal mine production, due to transmission cables, power supply, environmental interference and other factors will cause false alarms in the coal mine safety monitoring system. Therefore, relevant personnel must take effective measures to ensure the stability of transmission signals through a series of technical means, reasonable maintenance and use of equipment and strengthen the ability of equipment to resist environmental interference. Ensure the data reliability of coal mine safety monitoring system.

## 2. ANALYSIS OF FALSE ALARM CAUSES OF COAL MINE SAFETY MONITORING SYSTEM

### 2.1 Affected by Transmission Cables

At the present stage, the coal mine safety monitoring system mainly uses industrial Ethernet as the main structure, so the sensor signal generally adopts the frequency output mode to a certain extent, so as to facilitate the replacement of equipment maintenance. On the other hand, the connection between the sensor and the transmission cable of the device is designed in the form of an aviation head, and the transmission cable will be extended appropriately through the junction box. Therefore, one cable is usually connected to two sensors on site. In this case, the cables of multiple sensors are bound together. In actual coal mine safety monitoring system equipment, it is common for multiple cables to be connected together. However, in the process of signal transmission by the sensor, under the influence of the characteristics of frequency signals, data coupling or wrong connection may occur between the junction box, cable and aviation head, thus causing false alarm [1].

### 2.2 Affected by the Power supply

As production operations in underground coal mines require large equipment such as winches, locomotives and belt conveyors, frequency conversion technology is generally adopted in order to improve power efficiency as much as possible. Once the coal mine safety monitoring equipment and these loads share a power supply, when the equipment is started, it will produce a large radiation and surge interference, through the AC end will seriously affect the stable operation of the safety monitoring system, will cause the sub-station or sensor reset, or even crash, eventually lead to the coal mine safety monitoring system false alarm. In addition, unplanned power outages often occur due to the unreliable power supply of downhole lighting. When the lighting power supply is used in the security monitoring system, relatively frequent power outage will also cause the switch between AC and DC power in the security monitoring system. If the circuit is not properly handled, the sub-stations or sensors will be reset, resulting in false alarm of the security monitoring system [2].

### 2.3 Be affected by environmental disturbances

The false alarm of coal mine safety monitoring system is highly disturbed by the environment. This is because the environment under the coal mine is relatively humid, especially in summer, there is more water vapor in the mine. If the safety monitoring equipment is improperly maintained, it will lead to water vapor entering, which will have a serious impact on the sensor circuit and induction head, prompting the safety monitoring system to be in an uncontrollable state, resulting in false alarm phenomenon. In addition, on the working surface, some shearer or roadheader will produce a large amount of dust, coal dust, static electricity, etc., which will also cause the coal mine safety monitoring system to suffer from operation interference and false alarm. In

addition, due to work requirements, some high-power equipment, wireless signal and other frequency conversion equipment are also set up under the mine, which will produce certain radiation during operation and affect the sensor signal of the mine safety monitoring system, thus leading to false alarm [3].

### **3. MEASURES TO SOLVE FALSE ALARM OF COAL MINE SAFETY MONITORING**

#### **3.1 Ensure stable signal transmission**

In view of the phenomenon of false alarm caused by signal transmission in the current coal mine safety monitoring system, the Ethernet ring network communication and switch can be formed into a ring network platform through the corresponding technical means, which can minimize the influence of the outside world on the sensor signal transmission. The principle is to use the bus for digital communication between the sub-station and the switch, in the process of data transmission will be checked for anti-interference, so as to effectively avoid false alarm phenomenon. The specific technical measures are the use of digital signal bus signal transmission, not only to meet the sensor adjustment needs, but also to identify the working state of the equipment, detection of the original working life; Secondly, the shield cable is used as the data transmission cable, which is conducive to realize the connection between the two ends of the sub-station and the sensor, and can avoid the spatial interference to a large extent. Finally, it is necessary to add filtering and data recognition algorithm in the sub-station, which can facilitate the sensor to increase the mutation data recognition, and eliminate the external interference factors within the allowable range of the standard.

#### **3.2 Maintain and use the device properly**

Good maintenance of equipment can effectively reduce the main measures and means of coal mine safety monitoring system false alarm, so in the actual work and maintenance, we should try to avoid the sub-station take point power supply and other large equipment sharing the same power supply, as far as possible to avoid the frequency conversion equipment, under the condition of permitting, do not choose unstable lighting power supply. At the same time, it is necessary to add filters, surge suppressors and other equipment in the substation power supply, which can realize good grounding.

Reduce the impact of surge and static interference on the power supply; Secondly, in the wet working face, the relevant technicians need to improve the aviation head of the sensor into a directly connected waterproof plug, and the internal docking plug-in of the sensor is sealed, focusing on the location of the transmission signal and signal output connection line. At the same time, technicians should also take into account that the junction box damp will also lead to false alarm, so it is necessary to seal the junction box relatively close to the working face internally to avoid the influence of water vapor infiltration on the transmission signal; Finally, technicians need to carry out regular sensor well lifting to solve the phenomenon of moisture sensor components. The sensor is usually brought up after about 15 days of service, and is kept on the surface for 7 days to ensure that the moisture of the sensor disappears before it can be run again. Among them, the service life of the catalytic element and electrochemical element of the gas sensor is 1 year, and the thermal conductivity element is 3 years. In the maintenance process, if the components are found to have reached the service life, they should be replaced immediately to prevent false alarm.

#### **3.3 Enhance the anti-interference capability of the device**

For the interference factors of underground environment in coal mine, technicians should try to choose safety monitoring equipment with strong anti-interference ability. As downhole interference cannot be completely avoided, technicians can solve it through the following three aspects:

(1) Establish equipment protection levels. Because in the underground environment, water vapor, dust, coal dust, etc., will have a great impact on the circuit board of the safety monitoring system, and may even cause circuit break. Therefore, the relevant personnel need to choose the safety monitoring equipment with higher protection level as far as possible, to ensure that it can also operate normally and stably in the water environment.

(2) Surge treatment of power supply. Generally, surge signals will be generated during thunderstorms or when large equipment is started or stopped, which will cause great damage to the security monitoring system. Therefore, technicians need to add high-power transient diodes in the signal input and output ports, which can effectively avoid the impact of surge on security monitoring equipment. At the same time, surge suppression circuit can also be added to prevent equipment damage.

(3) Processing of signal output and input. In coal mine safety monitoring system, the signal port is relatively fragile, and it is very easy to be interfered by external signals. Therefore, relevant technical personnel can re-sample port and communication port or control port to increase the protection circuit, to a certain extent, can reduce the impact of interference signals on security monitoring equipment. For example, in the process of starting and stopping the sensor, electromagnetic infection can be avoided to ensure the accuracy of monitoring data. Moreover, the digital signal processing technology can also effectively improve the sampling efficiency and prevent false alarm by increasing the number of filtering.

#### 4. CONCLUSION

To sum up, the coal mine safety monitoring system operates in the complex environment under the mine and is inevitably affected by various factors. Therefore, relevant technical personnel should correctly understand the factors that affect the false alarm of the safety monitoring system. For the common transmission cable influence, power supply influence and environmental influence, It is necessary to adopt the corresponding technical means to ensure the stability of signal transmission, reasonable maintenance and use of equipment, and enhance the anti-interference ability of equipment. So as to minimize the occurrence of false alarm, ensure the reliability of safety monitoring data, fully protect the safety of coal mine production.

#### REFERENCES

- [1] DU Gang. Logical Alarm Analysis of Coal mine Monitoring Based on multi-system data level Fusion [J]. *West Coal*,2017,37(05):13-21.
- [2] Chen Bin, LIU Yunjian. Discussion on the causes and Countermeasures of false alarm in Coal Mine Monitoring System [J]. *East Industrial Technology*,2017(13):72.
- [3] SONG Shipeng. Analysis and Countermeasure Research on False Alarm of Gas Sensor in Coal Mine Monitoring System [J]. *Inner Mongolia Coal Economy*,2017(09):90+141.