Technical Analysis on Safety Video Control for Electric Power Operation Field

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Abstract. In order to strengthen the safety control and control in all kinds of work sites of electric power enterprises, the whole process monitoring and control control platform of the on-site operation is built, realizing video monitoring of the whole process of all kinds of work sites in real time. The platform is equipped with such functions as audio and video transmission, interactive communication, high-definition monitoring, audio and video data storage, and so on, which can be applied to all the sites of production, construction, technical innovation and so on and implement the whole process supervision of all the working sites of their institutions.

Introduction

At present, the on-site operation of power enterprises has such advantages as heavy task, short time, long duration and high risk; the provincial power company in state grid can't fully cover the safety supervision of production sites in subordinate units. The safety control is weak in some small, scattered, temporary work sites, which can easily cause blind area of safety supervision; as a result, higher level companies cannot fully grasp all kinds of safety risks in all kinds of working sites of production, construction, technical renovation, and power operation expansion, and the safety pre-control measures cannot be effectively implemented in supervision. As loss of effective supervision in power production field is the main factor causing accidents, improving the safety supervision of all kinds of working sites is an important means to ensure the safety of electric power production, and how to realize the remote real-time monitoring of all the working sites now is a problem in urgent need to be solved.

Application background of safety video control techniques in electric power operation field

To improve the coverage of site safety risk control, so as to comprehensively eliminate the safety monitoring blind area of small, scattered, and temporary working sites, on-site process monitoring control platform is set up; monitors can timely find illegal behavior through audio and video, makeon-site personnel exchanges with on-site operators and conduct determent peccancy, and the application effects can be seen. Sub-platforms are established in each institution, which can realize scattered distribution through the collection, transmission, storage and manipulation of all the signals of terminal systems and control terminal equipment; in the monitoring process, audio and video interaction can be conducted directly in the process of monitoring, so as to timely detect and stop regulation violation behaviors, reduce safety supervision cost, and improve working efficiency.

(1) Selection of field control terminal device

The field control terminal device mainly has crossover/switching matrix, audio switch box, serial data decoder, image splitter, etc. The selection in this scheme is summarized as follows:

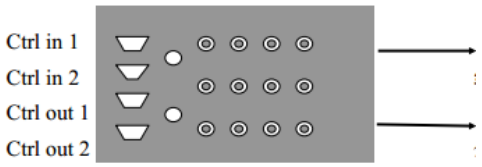


Figure 1 Scheme of switching matrix

Switching matrix: the main device of field control terminal, mainly completing the distribution and delivery of all kinds of information (control instructions, video/audio signal, alarm and other sensing interrupt request signal, etc.) under software control. Specification is mainly defined by the number of channels of input and output. Take the 16*4 crossover/switch matrix used in this scheme as an example. The main function is as follows: 1: control the input: Ctrl In1 port is RS232 interface, from which the computer control signal to the front-end device (send from the decoder) is sent; Ctrl In2 port is the parallel interface, from which the computer switching signal to the video/audio is sent. 2: control the output: Ctrl Out1 port is RS485 interface, sending control order to decoder; Ctrl Out2 port is RS232 interface with 25 needs, controlling the relay-based output of the auxiliary 8 channel. 3: Video input: 8 video input ports can receive 8 channels of video signals. 4: Video output: 3 video output ports can switch to 3 channel output according to 8 channel input. 5: Alarm linkage interface: two interfaces can produce responses to the alarm signals in 8 channels from software control. Generally, they can be used to connect video-recorder and alarm. 6: 8 channels of relay-based output: software control and video switching can form linkage, used for the real-time control of auxiliary peripherals. 7: Branch control system: numerous branch control devices can be added, used for field branch control. Normally, two branch controls can be set, and if more branch controls are needed, auxiliary devices can be added.

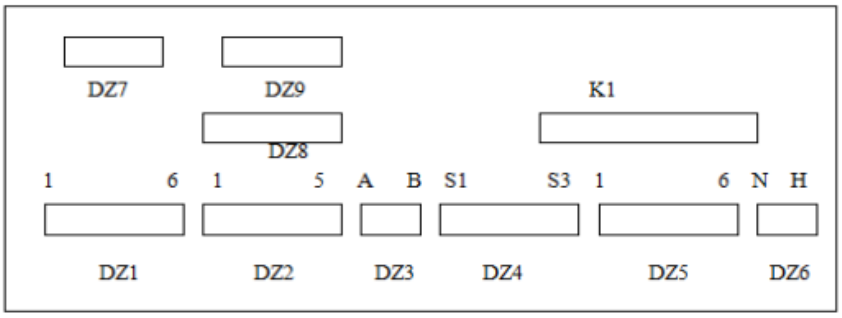


Figure 2 Diagram of an input and an output

1: Use terminal set DZ5 to control cradle head, and the 6 terminals are: DZ5-1：levogyration; DZ5-2: dextrorotation; DZ5-3: pitching-up; DZ5-4: pitchdown; DZ5-5: autorotation; DZ5-6: common terminal. 2: Use terminal set DZ1 to control three changeable video cameras; as for four-line control video camera, the wiring is: DZ1-1: double; DZ1-3: focus; DZ1-5: aperture; DZ1-2, DZ1-4, and DZ1-6 connect together as common terminal. As for 6-line control video camera, the wiring is DZ1-1（+）DZ1-2（-）: double; DZ1-3（+）DZ-4（-）: focus; DZ1-5（+）DZ1-6（-）: aperture. 3: Provide a set of controllable relay DZ4, to control the auxiliary device, which usually is: S1: power switch of video camera; S2: power switch of wind-shield wiper; S3: reserve switch (can be used for the power switch of infra-red lamp).

(2) Tele transmission and control system

The distance from the site terminal to the central terminal is rather long, and the transmission bandwidth of 2M is used for the transmission of optical fiber. Use T400A/B remote transmission codec, the E1 (g. 703) interface of T400A is connected to the optical terminal, and at the center, the optical end is connected to T400B. T400 brief introduction: T400A/B video transmission codec is the

transmission device of video, which can realize audio, video and data transmission; it can work on 2 MBPSPCM communications lines, realizing data, audio and video transmission.

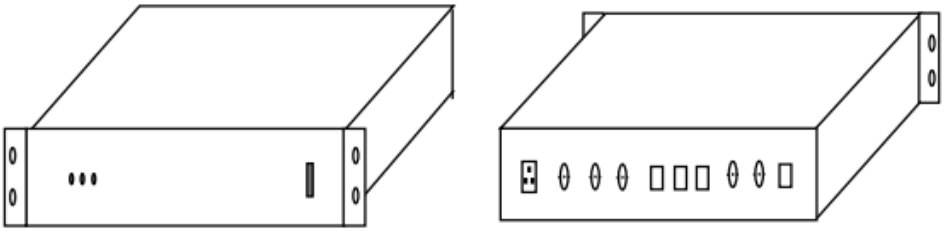
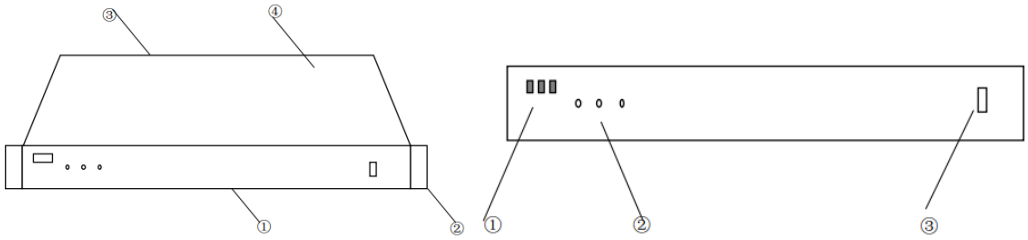


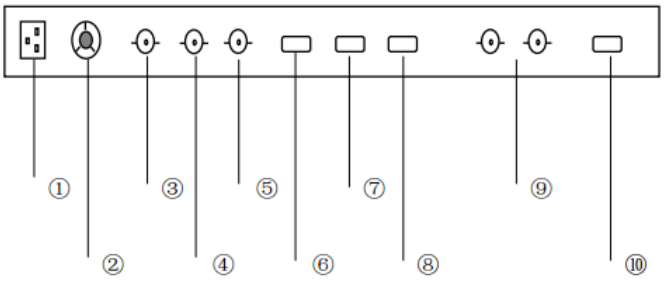
Figure 3 Diagram of T400A / B outline

The T400 device can be divided into two parts: the delivery and reception terminals of video which are T400A and T400B respectively. At the same time, it has multiple data interfaces: T400A can realize the input of audio and video, and compress them in the process of long-distance transmission; T400B can achieve video and audio output, and conduct signal restoration processing. T400A can realize the connection with various industrial main-control video cameras and ordinary simulated cameras; meanwhile, it can also match with the divider of multiple pictures and videos and realize the match with monitoring matrix. T400B can implement video standard output, and its image can be displayed on TV; at the same time, it also can be displayed on professional monitor. Meanwhile, T400 is able to connect easily with the monitoring device.



① Model marker ②LED indicating light ③ Power switch

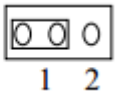
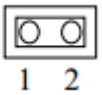
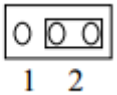
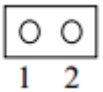
Figure 4: Outlook of device Figure 5: Front board



①Socked of AC power line ② Mechanical fan ③ Interfaces of video input/ output ④ Audio input interface ⑤ Audio output ⑥RS-485/RS-422 data interface ⑦RS-232 data interface ⑧SETUP interface ⑨G.703 75 Ohm interface ⑩G.703 120 Ohm interface

Figure 6 Back board

Audio input jumper setting

Input type	J5	J6
Condenser microphone	1-On 	1，2- On 
Line level	2-On 	1，2- Off 

The voltage support of the whole system is provided by the power supply circuit; to ensure the stability of the system voltage, the design of the power circuit is very important. In the circuit board, the power supply is generally 5.0V or 3.3V; this design scheme adopts 5.0v DC power; when 5.0v DC power passes special voltage stabilizer, the output voltage is 5.0v DC stabilized voltage. The gained

5.0v stabilized voltage is processed through voltage regulator, which is converted into 3.3V voltage, used for ARM processor and partial interface module. The design of power conversion circuit is shown in figure 7.

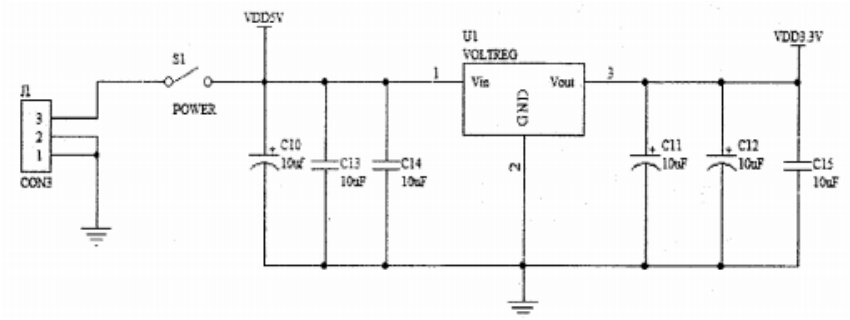


Figure 7: Design of power circuit

The reset circuit is an integral part of the system design. When the program is in a dead cycle or the system appears to be dead, a reset circuit is needed to restart the system. This system design adopts special reset chip to complete the reset function; the reset chip selects MAX81 1S, and the chip has the function to be reset with power on; you only need to press the reset button S2 to power the chip on, the system reset complete can be completed and you can restart the system. The design of reset circuit is shown in figure 8.

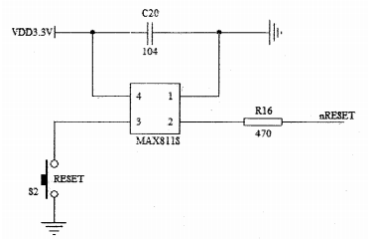


Figure 8: Design drawing of reset circuit

The Tw2835 first determines the address of the page address and the internal register of the video data to be written or read, and then completes the energy signal setting, so as to finish the corresponding read-write function. The performance function to write the bytes is as follows:

```
Void Write A Byte(uchar page，  uchar addr uchar dat)
{
if(pg==PG0)
{HCSBI=O；HCSB=0；) ／ ／page selection
else if(p92=PGI)
{HCSBI=0；HCSB=1；)
else if(pg=2PG2)
{HCSBI=I；HCSB=0；}
HDAT=addr；  ／ ／address selection
HALE=I；HALE=0；
HDAT=dat；  ／ ／byte writing
HWRB=O；HWRA=I；
HCSBO=I；HCSBI=I；
HDAI=0XFF；
}
```

Suppose the area of the spherical surface is S, the charge density on the surface of the sphere is σ(t), then the charge Q(t) on the upper hemisphere surface is:

$$Q(t) = \int \sigma(t) ds$$

The inductive charge will generate a voltage in the measuring capacitance C_, and the voltage is as follows:

$$U_M=Q(t)/C_M=KE/\ C_M$$

Conclusions

Through the application of on-site whole-process monitoring control platform, safety supervision of the whole process in all kinds of production sites can be realized, which can effectively promote the safety supervision ability and the working degree of anti-regulation-violation, greatly enhance the safety risk awareness of on-site operation personnel, standardize the operation behaviors, form a good atmosphere of safety supervision and management with the involvement of all the people, and elevate the company safety management level.

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