

Development and Application of Intelligent Remote Alarm Device

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Abstract: With the advent of the smart grid era, the concept of power load management has also become more deeply rooted, in recent years, the popularization and installation of load control terminals have greatly improved the accuracy and timeliness of power data collection, which has important practical significance for realizing the goal of "full collection, full coverage and full cost control" of state grid corporation. Negative control is load control, also called power load management. Load control terminal is a kind of power system remote control device which integrates current overload protection function, automatic power cut - off, alarm, reset and other functions. The realization of the alarm function requires the negative control terminal to cooperate with the alarm device to be used at the same time. The alarm device can play a voice reminding role when the user owes electricity, thus avoiding the user from delaying the payment time and affecting the production and life of the enterprise.

1. Introduction

Negative control is load control, which is also called power load management. When a power user signs an electricity contract, there is a maximum load limit, which may be equal to the capacity of the transformer reported by the user, or may be less than the transformer capacity. When the user exceeds the load limit, the power supply company will implement measures to reduce the load ^[1].

In order to realize the load control function, the 100kVA and above specialized transformer users of the State Grid Jinzhou Power Supply Branch shall be installed as load control terminals and alarm devices. Therefore, the load control function of the negative control terminal is of great significance for achieving "full acquisition, full coverage, and full cost control" ^[2].

The negative control terminal alarm device can serve as a voice reminder for the user's use of electricity in a short time, so as to avoid the user delaying payment time and affecting the production and life of the enterprise. In general, the alarm device is installed in the transformer substation together with the negative control terminal. when the user owes money, the alarm device gives out a warning sound of arrears, and the personnel on duty can hear and take measures in time. However, when some users' negative control terminals and alarm devices are installed in the negative control metering integrated cabinet under the transformer substation outside the factory area, users will not be able to hear the voice alarm prompt in time, which affects the production power consumption. this requires that the alarm devices be moved to the factory area, while the negative control terminals outside the factory area will be connected by erecting or burying signal cables. Due to the complexity of the site environment and the difficulty of laying cables, the erection or burying of cables at high altitude not only increases the complexity of construction and material costs, but also increases the potential safety hazard and subsequent maintenance costs in the construction process. at the same time, it also reduces the working efficiency of personnel.

Therefore, in order to enable users to hear voice alarm prompts in a timely and stable manner, and

avoid users from tripping due to power overcharges, the overall planning and deployment of “safety and orderly use of electricity” can be implemented to solve the alarm communication problems of existing negative control devices. It is imperative.

2. Development of equipment

2.1 Working principle of device

The intelligent remote alarm device comprises a transmitting unit and a receiving unit, wherein the transmitting unit is arranged at the side of the negative control terminal and receives alarm instructions of the negative control terminal in real time and transmits signals through the intelligent data transmission module; The "receiving unit" is installed at the side of the alarm device, receives the signal alarm through the intelligent data transmission module, and transmits the alarm instruction information back to the transmitting unit.

2.2 Functional module design

In order to ensure the effect of data transmission between the transmitting unit and the receiving unit, the data transmission module should have the following characteristics: the data transmission error rate should not exceed 10⁻⁵, the transmission power should be 100MW, and the wireless data transmission should be 433MHz. Committees apply for frequency band (430MHz ~ 470MHz) high anti-interference ability and low bit error rate, transmission distance, transparent data transmission, programmable channel, with a large data buffer.

The definition of the connection terminal of intelligent data transmission module: provide a 5-pin cable connector, the definition and connection method with the terminal is shown in the table 1 below.

Table 1. The definition and connection method with the terminal

Pin	Definition	Instructions	Connect to terminal	Remark
1	VCC	Positive power supply	5VDC	Lowest 3.3VDC
2	GND	Power ground	Power ground	
3	TXD	Data output port	Data input port	
4	RXD	Data input port	Data output port	
5	GND	Signal ground	Signal ground	

After the design is completed, the smart data transmission module is as follows:



Figure 1. The physical map of smart data transmission module

The two parts of the transmitting unit and the receiving unit of the intelligent remote alarm device adopt point-to-point communication mode, which does not affect the normal operation of other devices. The "transmitter unit" is installed on the negative control terminal side and receives the alarm instruction of the negative control terminal in real time and passes the data transmission module. Transmitting signal; "receiving unit" is installed on the alarm device side, receives signal alarm through the micro power data transmission module, and transmits the alarmed instruction information back to the transmitting unit. As shown in the figure, the device consists of a transmitting unit 1 and a receiving unit 2.

The transmitting unit 1 has an alarm interface for electrical connection with the negative control terminal 3 and has a built-in data transmission module I. The data transmission module I is electrically connected to a small antenna 5.

The receiving unit 2 has an alarm interface for electrical connection with the alarm device 4 and has a built-in data transmission module 2, and the data transmission module 2 is electrically connected with a small antenna 6.

The data transmission module 1 sends an alarm instruction to the receiving unit 2 through the small antenna 5. The data transmission module 2 transmits the alarm information back to the transmitting unit 1 after receiving the alarm instruction through the small antenna 6.

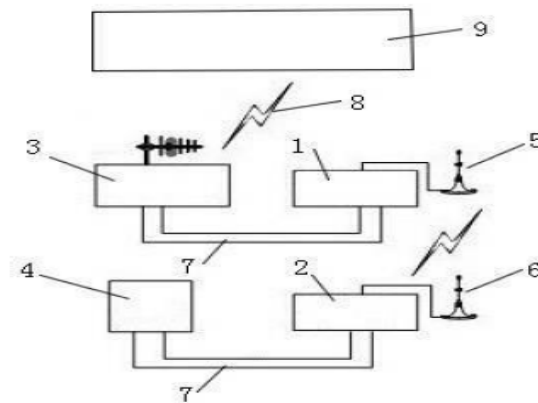


Figure2. The structure diagram oh smart data transmission module

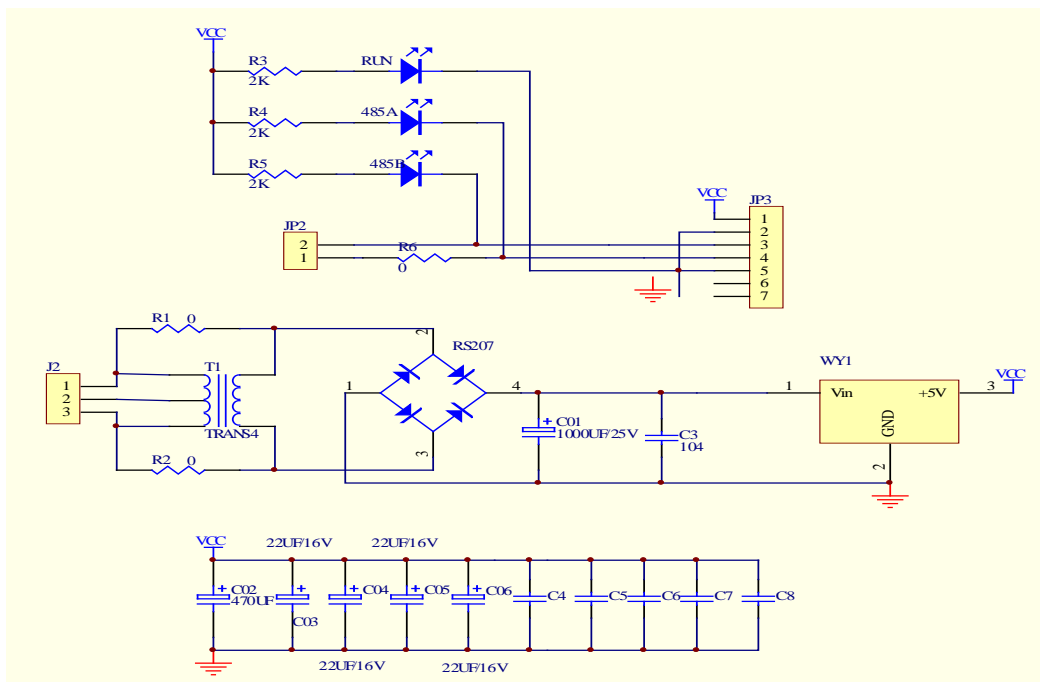


Figure3. The control circuit diagram of intelligent remote alarm device

2.3 Parameter setting

Table2 The parameter setting

serial number of equipment	Project	Parameter value
1	Intelligent data transmission module	
1.1	Modulation	GFSK
1.2	Working frequency	433MHz
1.3	Interface data format	8N1(No check), 8E1(Even check), 8O1(Odd check)
1.4	Transmit power	100MW
1.5	Receiver sensitivity	-116dBm@9600bps
1.6	Channel rate	1200/2400/4800/9600bps
1.7	Interface rate	1200/2400/4800/9600bps
1.8	Emission current	≤100mA
1.9	Receive current	≤40mA
2	Transmitter unit (receiving unit)	
2.1	Total power consumption	<2W
2.2	Module transmit power	<100MW
2.3	Emission frequency	430-470m In the case of wide viewing distance, antenna placement height position>2m;
2.4	Transmission distance	9600bps Reliable transmission distance is greater than500m; 1200bps Transmission distance up to 800m
2.5	External dimensions	80mm×60mm×30mm

3. Scope of application

The intelligent remote alarm device is suitable for power users installed outside the factory with the negative control terminal. The alarm device is installed in the duty room. It uses the micro power signal for remote transmission of data between the negative control terminal and the negative control terminal. This can enable the user to listen to the time. To voice alarm sound, to prevent arrears of tripping, but also to avoid the construction costs of high-altitude erection or buried cable, but also reduce the labor intensity of personnel, effectively improve the safety performance and work efficiency.

4. Economic benefits

Before the device is used, the method of erecting or burying cables can only be used for the negative control terminals and alarm devices that cannot be directly connected, and due to external influences and the like, frequent round trips are often caused. After the device is adopted, the installation time of the terminal is shortened, the consumption of manpower, material resources and financial resources is reduced, and the cost is saved.

Before installation, the average consumption of each installed negative control device was: $128.7+1120+8\times 50$ (the cable cost used) + 200 (the related material cost) =1848.7 yuan. After installation, the average consumption is: $59.4+172.8+200$ (the difference between the intelligent remote alarm device and the normal alarm device purchase cost) = 432.2 yuan. Therefore, the use of the alarm device can save costs $1848.7-432.2 = 1416.5$ yuan.

5. Conclusion

In summary, the smart remote alarm device has been widely promoted and used by the State Grid Jinzhou Power Supply Company, and has achieved good results. The device is simple in structure and convenient to install, and replaces the difficulty and high cost of cable laying, which not only reduces the equipment construction investment and operation and maintenance costs, but also effectively

improves the safety performance. After more than a year of operation, it has been widely recognized by field installation and commissioning personnel.

References

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