The Common Problem Analysis and Improvement Measures Based on Load Control Terminal

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Abstract: This paper states the development of electric power load control system application through the electricity information acquisition system in recent years, and realizing remote automatic meter reading is an important part of the construction for unified strong smart grid. It is the important basis of standardized construction for electric power enterprise marketing measurement, metering and charging, it is the necessary choice of improving service ability, achieving residents ladder electricity price, so guaranteeing the success rate of acquisition system is an important index of the practical system. Reducing the failure rate of power load control terminal is an effective means and way to improve the success rate of power user electricity information acquisition system, and it is the prerequisite and important guarantee to improve the success rate of power user electricity information acquisition system. The paper is in view of the above content, the importance of reducing the power load control terminal failure rate is discussed, the load control terminal common problems and improvement measures are focused on, and the application effect and promotion prospects are shown at the end of the paper.

1. Introduction

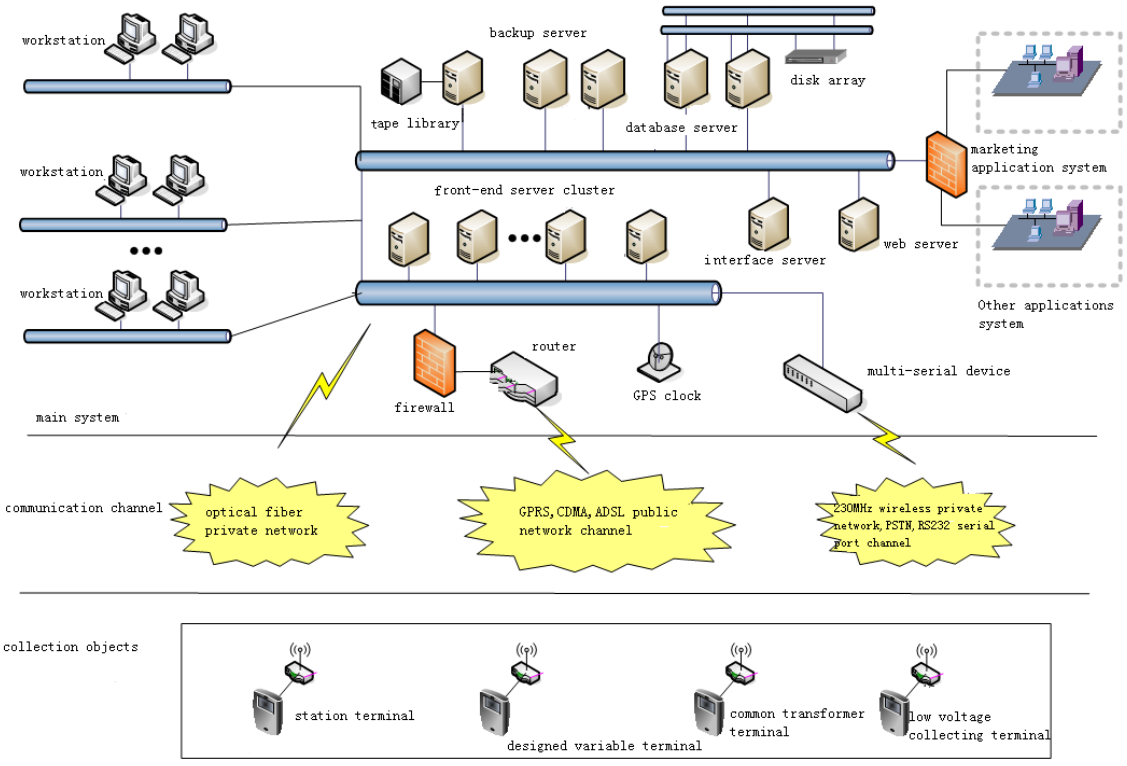

Fig.1. load control schematic diagram of electricity information acquisition system

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Power load control and monitoring is a kind of integrated management information system for monitoring power load, this system makes full use of communication technology, computer technology and automatic control technology. Usually, the system consists of the main station, the negative control terminal and the communication channel between the main station and the terminal. The negative control terminal is composed of the microprocessor system and the data transmission channel. The microprocessor system owns the function of data acquisition and processing, the user's electricity information, power supply status, electricity quantity information, electricity meter measurement data are collected, and they are sent to the main station of the system by using the data transmission channel. At present, the negative control terminal can monitor users' electricity consumption in real time, the function determines the operation, maintenance and management level and fault handling ability of the negative control terminal, so it plays a decisive role in the smooth and reliable flow of copying, checking and receiving of power marketing, load control schematic diagram is shown in Fig. 1.

2. Significance of reducing the failure rate of power load control terminal

2.1 Significance of line loss management

Management work of line loss is the key of the power supply company and electric power load control terminal (hereinafter referred to as negative control terminal) is one of the important auxiliary equipment, calculation of line loss to better support line loss management, the line loss is calculated accurately, and negative coverage, real copy rate control terminal, online rate, accuracy and integrity must be made sure as part of the information system, reducing power load control terminal failure.

2.2 Important work objectives of the power supply company

The construction of user electricity information acquisition system takes "full coverage, full collection and full prepayment" as the overall goal, and it has always been the key content of the marketing system construction for "three sets of five major" of power supply companies. The success rate of collection has always been concerned by leaders at all levels. At present, power supply companies require the failure rate of negative control terminals to be less than 5%. However, there are many problems in the distribution network measurement terminals, it affects the online rate and accuracy rate. Therefore, it is the great significance to reduce the failure rate of negative control terminals, it is shown in Fig. 2.

Fig.2. Negative control terminals

2.3 Power load control terminal failure rate status

There are 3045 negative control terminals in the company according to the investigation until March 2018, they are under the cooperation and management of three operation and maintenance working groups and eight power supply branches. The products of 9 manufacturers include Hangzhou Huali, Hunan Weisheng, Ningbo Samsung and Jiangsu Linyang. The average failure rate of negative control terminals is 5.16%.

The daily maintenance and management data of the negative control terminals are basically divided according to the types of maintenance. The statistics of the terminals with faults are shown in Table 1 from January to march in 2018.

Table 1 Statistical table of fault terminals according to fault types

The serial number	The fault types	Fault number (sets)	Percentage of total failures
1	Antenna position problem	64	40.76%
2	Module problem	41	26.11%
3	Meter failure	26	16.56%
4	Communication network problem	12	7.64%
5	SIM card problem	6	3.82%
6	Environmental problems	3	1.91%
7	others	5	3.18%
total		157	100%

3. Analysis of common problems for load control terminals

3.1 Terminal antenna position problem

The negative control terminal can successfully collect data, and it is directly affected by the installation position of the terminal antenna. When the signal is too weak, even if the negative control terminal has a signal, it is also prone to drop the phenomenon. Under normal circumstances, only the return value of signal quality is within the range of 20～30, stability of data transmission can be guaranteed, thus achieving successful data collection. Therefore, the antenna position is designed and installed to make the signal quality return value more than 20 in some extent, it is shown in Fig. 3.

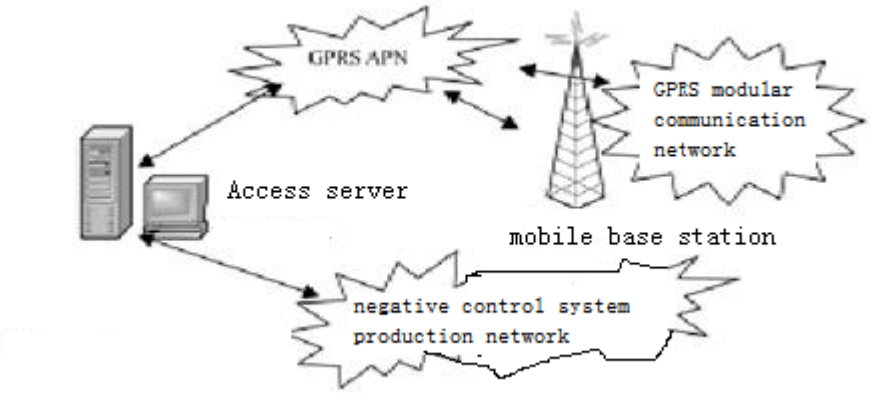

Fig.3. Schematic diagram of negative control system communication

3.2 Module problem

Modules are divided into two types, general application type and industrial type. In terms of the influence on the communication quality of the system, the wireless module is relatively large in radio frequency index, network compatibility and network protocol consistency. The damaged module is observed on site. After energizing, the red and green of NET lamp flicker alternately. After the module is embedded into the terminal, the word "no response" appears on the terminal display interface.

3.3 Problems related to the meter

RS485 connection polarity of the meter is wrong, and the connection of the pulse line is wrong, so the output data of the 485 communication port is abnormal. The fault treatment of the negative control terminal is found on site, there are three common faults for the 485 communication port of the low-voltage sub-meter:

(1) 485 communication port test owns DC voltage value, and above 3.5V, collecting data is notsuccessful;

(2) Testing DC voltage value of 485 communication port is too low, below 2.6V, collecting data is successful;

(3) Reading test for 485 communication port shows that no data can be tested, suspecting internal 485 working circuit damaged.

3.4 Communication network failure

Communication network system is divided into three states, idle state, ready state and prepared state. Due to the limited network resources and different signal coverage areas, the data collected cannot be transmitted by the negative control terminal and the terminal display drops, structure diagram is shown in Fig. 4.

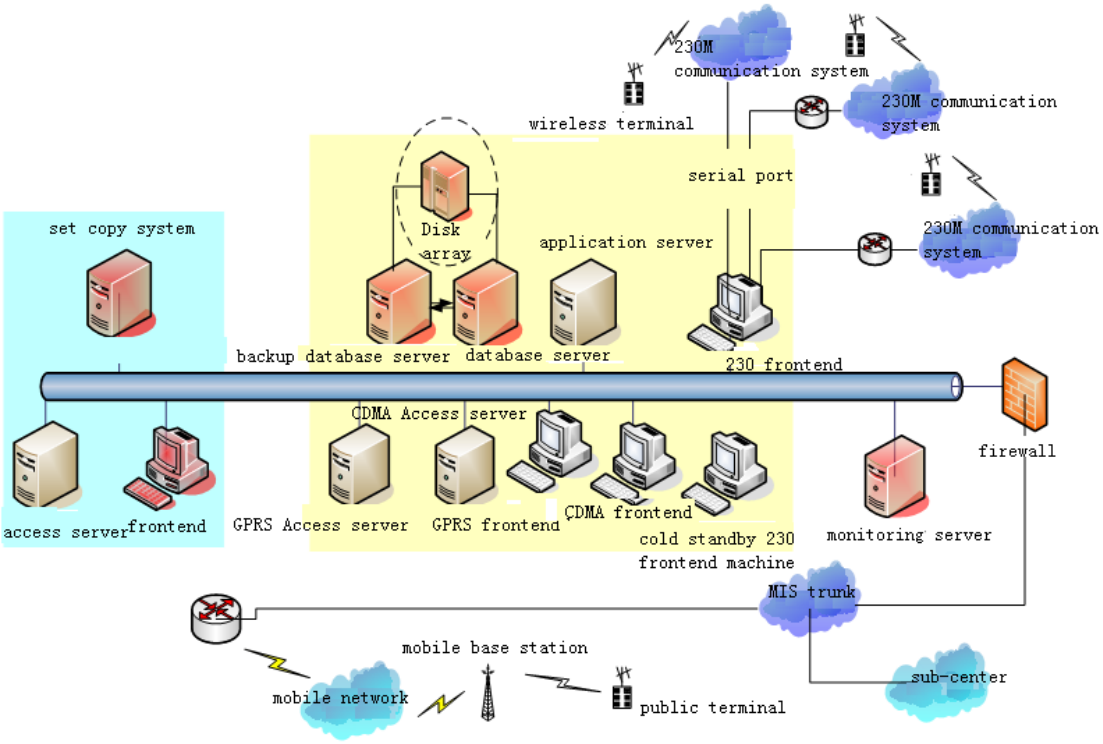

Fig.4. structure diagram of negative control system

4. Improvement measures

4.1 Improvement measures for terminal antenna position problem

In the process of installing the antenna, the connection and packaging technology of the antenna oscillator, high-frequency cable head and the entrance of the feeder are checked in place; Or the high frequency head is in the production process, the copper pin is processed clean or not, and the height is not enough, or there is blocking and interference and so on. When the signal value is less than 20, it can be considered to raise the antenna position or lengthen the pulse line, and then the antenna is pulled to install outdoor, so as to facilitate the antenna to receive signals in a certain extent. In the factory design, the antenna and the terminal circuit interface characteristic impedance match, the signal reflection is reduced, and the signal is kept well.

4.2 Improvement measures for module problems

When wireless module is chosen, radio frequency index, network compatibility and network protocol consistency are the main consideration. In the process of self-purchase and self- provision for negative control terminals, the technical agreement for ordering must be put forward, and the items components of checking and comparing the list should be added in the acceptance link after the arrival of negative control terminals, and the manufacturers should be constrained to select

industrial modules in the link of quality assurance. In the case of collection failure, upgrading procedures are found timely by corresponding terminal manufacturers.

4.3 Improvement measures for problems related to the meter

DC voltage file of the multimeter is tested through the output voltage value of 485 communication port. If there is no voltage value, it can determine preliminarily that the internal 485 working circuit is abnormal. When there is a voltage value and the amplitude is too low, the infrared reading handle device can be used for reading data detection without reading data display. 485 communication port fault can be judged.

The key to successful meter reading is to connect the watt-hour meter RS485 and pulse wire correctly. The shielded twisted pair wire is used to connect the signal wire of the watt-hour meter RS485. The shielding layer of watt- hour meter should be reliably grounded, and its polarity can be distinguished by the color of the secondary wire.

Configuration parameters are verified by the main station, such as factory number, table address, table specification, table type, communication port number and rate of the meter, it is shown in Fig. 5.

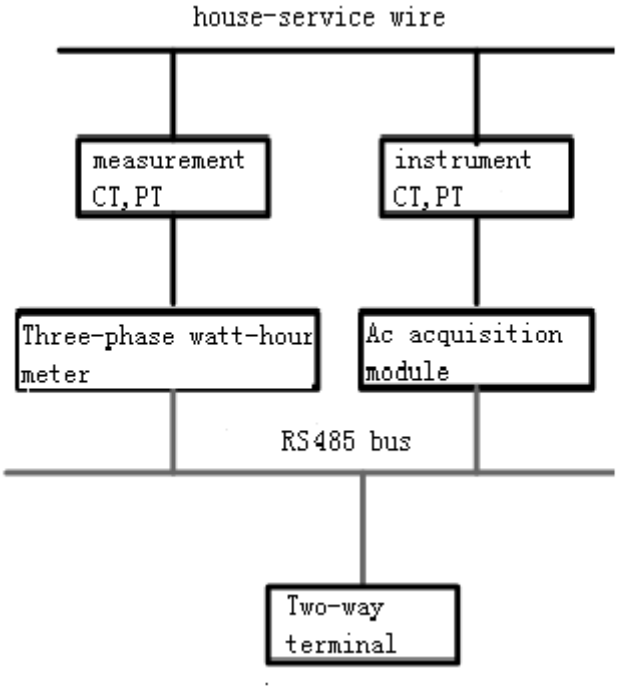

Fig. 5.connection diagram between negative control terminal and meter and AC sampling module

4.4 Communication network fault improvement measures

By increasing the base station or transmitting power, the problem of bad network signal can be solved, especially some remote places are eliminated or the operating environment is in the basement, the local signal coverage of negative control terminals will be affected in some extent. It is also possible to replace the high gain antenna or add a signal amplifier when the installation conditions are available.

5. Conclusions

The implementation is completed, in order to check whether the implementation of the working group has achieved results, the working group made statistics on the negative control terminal failure in September 2018, it is shown in Table 2.

Table 2 Statistical table of negative control terminal failure in September 2018

The serial number	time	total number	number failures	failure rate
1	September	3169	23	0.73%

The average failure rate of negative control terminals decreased from 5.16% to 0.73% through working group activities in September 2013 according to the statistical results, the target value of less than 5% required is reached by the company.

The failure rate of negative control terminals is reduced effectively, the work efficiency of operators can be greatly improved and their workload is reduced. More importantly, it provides a strong scientific basis for line loss management. The use of electrical information acquisition system has become an indispensable technical support in the process of power marketing. Reliable operation data for daily transformer distribution and maintenance is provided, the interpretation, reporting and handling of current overload, voltage disqualification and other problems are facilitated, the occurrence of burning transformer and other similar accidents are reduced, and the reliability of power supply is improved.

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