

## Analysis and Solution of Abnormal Causes of Data Upload in Special Acquisition Terminal

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**Abstract:** In recent years, the State Grid Corporation of China has built a power consumption information collection system that covers users, and has achieved "full coverage, full collection, and full cost control" of power users in the operating area. However, the success rate of data upload from collection terminals is relatively low, affecting the comprehensive application of collecting electrical energy data. This article mainly focuses on the special transformer acquisition terminal as the research object, introduces its working principle and communication method, analyzes the causes of abnormalities in the process of uploading electrical energy data, and takes solutions for different abnormal situations.

### 1. Introduction

The special transformer collection terminal is a device that collects the electricity consumption information of the user of the special transformer. It can realize the collection of energy meter data, the detection of the working conditions of the energy metering equipment and the quality of the power supply, as well as the monitoring of the customer's power load and energy. Data is managed and bidirectionally transmitted. Its working principle is shown in Figure 1.

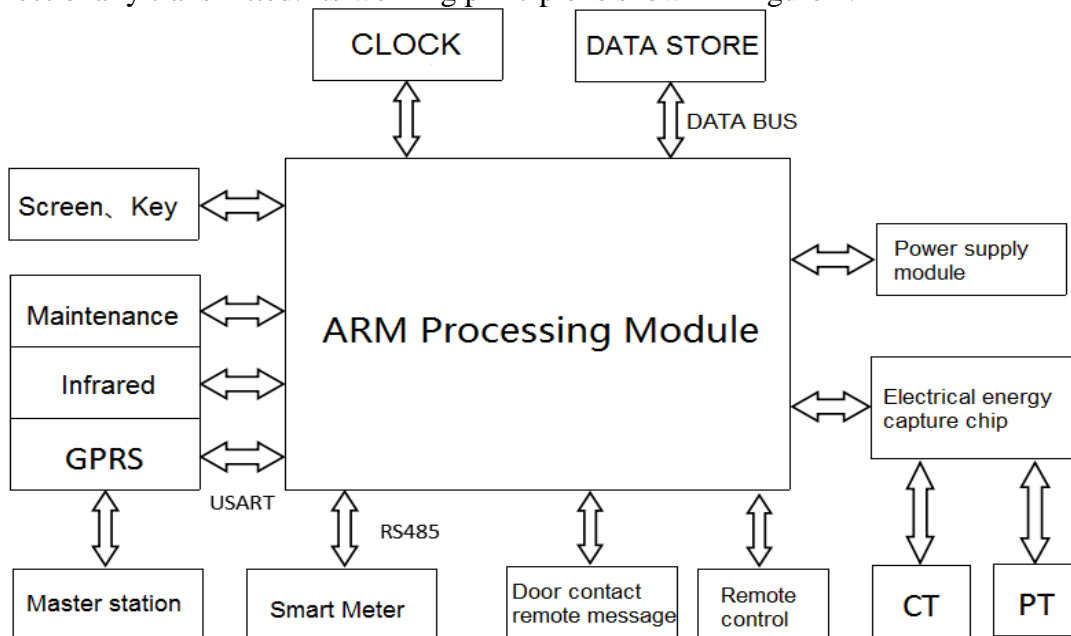


Fig. 1 Working principle of the special transformer acquisition terminal

### 2. Abnormal phenomenon of data upload of special acquisition terminal

The data upload abnormalities of common special transformer acquisition terminals are mainly divided into hardware and software. The specific analysis is shown in Table 1.

Table 1 Abnormal analysis of data upload of special transformer acquisition terminal

No.	Unusual phenomenon	Abnormal
1	A black screen appears The display is abnormal	High temperature and high humidity in the installation environment
2	Unable to log in to the master station gprs module exception	Poor antenna installation or poor signal
3	Unable to read the meter RS485 interface is abnormal	RS485 wiring error
4	Terminal cannot run CPU exception	Component soldering
5	Meter reading parameters are missing Memory exception	Component soldering
6	No frozen data Clock anomaly	Battery undervoltage Bad battery connector contact
7	Unavailable sim card abnormal	The sim card is not installed securely or due
8	Data upload error Communication error	The channel is too narrow and the parameter settings are wrong

### 3. Analysis of Abnormal Causes of Data Upload on Collection Terminals

At the scene, the common abnormalities of the acquisition terminal of the special transformer are mainly divided into two categories: abnormal communication between the acquisition terminal and the main station of the power acquisition system, and abnormal reading of the acquisition terminal and smart energy meter. The following two categories are summarized and analyzed.

The communication between the acquisition terminal and the master station is abnormal

The data communication between the special transformer acquisition terminal and the main station of the electricity information collection system is mainly remote communication. The common communication methods are 230MHz wireless private network and GPRS wireless public network. The 230MHz wireless private network uses point-to-point communication. The terminal station needs to be consistent with the frequency of the master station, and is easily affected by co-channel interference and intermodulation interference. At the same time, at the same frequency, the amount of data information that the system can pass is very limited, which will also cause the failure of power data upload. GPRS wireless public network communication is that the terminal accesses the wireless public network through the wireless communication module, and then accesses the master station acquisition system through the dedicated optical fiber network. The main bearer service of this communication method is voice calls. When the channel is insufficient, voice priority will affect data. Information transmission has caused abnormal uploads of electrical energy data for special transformer terminals. Such problems are analyzed from the following three aspects:

#### 3.1 Human factors

During the installation of the special transformer acquisition terminal, not only need to follow the marked wiring to prevent wrong wiring, but also pay attention to the consistency of the communication parameter settings and the terminal address of the special transformer acquisition terminal. There are mainly two cases of parameter setting errors: The terminal of the power collection system, such as the address code and area code, is issued incorrectly or incompletely. The second is that the meter and the terminal communication protocol do not match or the communication protocol is wrong. The above two conditions will cause the special transformer

acquisition terminal to fail to communicate properly. Master station communication. In addition, when the sim card is not installed securely or in arrears, the rs-485 line interface is incorrect, and the antenna is not properly connected, it will cause communication transmission failure of the on-site special transformer acquisition terminal, which will affect the successful upload of collected energy data. rate.

### 3.2 Environmental factors

Under the high humidity and low temperature environment, the internal components of the special acquisition terminal will be frosted and the communication module will be damaged. Under the high humidity and high temperature environment, water ingress will occur directly inside the terminal, which will affect the normal operation of the terminal. When the electronic components of the module are damaged by overvoltage such as lightning, the terminal will not be able to communicate normally for a period of time.

### 3.3 Software factors

For whether the narrow transmission channel of the 230MHz wireless private network affects the communication of the system's master station, take the special transformer station area in Haizhou District of Fuxin City as an example. Use the oscilloscope to detect the transmission channel bandwidth on the spot and record the upload success rate of the terminal on that day. Select a 30-day measurement The results are shown in Table 2.

Table 2 Statistics table of transmission channel bandwidth and terminal upload success rate

No.	Transmission channel bandwidth (MHz)	Terminal upload success rate	No.	Transmission channel bandwidth (MHz)	Terminal upload success rate
1	240	98.69%	16	241	99.23%
2	237	98.89%	17	225	98.62%
3	233	98.92%	18	237	99.20%
4	228	98.97%	19	239	99.24%
5	243	99.23%	20	242	98.72%
6	230	98.78%	21	233	98.69%
7	224	98.38%	22	218	98.46%
8	225	98.28%	23	216	98.33%
9	232	98.56%	24	247	99.42%
10	238	98.77%	25	244	99.38%
11	240	98.91%	26	242	99.62%
12	220	98.24%	27	246	99.78%
13	227	98.32%	28	245	99.57%
14	215	98.18%	29	248	99.66%
15	228	98.58%	30	238	99.48%

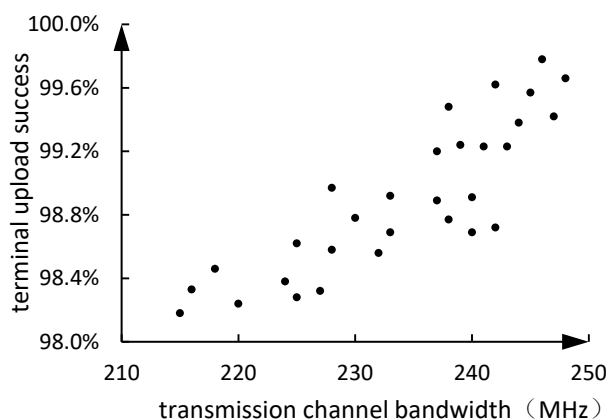


Fig. 2 Scatter diagram of transmission channel bandwidth and terminal upload success

Draw a scatter plot for analysis based on the above data, as shown in Figure 2.

It can be seen that for the 230MHz wireless private network communication method, the transmission channel bandwidth has a significant positive correlation with the acquisition terminal power data upload success rate. The narrower the transmission channel, the lower the terminal upload success rate.

#### 4. Abnormal reading numbers of collection terminal and smart energy meter

Common abnormalities in meter reading at the acquisition terminal are the terminal's absence of meter reading energy data and meter reading energy data errors.

##### 4.1 Collection terminal has no meter reading data

There are four problems with this abnormal situation. The first is that the parameters of the smart energy meter are inconsistent with the parameters of the terminal device. The main content is the meter specification, port number, and communication address. The second is that the parameters of the new meter are not uploaded. The meter-receiver did not communicate with the collection operation and maintenance personnel after changing the meter, did not set parameters, and the power collection system did not re-send parameters. The third is that the meter reading procedure of the collection terminal is inconsistent with the meter specification. The fourth is the 485 interface of the collection terminal. The 485 interface with the meter is faulty. When it is impossible to read the meter or the address is changed, you need to replace the meter or the interface board.

##### 4.2 Collection terminal meter reading data error

For meter reading data errors caused by accidental factors, it is necessary to re-call the electrical energy data of the electricity information collection system. However, because the electricity information collection system allows only one terminal to go online for the same address, and another terminal with the same address After logging in and going online, the system will automatically kick out the previously online terminal. Therefore, the terminal system often uses the terminal address to be reused, which causes the reading terminal to read the meter's energy data error. This situation is not only caused by the ip address input error. There are also system router, firewall configuration, and sim card failures.

#### 5. Solution for abnormal data collection terminal data upload

##### 5.1 Standardize daily inspection work

The daily inspection work is mainly based on the failure of terminal meter reading. Such problems mainly check the file parameter information. Among them, the measurement point number, communication rate, communication protocol, communication table address, verification method and other parameters of the measurement point parameter information shall be determined

according to The corresponding collection terminal manual is set. In addition, when the master of the collection system performs remote operations, the parameters of the field terminal are modified to ensure that the parameters of the field terminal equipment and the master of the collection system are consistent. For field problems, the field meter and the collection terminal Verify the wiring, meter address, communication protocol and other information to ensure that the electricity consumption information of the corresponding meter in the terminal device is collected on-site. At the same time, check whether the mobile signal strength at the terminal location meets the collection requirements and antenna installation stability, etc. to ensure that Terminal power data upload accuracy.

## **5.2 Strengthen operation and maintenance management**

The operation and maintenance of the special transformer acquisition terminal should be specifically divided into daily inspection maintenance and equipment fault maintenance, a perfect and reasonable maintenance mechanism should be established to standardize and institutionalize it. According to regulations, the daily regular inspection terminal failure rate is generally Below 10%, the inspection cycle is once every six months; when the failure rate is greater than 10%, the number of inspections is increased once according to the failure problem. However, due to problems such as the quality of the terminal equipment, the operation status of the smart energy meter, and environmental factors, the terminal operation and maintenance are negatively controlled The personnel shall prepare a monthly plan according to the actual situation on the site, according to the nature of the measurement point, the level of the measurement device, the power supply environment, etc., and implement it after review and approval by the superior department.

## **5.3 Prevent potential hazards at the collection terminal**

For observing the faults of the acquisition terminal, we can take effective measures to strengthen control and prevention in a timely manner, while for potentially dangerous faults, we need to detect the device through the acquisition terminal. Especially problems with communication-related equipment, such as radios, antennas, feeders, Modems, arrester discharge tubes, etc. The collection operation staff must make full use of the power information collection terminal system to effectively monitor the power consumption of the power users, and analyze and analyze the changes in electrical energy data to find and resolve the data upload of the collection terminal in time. Exception problem.

## **6. Summary**

The special transformer collection terminal is used to realize the online monitoring of the metering device and the real-time collection of important information such as customer load, power, voltage, and waveform, and can provide the basic data for the power consumption information collection system in a timely, complete, and accurate manner. At the same time, the collection terminal can Realize comprehensive pre-control of electricity tariff collection, and provide a technical basis for the implementation of marketing-based business strategies such as smart electricity bill settlement.

For the State Grid Corporation of China, the special transformer acquisition terminal reduces the number of abnormal uploads of electrical energy data, and can successfully upload the acquisition terminal to meet the company's requirements for collection indicators. The number of times greatly improves the work efficiency. For customers who use electricity, it reduces the occurrence of trips and power failures caused by terminal data collection and upload failures, ensuring the reliability of power supply, and improving customer satisfaction with power consumption. Various electrical energy data collected by special transformer collection terminals The analysis and comparison can guide users in a scientific, reasonable, and orderly use of electricity. Therefore, how to deal with various abnormalities in the uploading of energy data from special transformer collection terminals in a timely and accurate manner is particularly important.

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