

Design of Meter Reading Concentrator Based on METER-BUS

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Abstract

In this work METER-BUS technology and computer emdedded technology is implemented in intelligence remote meter reading system. METER-BUS technology is a kind of field bus technology, which is used to collected data information of meter. A new way is proposed to design a new meter reading concentrator, compared with the traditional concentrator, the new concentrator improved the load capacity and enhance the reliability of the intelligent meter reading system.

Keywords: METER-BUS, Concentrator, Intelligent Meter Reading System

1. Introduction

In recent years, with the rapid development of information technology, informatization and management departments at all levels have been greatly improved, at the same time meter reading mode also has developed. At present, there are three kinds of reading methods: A. manual meter reading. B.IC card charging meter reading. C. Bus meter reading[1]. In the mode A and mode B, there have many shortcomings: the waste of human resources, inefficiency and not convenient to management[2]. In mode C, bus- reading can be copied to the user meter information, simple operation and promptly. Bus -centralized meter reading system is divided into cable meter reading system and wireless meter reading system. At present, the wireless meter reading system is still in trial stage, the mainly use is cable meter reading system[3]. RS - 485 bus technology has dominated this field of application. RS - 485 bus technology has dominated this field of application, but due to its less articulated load, transmission distance is limited, can't give from equipment supply, construction is not convenient, the RS - 485 bus technology to be

being washed out gradually[4]. METER - BUS technology replaced the RS - 485 bus technology. The key link of METER - BUS technology is the on load capacity. On the market of the existing concentrator on load ability is limited, which makes the cost of the existing meter reading system is high. In order to overcome the above disadvantages and to meet the requirements of current informationization development, we developed a new kind of concentrator based on the technology of METER - BUS.

2. METER-BUS modulation and demodulation theory

In the physical, METER - BUS bus is divided into master station and slave station. The master station transmitted information and power supply to slave station by METER - BUS bus. Between master station to slave station used the voltage modulation. Voltage value of 24~42 mean logic 1, and voltage value of 12~21 mean logic 0. The voltage modulation can be seen in Fig.1. Between slave station to master station used the current modulation. The 0mA~1.5mA loop current is on the bus, which is detected by master station mean logic 1, and the 11mA~20mA loop current is on the bus, which is detected by master station mean logic 0[5]. The current modulation can be seen in Fig.2. Downward modulation signal and uplink modulation signal on the METER - BUS don't interfere with each other, which have a strong anti-interference function. In the remote intelligent meter reading system, concentrator is the master station, and meters are slave station.

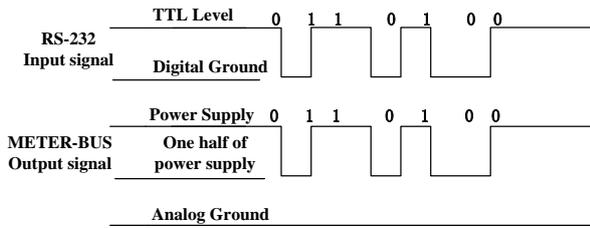


Fig.1 METER-BUS Voltage Modulation Waveform

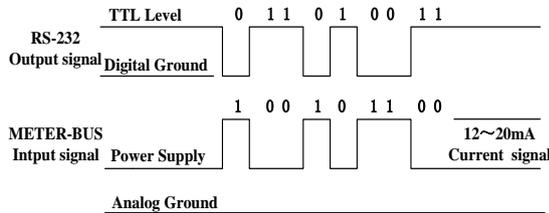


Fig.2 METER-BUS Current Demodulation Waveform

3. Meter reading system design

The system uses the METER-BUS bus topology, which is mainly divided into two parts: concentrator and meters. System block diagram is shown in Fig.3. As can be seen from the figure, concentrator plays an essential role in the whole network system. Concentrator has two communication side, one is a serial port which communicated with computer, the other one is METER-BUS bus interface which communicated with repeaters or meters. Concentrator receives the computer meter reading command, and then sent to the meters by the METER-BUS bus. Meter transmit data information to the concentrator through current modulation. Concentrator receive the data information, then sent data packet to the computer.

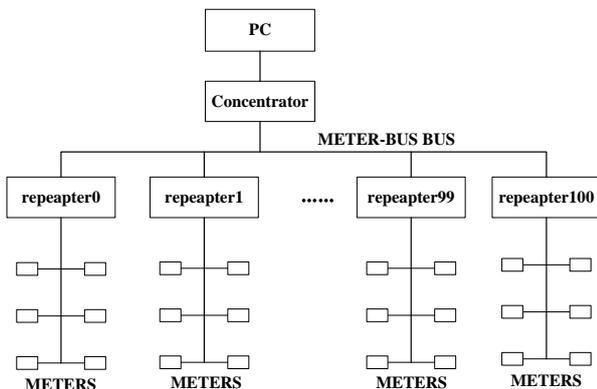


Fig.3 The Diagram of Meter Reading System

4. Concentrator design

The block diagram of concentrator is shown in Fig.4. The concentrator power doesn't distinguish polarity,

which support convenient installation. After receiving the computer command, concentrator sent command to meters through voltage modulation, and then receiving the meter information through current modulation. In order to against lightning and enhance the system's interference, between concentrator and computer using high voltage isolation design, and meter between separated by relay.

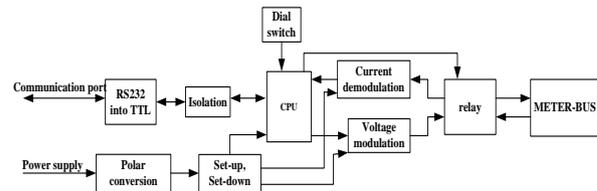


Fig.4 The Schematic Diagram of Concentrator

5. Current demodulation circuit design

The innovation of new concentrator lies in the design of current demodulation circuit. Compared with the traditional concentrator, the new concentrator can hang more meters. The current demodulation circuit consists of a voltage reference circuit, high-pass filter circuit, amplifying circuit and comparator circuit, which can be seen in Fig.5. Ascending current signal into voltage signal by the sampling resistor. The voltage signal contains dynamic load of AC voltage component and static load of DC voltage component. With the load increase of concentrator, composition of DC voltage also increases. When the dc voltage component increases to a certain value will lead to the amplifier saturation in the traditional concentrator. The demodulation circuit of our concentrator is improved. Firstly, we filtered the DC voltage component, and then make the reference voltage to the half of power supply voltage. Amplifier works on the reference voltage and doesn't saturated. Based on the above principle, the new concentrator can hang more meters.

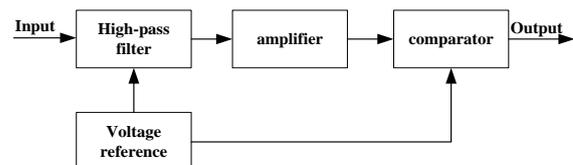


Fig.5 The Schematic Diagram of Current Demodulation Circuit

6. System testing

Experimental installation: a computer, a meter test bench(ten lines, each line hanging ten meters), a repeater, a traditional concentrator, a new concentrator.

The first experiment: The computer is connected to a traditional concentrator. The concentrator is connected to a repeater. The repeater is connected to thirty meters. Computer software can read meter successfully one at a time. The repeater is connected to fifty meters. Computer software can also read meter successfully one at a time. Computer software can't read meter successfully one at a time when the repeater is connected to eighty meters. Computer can read back fifty meters information, other thirty meters can't be read back. Computer software can only be read the data information of fifty meters when the repeater is connected to one hundred meters.

The second experiment: The computer is connected to the new concentrator. The new concentrator is connected to a repeater. Computer can read all data information when the repeaters are respectively connected with thirty meters, fifty meters and eighty meters. Computer software can't read meter successfully one at a time when the repeater is connected to one hundred meters, but can read back the data information of ninety-five meters. The experimental results can be seen in table 1.

Table 1. The System Test Results

The number of meters	The meter reading success rate of traditional concentrator	The meter reading success rate of new concentrator
30	100%	100%
50	100%	100%
80	62.50%	100%
100	50%	95%

7. Conclusion and discussion

From the experiment data can be seen, the new concentrator can hang one hundred meters. The meter reading success rate of more than ninety-five percent. Compared with the traditional concentrator, the new concentrator can hang more meters, communication is more stable, lower construction cost.

8. References

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