Frequency Conversion, speed regulation, hierarchical and constant pressure water supply control system and its application in sprinkler and micro irrigation schemes

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Summary

This paper introduced the composition, operation theory, function, application range of frequency conversion, speed regulation, hierarchical and constant pressure water supply control system as well as the determination of pressure scaling of the system, and concluded that this system can realize classification constant pressure automatic water supply irrigation according to irrigation zones so that to increase irrigation uniformity.

Introduction

Irrigation uniformity is an important parameter to weigh irrigation quality in the planning, design and construction of irrigation and micro irrigation schemes. However, the sprinkler and micro irrigation system pressured with electrical pump can’t meet the requirement for water supply under constant pressure and therefore influence irrigation uniformity and quality as on-farm water use is usually in a stochastically varying conditions, the uncertain water use often cause the variation of pressure and flux of the pipe system. Application of water tower, high level water tank, pressured regulating tank et al regulation and control facilities do play the roles of controlling the variation of pressure and flux of pipe system, but they have some limitations. Meanwhile, with regard to a sprinkler and micro irrigation system which irrigates large area or the topographical gradient is relatively huge, the use of a constantly pressured pipe network can’t meet the requirement for irrigation uniformity of the whole farmland. The frequency conversion, speed regulation, hierarchical and constant pressure water supply control system set various pressure control scaling under various irrigation zones. It can regulate the frequency of the power supply, adjust the rotate speed of pump, change discharge flux and realize hierarchically constantly pressured water supply according to the variation of pipe flux. It has such strongpoint as high irrigation uniformity, good effects in water and energy conservation, and convenience in operation and management. In the meantime, it is easy to integrate with automatic control technology and can realize automatic switch.
Methods and materials

The system is composed of transducer (with PID controller), programmable time switch, PLC, water level display controller, remote pressure gauge, water level sensor and relevant electrical control units. It can realize automatic control to one or many three phase, 380V and 50 Hz water pump engines simultaneously. It is an intelligent equipment integrated with engine and electricity with the functions of frequency conversion, speed regulation, automatic closed loop control. A multi-scaling pressure setting and conversion circuit was designed in this system, so it can realize conversion of pressure scale according to irrigation zones, and also control the opening and close of electromagnetism valve to guarantee irrigation uniformity and improve irrigation quality. This system can also monitor and control the water level of water storage tanks and guarantee the safe operation of the system.

Results and discussion

a. When the sprinkler and micro irrigation system pressured with electrical pumps is working, the electrical pump is usually under operation at constant speed using normal power frequency (50Hz).

b. Irrigation uniformity is an important parameter to weigh irrigation quality in the planning, design and construction of irrigation and micro irrigation schemes. When the irrigation area is large or the topographical gradient is huge, the application of pipe network with constant pressure can’t meet the requirement for irrigation uniformity of the whole farmland.

c. The frequency conversion, speed regulation, hierarchical and constant pressure water supply control system uses the theory of frequency conversion, speed regulation and constant pressure, on the basis of the traditional design method of sprinkler and micro irrigation, carry out irrigation zoning according to the pressure scaling, each zone realizes automatic water supply with relevant pressure scaling and therefore can meet the requirement for irrigation uniformity.

d. This system has such strongpoint as good effects in water and energy conservation, high automatic degree, and convenience in operation and management. In the meantime, it has the function to guarantee the safe operation of pipe network and water pump.

References


