Design of Automatic Recloser Protector Based on Miniature Circuit Breaker

Abstract: In this paper, a Automatic reclosing controller with miniature circuit breaker was designed bas ed on analysis for protector with relay or contactor. Motor driving circuit, the real-time leakage detection circuit, grounding resistance at load side detection circuit and position detection circuit were designed in this paper. The Automatic reclosing controller designed in this paper which has good breaking capacity a nd overcurrent capability can ensure the continuation and quality of power supply. The reclosing controlle r has been stable and reliable and has been sucessfully applied in residential distribution system, China Mobile base station and China Telecom base station.

Keywords: Automatic reclosing controller ; Residual current; Miniature circuit breaker

1 Introduction

According to statistics, 80% of the low-voltage circuit breaker tripping, are caused by the cause of chance, and by the permanent failure caused by low-voltage circuit breaker tripping ratio of not more than 10%. In particular, the residual current circuit breaker, resulting in its malfunction for many reasons, such as lightning in the line caused by surge voltage, electronic equipment in the line caused by high harmonics, long wire to the ground capacitor current (leakage current) and so on.

Based on the above reasons to reduce maintenance costs and improve the quality of continuous power supply, automatic reclosing device appears to be inevitable; but the current domestic small automatic reclosing products are using electromagnetic relays or contactors to achieve the current connected and broken; The contact capacity of the relay or contactor is low and the safety is poor. When the abnormal breaking occurs, the contact welding phenomenon occurs, which threatens the safety of the whole power supply system. Even if the miniature circuit breaker is installed at the front or rear of the automatic reclosing device (MCB) protection, when the micro-circuit breaker (MCB) after the automatic reclosing device can not be achieved for the system automatically power supply function, can not meet the power system continuous power supply

requirements. In this paper, a miniature circuit breaker based on the automatic reclosing protector, through the protector drive motor to achieve by the micro-circuit breaker to turn on and off the current reclosing device.

This design of the FAR6 automatic reclosing protector is through the control MCB on and off to achieve the on and breaking current of the automatic reclosing device can solve the thunderstorm weather, power grid instability and other transient failure caused by switching tripping device can not power after Automatic power supply problems, equipment to provide a stable and reliable power to extend the life of electrical equipment, improve network service quality, reduce network construction investment and reduce maintenance costs. The continuity of the power supply, security is of great significance.

2.Design of Automatic Recloser Protector Based on Miniature Circuit Breaker

2.1 working principle

Figure 1 is based on the micro-circuit breaker automatic recloser protector block diagram, the protector from the power circuit, real-time leakage detection, sub-closing position detection circuit, before the load side of the load resistance detection, microprocessor, motor drive circuit, DC motor, gear operating agencies, micro-circuit breakers and other components.

Power supply circuit input for the power into the line, the use of switching power supply output DC power 12V, for the microprocessor, leakage sampling circuit, sub-closing position detection circuit, closing the ground resistance detection circuit, drive circuit, DC motor power supply. Real-time leakage sampling circuit input for the zero sequence transformer induction current signal, through the signal processing circuit output voltage signal to the microprocessor. The microprocessor determines whether or not the leakage threshold is exceeded based on the acquired voltage signal. If it is considered leakage, if the circuit breaker in the closing position at this time, the protector output signal to the triper to trip the circuit breaker. If the trip unit is damaged, the motor is opened. If the real-time collection of the

leakage value is normal, the circuit breaker and in the sub-gate position, then check the load side and the ground between the resistance value is greater than a certain resistance value, the resistance value reflects the size of the leakage value. When the grounding resistance exceeds the set value, that leakage is less than the set threshold, the output to the drive circuit drive motor rotation closing circuit breaker. Figure 1 in the micro-circuit breaker can be used ordinary MCB.

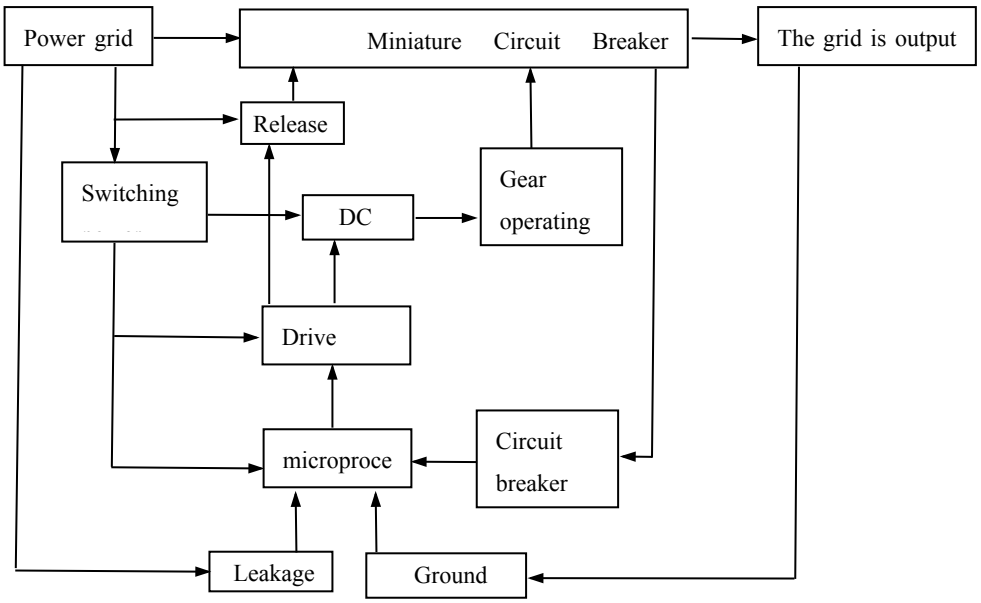


Figure 1 block diagram of automatic

2.2 real-time leakage sampling circuit

In this paper, zero-sequence current transformer for real-time leakage sampling [4]. Figure 2 shows the leakage of the sampling circuit, zero sequence current transformer secondary T1, T2 induced current through the resistor R10 to generate voltage, after amplification filter output voltage signal ULeak. And then ULeak signal into the microprocessor sampling side of the AD, the microprocessor's AD converter to sample the voltage acquisition signal to get the leakage value.

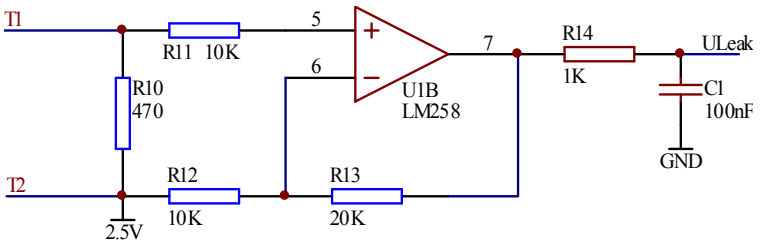


Figure 2 real-time leakage

2.3 motor drive circuitIn this paper, the use of DC motor drive gear to operate the operating mechanism for micro-breaker breaking or closing operation. Therefore, this paper designed the H-bridge drive circuit, according to the microprocessor's drive signal to control the motor forward and reverse. DC motor drive circuit shown in Figure 3.

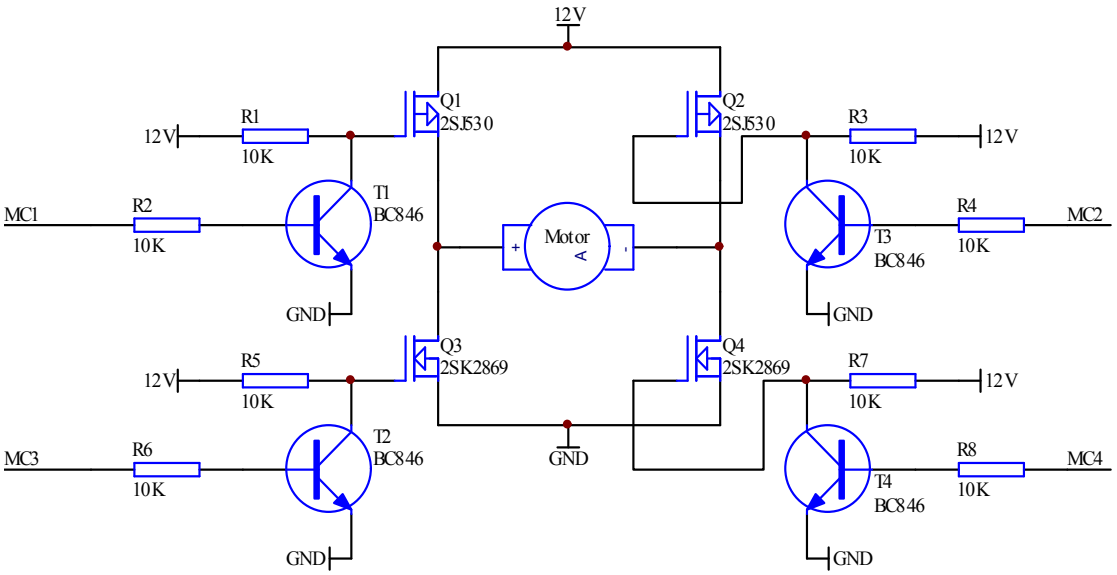


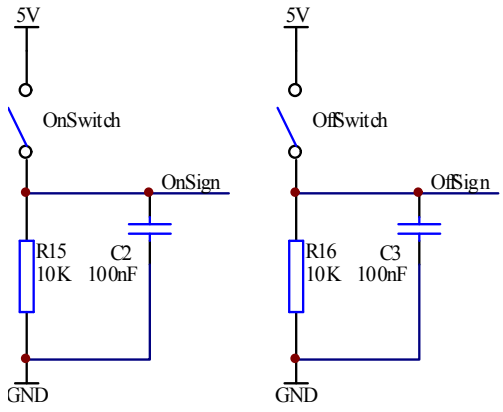
Figure 3 DC motor drive

In Figure 3, Q1, Q2 for the P-MOSFET; Q3, Q4 for the N-MOSFET. MC1, MC2, MC3, MC4 are low, Q3 and Q4 are on, Q1 and Q2 are not conducting, the motor is in the braking state. When the microprocessor detects the voltage undervoltage or overvoltage, the output drive control signal to MC1 is high, MC4 is low, MC3 is high, MC2 is low, then Q1 and Q4 conduction, Q2 and Q3 are not conducting, the motor is turning and the circuit breaker is opened through the gear operating mechanism. When the microprocessor detects the voltage is normal, the output drive control signal to MC1 is low, MC4 is high, MC3 is low, MC2 is high, then Q1 and Q4 is not conductive, Q2 and Q3 Conduction, motor reversal, through the gear operating mechanism to close the circuit breaker. Therefore, through the drive circuit of Figure 3 can be realized in the motor reversal, and

then through the gear drive mechanism to achieve micro-breaker opening and closing operation.

2.4 sub-closing position detection circuit

Because of the sub-closing operation of the circuit breaker, it is necessary to know the current state of the circuit breaker. In this paper, the use of two small micro-switch to achieve the separation of the circuit breaker detection. When the circuit breaker is in the closed state, the small microswitch OnSwitch is closed by the operating mechanism, OffSwitch is turned on; when the circuit breaker is in the open state, the small microswitch OffSwitch is closed by the operating mechanism, and the OnSwitch is turned on. Therefore, the state of the circuit breaker can be detected by detecting the microswitch. Detection circuit shown in Figure 4. In the figure, when the OnSwitch is closed, the closing signal Onsign is high. When the OffSwitch is closed, the trip signal OffSign is high. Therefore, the microprocessor through the OnSign and OffSign signal detection can know the state of the circuit breaker.



Design of Automatic Recloser

2.5 Preload side of the load side of the ground resistance detection

In order to avoid the occurrence of leakage in the case of electricity grid again after the closing operation caused by electric shock, the design of the automatic reclosing protector has a load before the load side of the grounding