Analysis on the Design and Application of the Protection Circuit of the Low Voltage Motor

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Abstract. With the constant innovation and development of the science and technology, the start and protection model performance of the motor is higher and higher. The traditional with the "star - triangle way" of the motor start under the condition of the starting torque can't be used. It can only be used to comply with the conditions of use occasions, and the coupling stress reliever the drawback of the starting motor is also exist. In recent years, the low voltage electric motors and high voltage motor startup mode has changed; the low voltage motor is basic electronic soft start and frequency converter start, the high voltage motor is the liquid resistance step-down start. The tradition protection method of the low voltage motor and high voltage motor can act as a motor starting and protection basically.

Introduction

The use scope is extremely broad, of the motor is very common in life and production, occupy the important position in all machinery. With the rapid development of science and technology, modern automatic production level is higher and higher, the pursuit of mechanical manufacturing technology increasingly perfect, the protection of motor and control equipment is becoming more and more demanding. Now the motor is mostly amount and overload operation. So, to the attention of the security and stability of motor equipment increased the maximum economic benefit at the same time, to ensure the safe operation of the motor. With motor design matures and the improvement of the design method, motor design at lower cost and higher request to improve the performance of the performance of electromagnetic materials and insulation materials, design leave some allowance for smaller and smaller, so, motor in cost reduction, at the same time, to improve the performance of heat capacity and thermal limits. In addition, due to the control system and the requirement of the actual situation, the motor will work in complex condition, such as continuous load and variable load, braking, and reversing, frequent starting, intermittent load), and the real environment, strict of electric and thermal shock is very big, the life of the motor are closely related to its start frequency and duration. So in order to ensure the safety of the motor running, it is necessary to improve the performance of the motor protection device.

The Low Voltage Motor Protection Appliances Overview

Motor protection appliances design work includes the following sections. (1) The current voltage signal collection: according to the electric main circuit of current transformer and voltage transformer for the current and voltage signal of the motor, after signal conditioning circuit of rectification, amplification, into a voltage signal after filtering and through the ADC sampling real-time input into the DSP chip. (2) The fault judgment: DSP chip for input current voltage signal, according to various fault diagnosis in the program subroutine, judge whether the motor is in normal operation condition, and the abnormal state run of motor protection action. (3) The fault records: the main record motor fault time and fault type. In case the motor too frequently starting and facilitate in the deep reason of analysis. (4) The design of human-machine interface: design motor protection shows part of the appliance, and can show the motor running the necessary information. On the one hand, intuitive display the motor current running status, on the other hand

will be better able to complete the main parameters of motor protection Settings. So the protector can adapt to the types of motor more complete for a variety of models of motor protection.

The Hardware Design of the Low Voltage Motor

The low voltage motor protection controller USES software and hardware design of originality: hardware adopts high-performance ADSP has strong ability of real-time signal processing speed can reach 400 MHz, synchronous sampling mode converter, high accuracy, fast response, using large capacity SDRAM memory at the same time, record the motor failure state and data, the effective data reduction failure status, the operation system has good stability and satisfy the communication bus, system management, and human-computer interaction, etc. The function of the software is more complex.

The low voltage motor general installation in the low voltage switchgear and site operation, contained in the application environment is relatively poor, low pressure motor must satisfy the small volume, high anti-interference, and 25 ~ + 65 ℃ and conditions such as high altitude can run continuously. When the machine is designed to meet the above requirements, with international and domestic similar aim for the highest standard of electromagnetic compatibility of low voltage motor, low pressure motor hardware power supply part adopts high frequency switch power supply, make the device more energy efficient, more able to adapt to A variety of different power supply voltage, CPU and A - D sampling the voltage benchmark with high stability and temperature compensation of the reference source, isolation device USES all input and output signal at the same time, from the ac input, low pressure motor, switch power supply, switch input output as well as the communication interface and so on each link fully consider reasonable electromagnetic compatibility design and PCB layout, and take A number of protection measures.
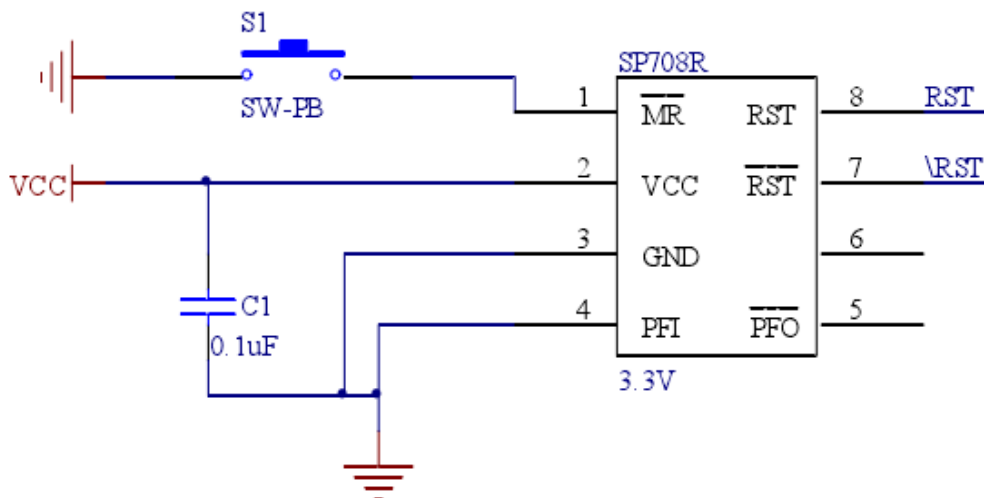

Fig. 1 Reset Circuit

At the same time, the low pressure motor uses a variety of anti-jamming in the software, and fault tolerance technology, such as fast Fourier filtering technology in ac sampling, switch input delay check filtering technique to improve the anti-interference ability of the whole machine.
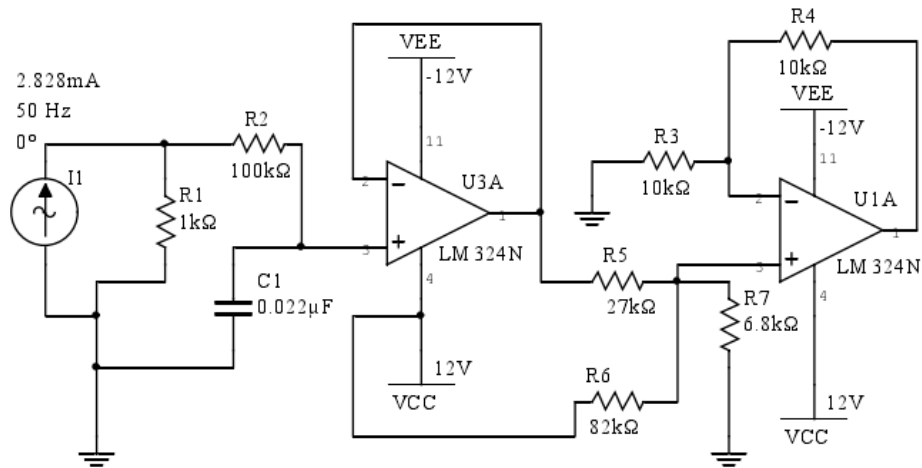
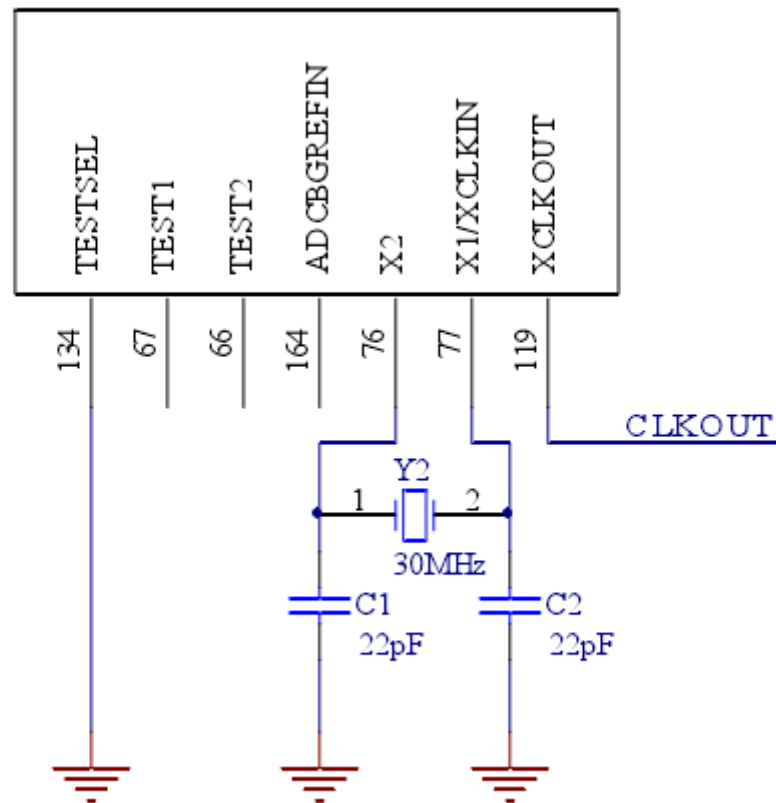Fig. 2 the Voltage Signal Conditioning Circuit Diagram

Fig. 3 the Clock Circuit

The Software Design of the Low Voltage Motor

The design of the software part mainly USES the embedded C language, in Visual DSP++ 5.0 compiler environment, the structure is clear, convenient upgrade and migration. Application framework with the main program as the core, including the initialization program, self-check, the main program and timer interrupt program and each functional module subroutine, the function of each subroutine is implemented in the main program.

The software initialization and self-inspection. Initialization mainly include pin configuration initialization, initialization, A - D channel timer frequency setting and system parameters initialization, etc. Self-checking mainly check the LCD backlit display is normal, the FLASH parameter is correct and devices connected to the monitoring system of communication is correct. If

you don't through self-inspection, system is at rest wait states, and an error message will be sent to PC and the field monitoring personnel. Self-checking is by entering the main program.

The main program design software. The low voltage motor internal device for software system initialization procedures after the execution of the main program, normal operation, in the main program to complete sampling, calculation, control, communication and the function such as protection operation, have such as self failure will be a fault signals, and the fault signal transmission management unit. Normal operation and to determine whether protection start, start a program to protect processing subroutine. In protecting processing subroutine, complete protection data calculation, protection, and perform the corresponding export operation according to the results of the judgment. There is no failure to return to the main loop.

The ac input signal direction adaptive technology. When motor protector three-phase ac current and voltage input terminals appear arbitrary phase alternating current input end with the same connection inverting or any phase voltage and current phase sequence connection error, do not need to change the existing external connection, using the three phase current ac sampling data vector and 3I0 judge whether meet the current transformer of the same name end, or use of the connection of current and voltage phase Angle to determine the voltage and current phase sequence is correct, the device automatically adjust by software method and adaptive existing connection mode, the error of phase current sampling point signal after the not as ac sampling values, safeguard its are in complete accord with the correct connection of ac sampling measurement data.

Summary

The technical development of low voltage motor protection controller is to track the user applications demand changing; also express the product technology development trend in the future. As countries increase the intensity of the smart grid construction and energy conservation and emissions reduction, traditional motor protector cannot meet the needs of the modern industrial field control, low pressure motor protection controller market demand is gradually increasing. Low-voltage motor protector of the industrial control application in the future development trends, low pressure motor protector is not limited to the protection, measurement and control into an organic whole, should have the motor running status analysis function, as the motor running performance fault early warning function, dynamic curve display near real-time running data, through the data and information, the staff can be judge in time and corresponding processing, so that can assist users understand the running efficiency of the motor, real-time control load energy consumption efficiency, the user can reference analysis report for equipment maintenance and repair work, to improve the production efficiency, improve the intelligent motor protector and functional, this also is the trend of the development of low voltage motor protection controller.

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