Precision Digital Controller using PSoC CY8C26443-24PI Microcontroller

Abstract

The specific objective of this project is to design a *precision digital controller* for fully automatic microcontroller controlled reaction vessels for use in development and manufacture of fine chemicals and bio-engineering products, drugs and their intermediates with a *high mass transfer efficiency*. Such applications impose stringent requirements on temperature maintenance, pH maintenance, foaming, and oxygen content over extended periods of time even exceeding 48 hours. Such a facility would help research labs and pharmaceuticals to define application specific control formats for multi loop and cascade control configurations.

Presently the analog version of the controller is available. This analog version has to be converted into digital controller without altering the existing system. Also the system cost should be less and give higher performance compared to the analog controller. The current project is being implemented on the existing system in digital form.

The heart of the system is the microcontroller CY8C26443-24PI from Cypress Microsystems. The manufacturer provides us with a microcontroller that can be configured according to our application. In the microcontroller, we use the ADC, PWM, PGA and Timer blocks configured according to our application. The application uses 4 analog signals which are provided to the 4 pins of port 0, through which the analog signals are fed to a multiplexer which selects the input channel and in-turn feeds 8 bit ADC through a Programmable Gain Amplifier (PGA). There are 4 8-bit PWMs that are used to control the motors to control the flow of different parameters such as acid, alkali, antifoam and oxygen. Other 4 pins of port 0 are configured as PWM outputs. A LCD panel is connected to Port 1 to display the values of different parameters dynamically. A 4-bit data bus configuration is used to control the LCD. Port 2 is used to control different motors and heaters, these are controlled by on-off mechanism. Also an audio buzzer is connected to port 2 for any warnings on over range in some parameters. A timer module in the device is utilized to countdown on time. The motors are driven using MOSFETs for achieve more power efficiency.

The sensors for the different parameters come along with the signal conditioners, which provide outputs of 0-5V or 4-20mA drive. The outputs from the sensor signal conditioners are directly given to the ADC inputs of the microcontroller.

The power supply section consists of two transformers, one to supply 5V at 1A to the digital system after regulation and the other to supply 12V at 4A for the motors.

In the present project only the automatic mode is used where the keyboard input is not taken for providing limit (Upper and Lower) values for different parameters. This feature will be added in the future upgrade of the project.

The block diagram of the Precision Digital Controller is shown in Fig 1.

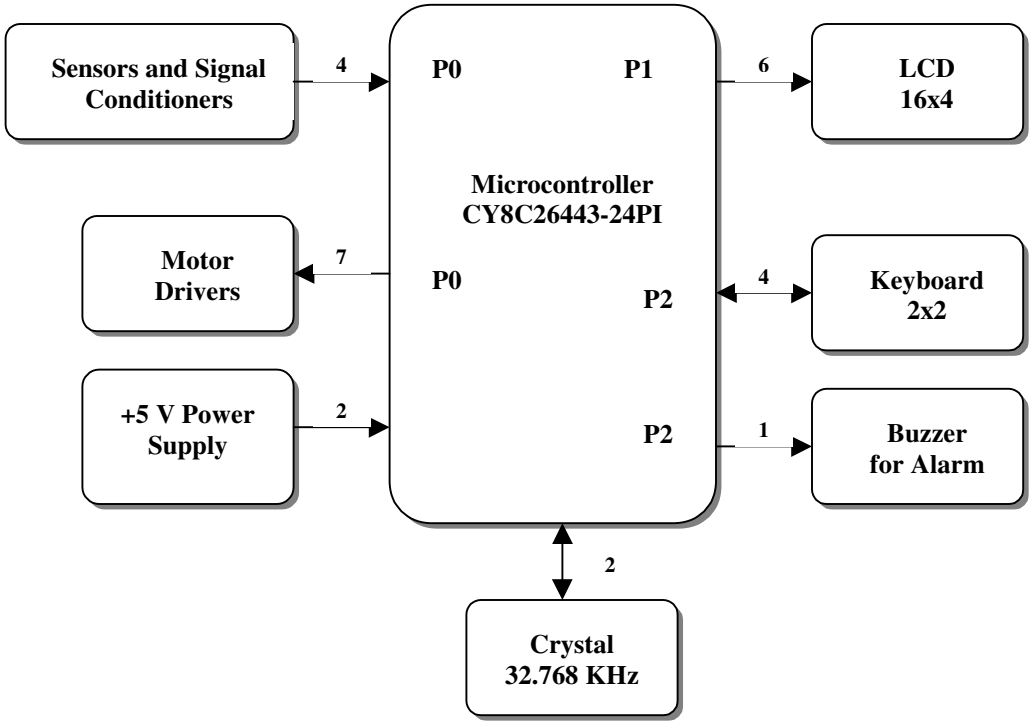
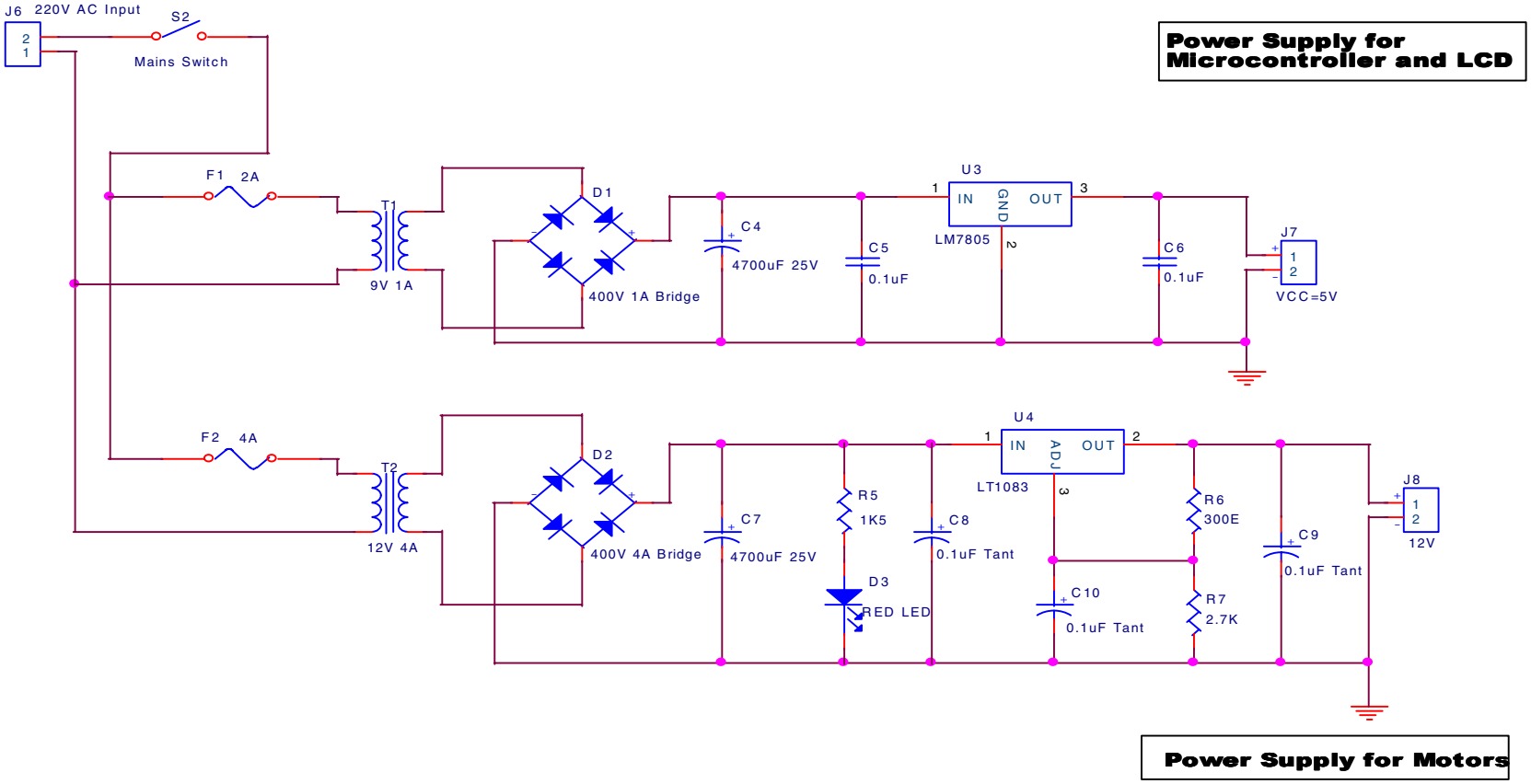


Fig 1. Block Diagram of Precision Digital Controller



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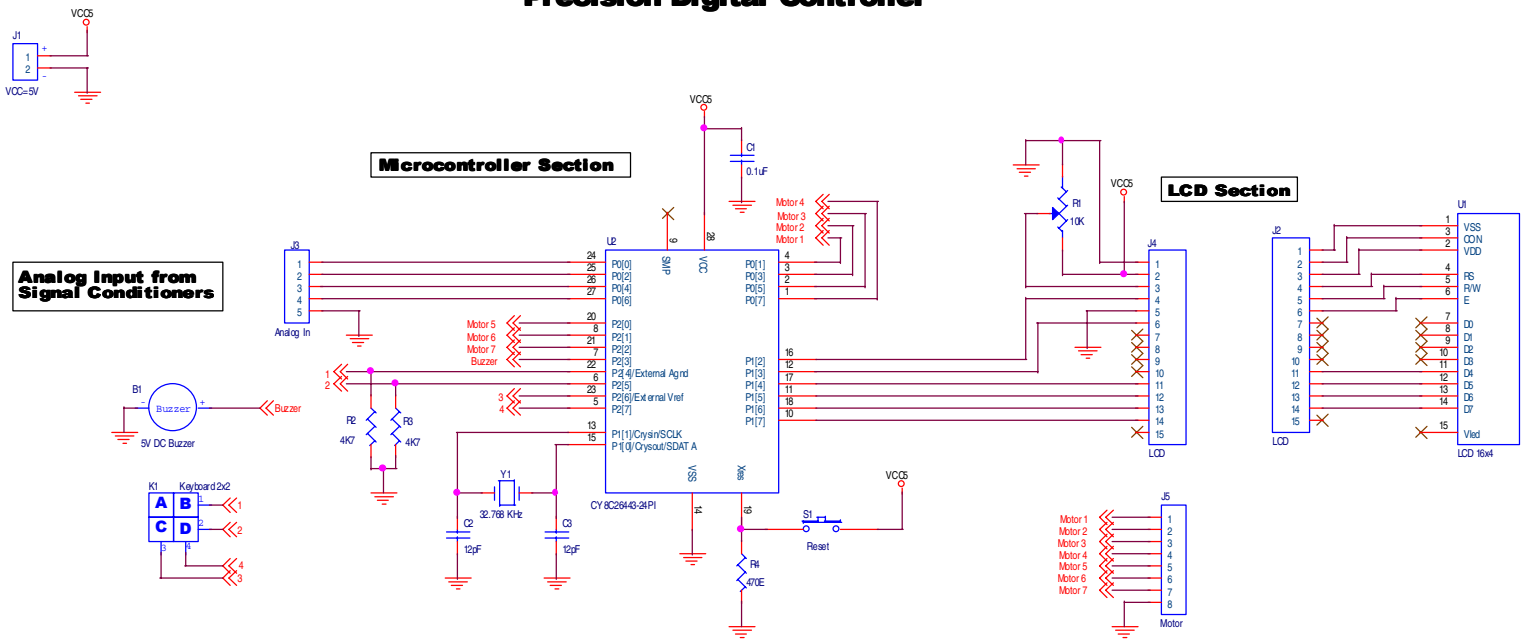
Precision Digital Controller



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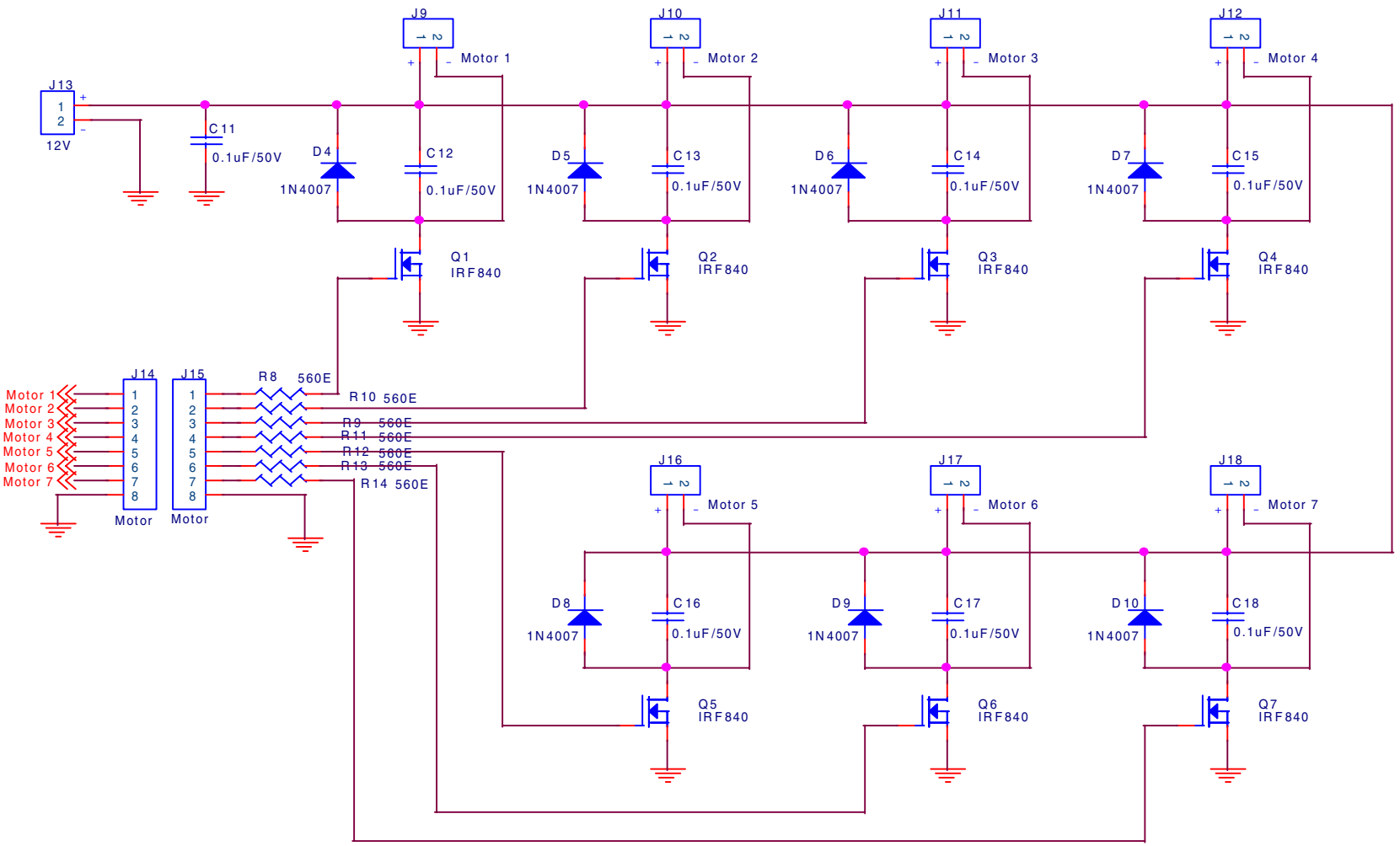

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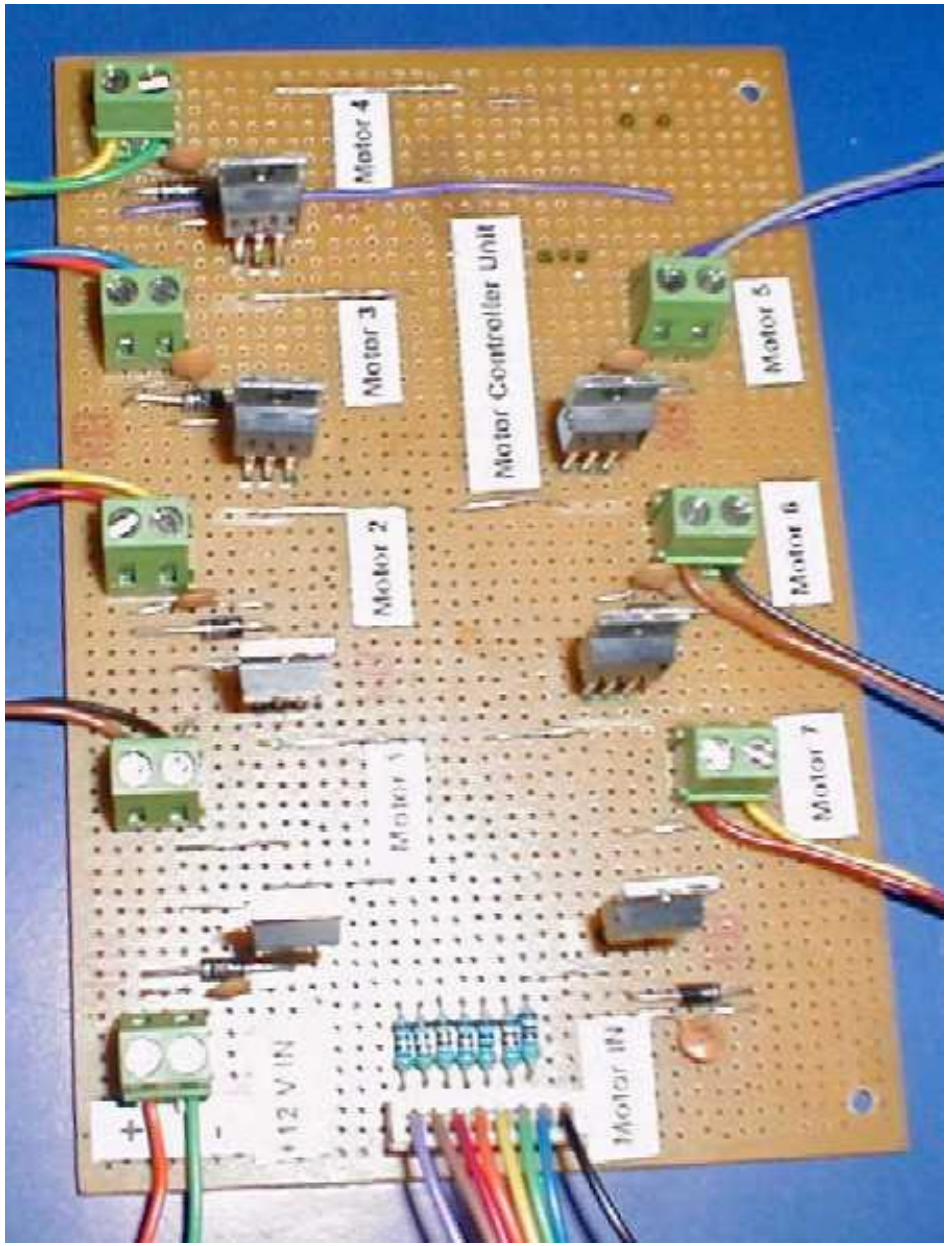

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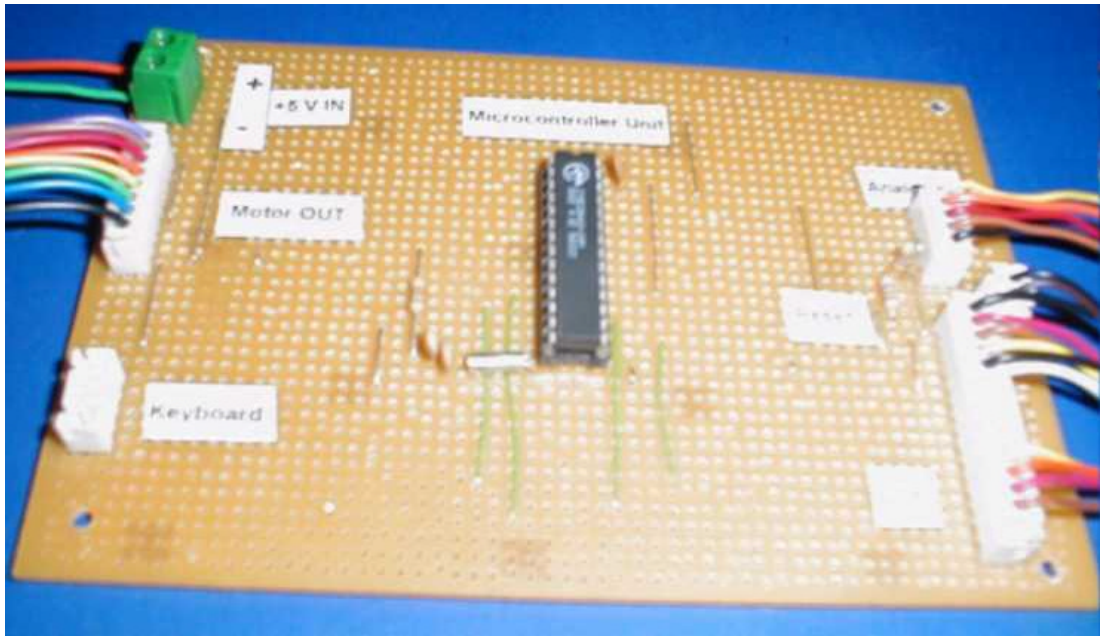

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