Application Note

Closed-Loop Motor Control

Contact:
Brazen Tek, Inc.
20121 Ventura Blvd.
Suite 310
Woodland Hills, CA 91364
Tel/Fax: (818) 710-9262
E-mail: info@brazentek.com

Introduction

Based on the review in the Application Note "Closed Loop Control System", the latter paper is the reference to this application.

System Overview

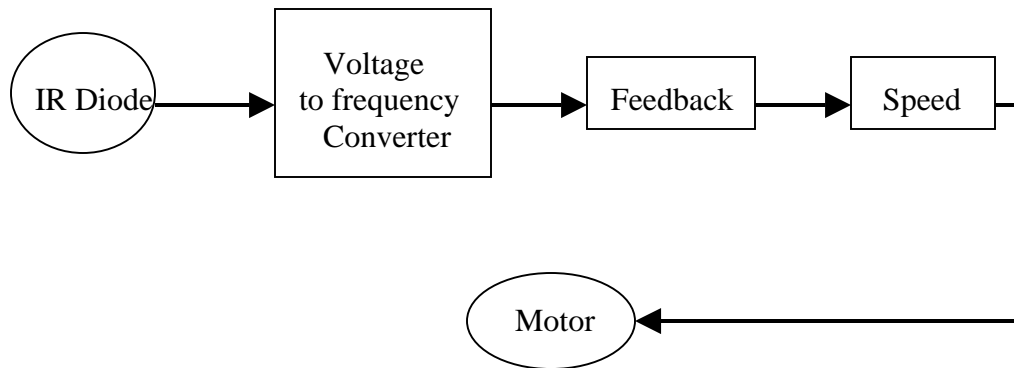The following diagram provides a scheme for the closed-loop motor control application:

Figure 1 – Closed-Loop Motor Control Diagram

One important feature of the design is revolved around the circuit being stable. This is achieved by having the closed-loop circuit operate at its best in an electrically noisy environment.

The use of IR diode as a detector in the circuit at its input is by implementing a phototransistor that generates radiation. This radiation is splitted into pulses by the motor fan blades. The quantity of pulses from the phototransistor is supplied to VFC (Voltage-to-frequency converter) that has a voltage proportional to the speed of the motor. VFC320 from Texas Instruments is a good option for motor speed and control applications. It can take either positive or negative voltages as input. The output of the converter is a voltage with following conditions: amplified, low-pass filtered and comparable with a manually adjustable control voltage that represents the commanded speed.

Manually adjustable is mainly driven from the monitoring circuit or in simpler way, a microcontroller that is performing the operations based on user inputs. The difference between the speed-measurement and speed command signals is a control voltage that is amplified and supplied to an external power amplifier that drives the motor. A selector switch at the output of the final amplifier of such a

circuit also enables the operator to bypass the circuit manually set the control voltage for the external amplifier. The chosen operational amplifiers are mainly due to their voltage supply constraints.

The circuit can be controlled via a PC graphical user interface (GUI), the communication between hardware and software can be between any of USB, RS232, etc. depending on the end-user's needs. Figure 2 described such a configuration:
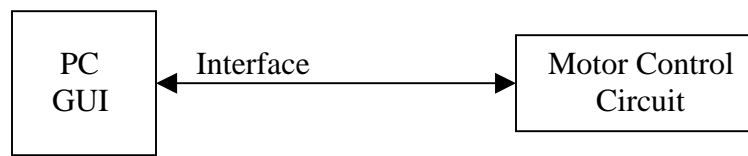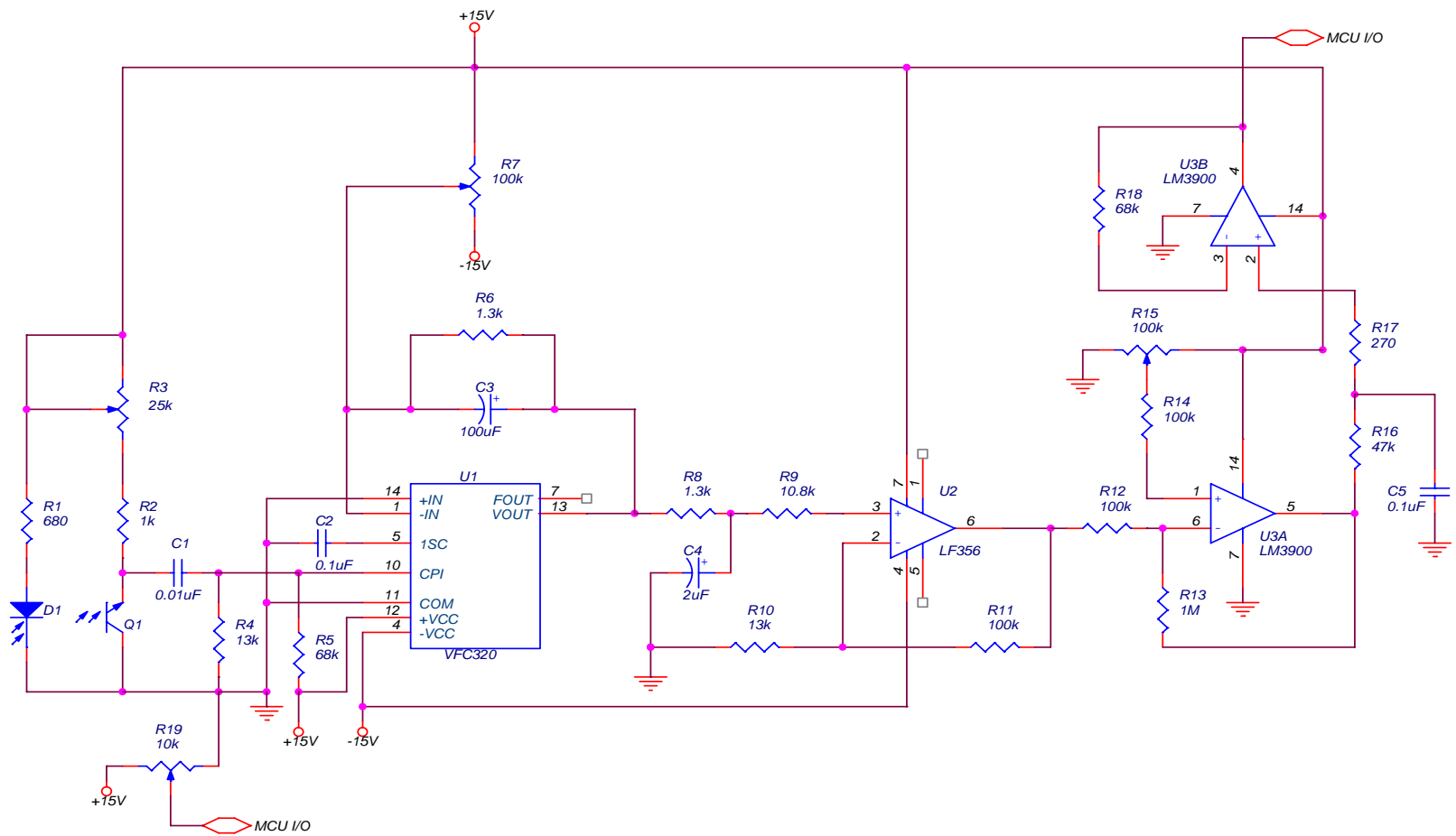

Figure 2 – User's control over the circuit

Power supply for this circuit should be dual output with ac coupled capacitors, these should be comprised of small and large capacitors. In this application note, +15V and –15V are the supply voltages.

The schematic of the closed-loop motor control is displayed in figure 3. Resistors in the circuit are 0.25W with 5% tolerance. The unused pins of LM3900 should be tied to ground.

+15V

MCU I/O

R7
100k

-15V

U3B
LM3900
4

R18
68k

7   14

3   2

R6
1.3k

R15
100k

R17
270

C3
100uF

R14
100k

R3
25k

R16
47k

U1

14 +IN   FOUT 7
1   -IN   VOUT 13

R8
1.3k

R9
10.8k

U2

3 +   6

R12
100k

1   14

C5
0.1uF

R1
680

R2
1k

C1
0.01uF

C2
0.1uF

5   1SC
10 CPI
11 COM
12 +VCC
4   -VCC

2 -

LF356

C4
2uF

U3A
LM3900

6 -   5

7

D1   Q1

R4
13k

R5
68k

VFC320

R10
13k

R11
100k

R13
1M

+15V

-15V

R19
10k

+15V

MCU I/O

Title		Rev
Closed-Loop Motor Control		
Size A	Document Number 9001-1	Rev A
Date: Thursday, January 29, 2009	Sheet 1 of 1	

Important Notes