

SPEED CONTROL OF DC MOTOR APPLICATION WITH MICROCONTROLLER INTERFACE WITH PC

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Abstract

Role of electrical drives is a major concern in industrial automation. Industrial applications use dc motors because the speed-torque relationship can be varied to almost any useful form for both dc motor and regeneration applications in either direction of rotation. Dc motors are often applied where they momentarily deliver three or more times their rated torque. In emergency situations, dc motors can supply over five times rated torque without stalling (power supply permitting). Dc motors feature a speed, which can be controlled smoothly down to zero, immediately followed by acceleration in the opposite direction without power circuit switching. And dc motors respond quickly to changes in control signals due to the dc motor's high ratio of torque to inertia. The system is intended to design here provides RS232 interface which is a standard for both PC and PLC. A set of commands is used to control drive.

Keywords: RS232, Microcontroller, Motor

I. INTRODUCTION

In this system various commands are given to drive by a computer RS232 interface. The drive responds accordingly like start, stop, and variable speed. The system supports UART protocol, fixed baud rate (9600bps). Field sense and current sense circuits are for protection of drive. The PC available to control operation of speed of motor which can increase productively wide range of industry RS232 signal transmitter end and receiver which transmit information according to signal relative to data size Process control and energy conservation are the two primary reasons for using an adjustable speed drive. Historically, adjustable speed drives were developed for process control, but energy conservation has emerged as an equally important objective. SCADA type systems often require controlling devices from PC directly. PLC demands PROFIBUS support in drives for interfacing. But PC does not have PROFIBUS. Thus only one drive cannot be used with both technologies. In this project this system is used to control the DC motor up to 3 HP also result in high power consumption motor run smoothly but this drive is fully digital firing is done by microcontroller and on analog port potentiometer is connected this system is divided into three parts as firing circuit armature circuit, field power section firing circuit. this section is main heart of the project this control the firing pulses of the phase following the control pulse transformer which convert the firing pulses square wave in a pulse of fine edge is fed to the gate of SCR it is fired rapidly because

fine edge contain more current it is drive by transistor which provide sufficient current gain to the pulses this is used because microcontroller runs at low current potentiometer is used to decide the firing angle potentiometer gives the microcontroller dc voltage from 0 to 5 and OP amp is used to detect the tripping of armature and field detector circuit is use to upper and lower of sine wave of ac .Opto coupler is use to convert ac wave to square wave of 5v and sine wave is coming from synchronizing transformer. [1][2][3]

II. HARDWARE SCHEME

In this project Driver circuit is designed to interface microcontroller with PC generator firing pulses project based on dual converter thyristor based design (H Bridge). Firing is done by microcontroller which trigger the thyristor and speed of DC motor is controlled, A step down transformer is used to convert 230v AC to 12v/5A and it will send to bridge rectifier. This rectifier convert AC output from transformer into DC output by voltage regulator 7805,7912(12v/5A). Voltage output which is obtained is DC and it is given to microcontroller. Field supply is also given which is check by microcontroller. when drive is ON, the four thyristor of Dual converter (H Bridge) is in forward direction. Current flows through resistance and diode connected which limit the current and voltage sense by protecting device OPAMP. Dual comparator LM741,LM358 it is a detector which detect the tripping signal of armature and field. detector

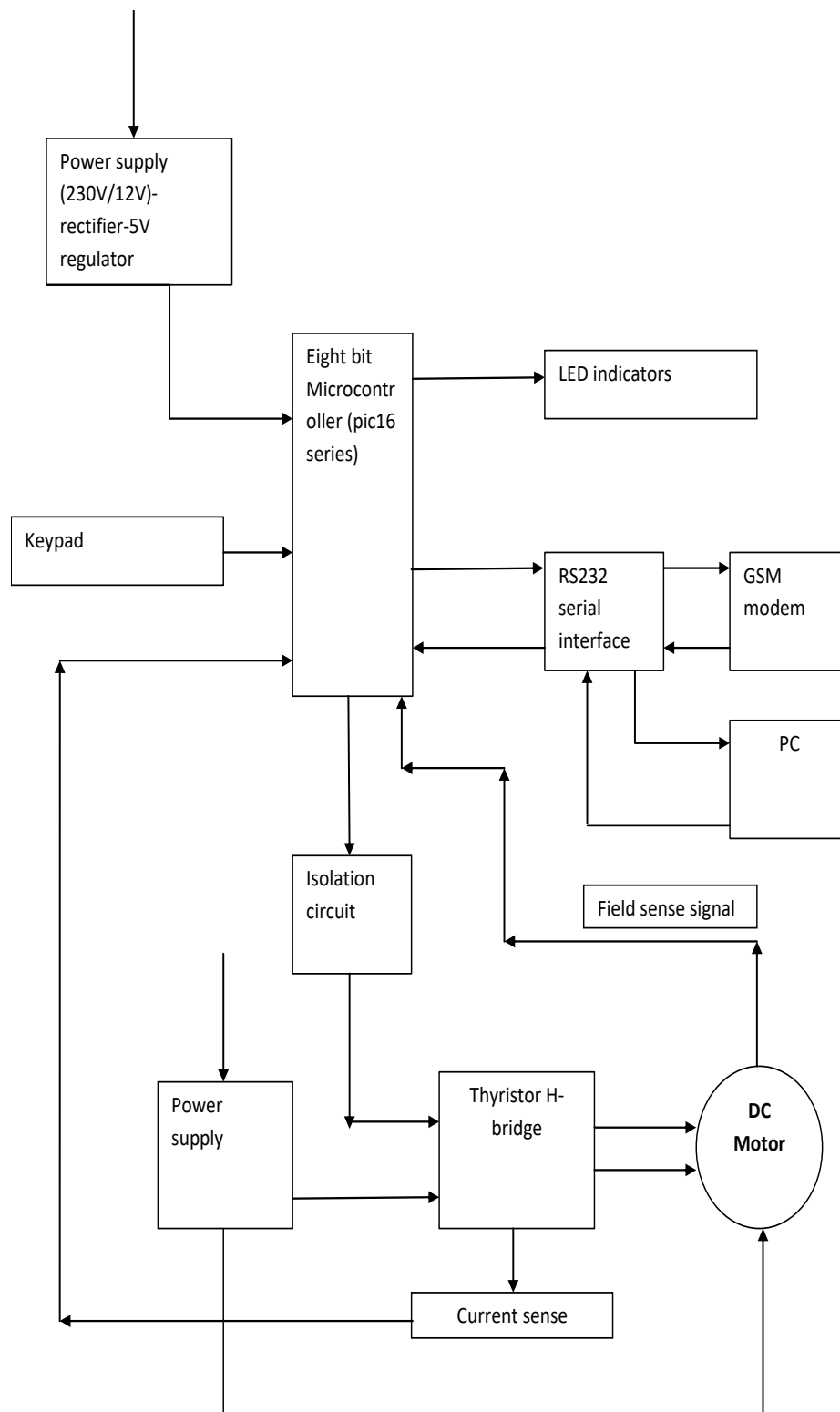


Fig. 1 Block diagram of the system

Detector circuit is used in upper and lower half of sine wave this OPAMP will sense the high current and voltage if output is high. It will read by microcontroller with logic 1 other OPAMP LM741 is also use to sense high voltage if output is high similarly if output obtained by LM741 is low it will read by microcontroller with logic 0. Eight opto

coupler PC817 which are connected to microcontroller pins which is used to isolate between controller and power circuit. It is used to convert AC wave to square wave of 5V and sine wave coming from synchronizing transformer. It is in the form of current and voltage signal received by optocoupler then these signals are read by microcontroller

logic 1 and logic 0 to generate the firing pulses microcontroller. Timer 0 and timer 1 are used to decide the time of pulse firing at 0.1 sec. Four pulse transformer 1:1:1 (430v/5A) is used which convert firing pulse of square wave coming from microcontroller into sine wave of fine edge is fed to SCR. It is fired since it contains more current. Driver TIP122 Darlington transistor (12v/5A) provides sufficient current to pulse transformer. Microcontroller gives firing pulses of low current across pulse transformer. It contains resistance of 1K ohms and diode in series and rectifies one polarity resistance and limit the current input signal read by microcontroller which gives to Darlington transistor and pulse transformer which triggers and firing is done.

There are two ways of switching Automatic, Manual where eight keys start, stop, forward, reverse, increase, decrease, auto, manual are connected to microcontroller pins with respect to LED glow. When start key press, it will read start command of logic 1 if key 2 press it increase the speed of DC Motor by steps and read the command of logic 1. When key 3 press it will decrease the speed of DC Motor and read the command of logic 0. When key 4 press it will rotate the motor in forward direction and key 5 rotate the motor in reverse direction in logic 0. In automatic mode, drive is operated interface with PC through RS232. key 7 when pressed to auto mode gives start command. LED will glow. microcontroller read START command of logic 1. It will display on PC if command gives SPE 64 microcontroller read the command of SPEED of logic 1 display on PC if STOP command gives microcontroller read STOP command then steps firing of thyristor motor stop running. if motor rotates in forward direction command is given DIRT F. After the command, reverse moror runs on DIRTR read by microcontroller and display on PC. This is how all parameters works. [4][5]

Model:



Fig.2 Hardware model of system

III. SOFTWARE SCHEME

Flow chart:

In this project MPLAB Software and ASSEMBLY Language is used for programming the flow chart and algorithm is done.

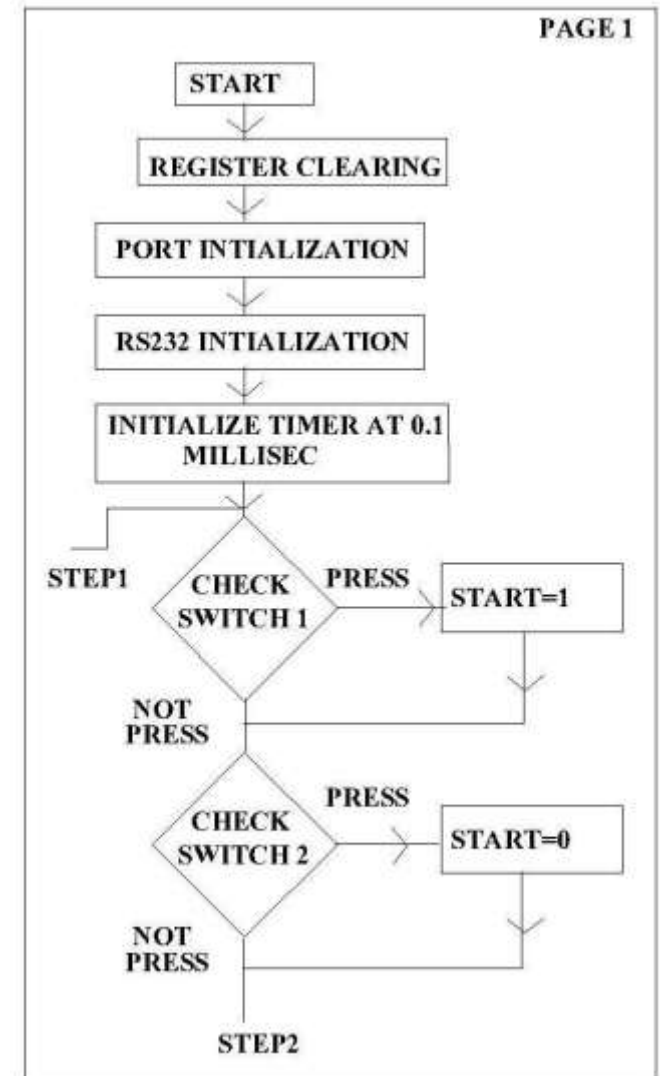


Fig.3 Flow chart 1

Algorithm

For Manual Mode

1. Clearing RAM and SFR.
2. Initializing of PORTA PORT B, PORT C
3. Initializing of RS232 configure its band rate, stop bits, parity bit.
4. Initialing of timer at 0,1 sec.
5. Press the switch 1 LED glow firing of thyristor takes place motor runs.
6. Press the switch 2 LED glows motor stop.
7. Press the switch 3 LED glows firing of thyristor takes place motor runs in forward direction.
8. Press the switch 4 LED glows firing of thyristor takes place motor runs in reverse direction.

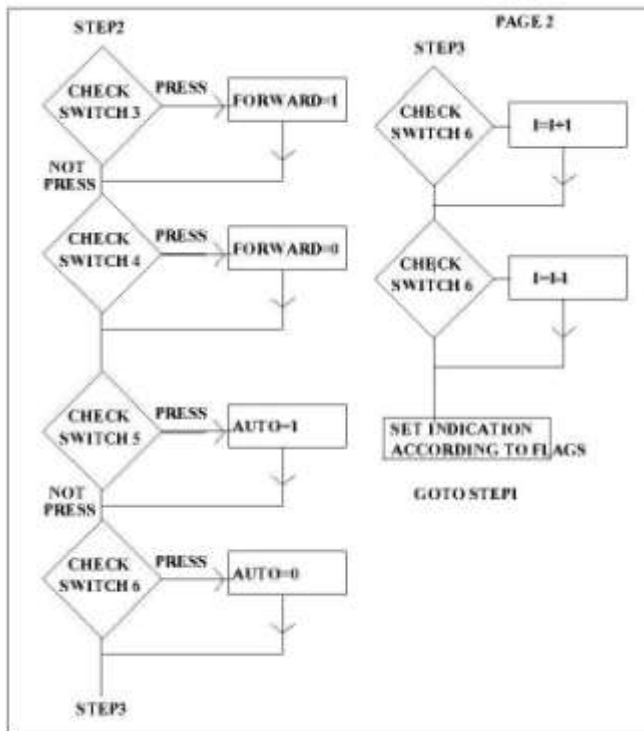


Fig.4 Flow chart 2

Algorithm

For Auto Mode

1. Press the switch 5 relay LED glows firing of thyristor takes place motor starts running.
2. Press key 6 relay LED OFF motor stops.
3. Press switch 7 motor start running in forward direction speed of motor can be increasing by steps.
4. Press switch 8 motor starts running in reverse direction speed of motor can be decreased by steps.

Command of RS232 interface

{START}-LED ON RELAY ON
 {SPE32}- FOR INCREASING SPEED UPTO 64
 {STOPD}-TO STOP THE MOTOR
 {DIRTR}-TO REVERSE THE DIRECTION LED OFF
 {DIRTF}-TO FORWARD THE DIRECTION LED ON [1]

IV. RESULT

Speed control of DC motor through RS232 interface with PC successfully done

Operating source voltage =230Vac

DC voltage =230*1,414 DC

Source current =4 amp (Armature current)& 3.5 amp (Field current)

Firing angle =90 degree

Speed=1500 RPM

Power=1 HP

Baud rate =9600 BITS/SEC

V. CONCLUSION

The speed of DC motor has been successfully controlled by using SCR as a full converter under operating condition

drive runs successfully microcontroller based design is done successfully designing of firing angle with full speed is done a 1 HP DC motor specification is taken and corresponding parameter are found out from derived design approach speed control of DC motor interface with PC through RS232 is done interfacing drive with computer.

VI. REFERENCES

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