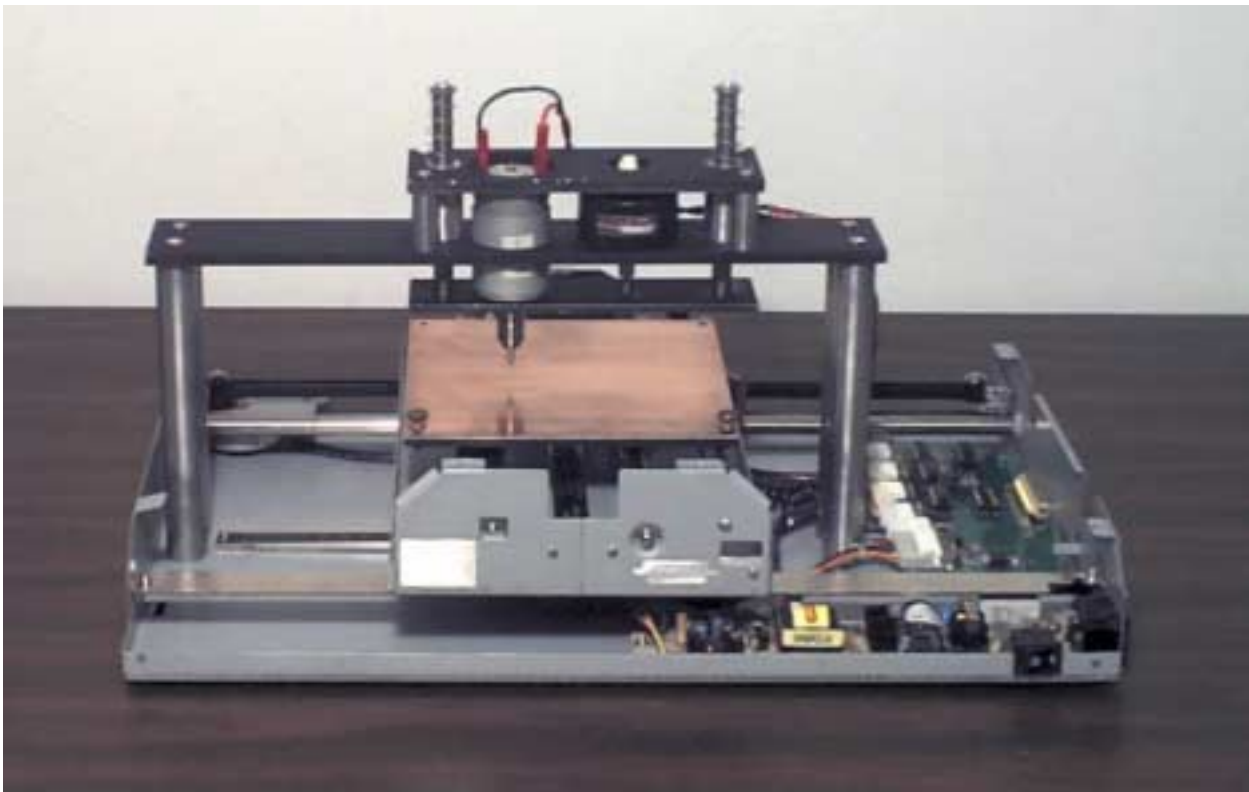


Printed Circuit Board Drill Project F2019

Abstract

This project's purpose is to design a fully automated machine for drilling a printed circuit board, (PCB) blank at a minimum cost and with the minimum amount of custom machining. This low cost philosophy is achieved by adapting the existing mechanical assemblies from readily available computer peripherals and electronic measuring instruments. Drill data is transferred to the PCDrill from an Excellon drill file generated by a PCB CAD program running on a personal computer.



The printed circuit board blank is mounted to an X-Y positioning table which is constructed from the mechanism of two 600 X 1200 dpi scanners which are capable of resolutions of a few thousandths of an inch. The table position is monitored in two axes by two modified electronic calipers which provide a digital output via a two-wire serial interface to the controller circuitry. Mounted above the table is a drill head consisting of a high speed DC motor which is raised and lowered by a linear stepper motor to perform the drilling operation. The table can accommodate PCB's up to 5" X 5" and thicknesses up to 0.125". Drilling rates are typically 400 holes per hour. Operator intervention is only necessary to change drill bits.

The controller is designed around an MC68HC908QY4 microcontroller. This device interfaces to the personal computer via the parallel port and receives commands to position the table and

drill the holes. It also coordinates the establishing of a reference point on the table with the reference point of the digital calipers. The serial data output of the calipers is converted from a 1.5 volt level to a 5.0 volt level and presented to the MCU via a data selector under MCU control. The MCU generates phase signals for the three unipolar stepper motors and enables each from its output port bits via drive transistors. Power is provided by the original scanner power supply which has outputs of 5.0 volts and 12.0 volts. A voltage divider and transistor generates the 1.5 volt power for the calipers.

Current software is written for hole drilling. However, with the appropriate commands and an end mill tool mounted in the drill chuck, the machine could be used for machining circuit traces also resulting in a complete PCB prototyping system.

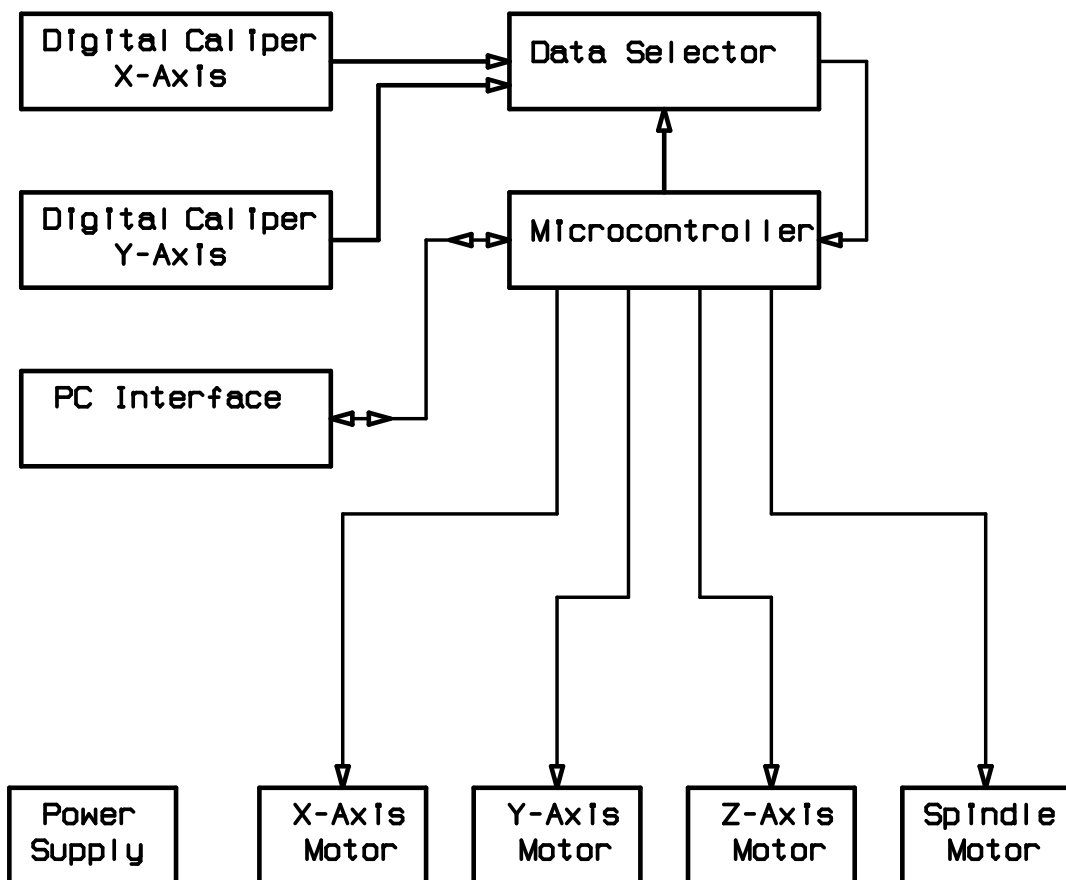
Code Sample - Motor Control Procedure

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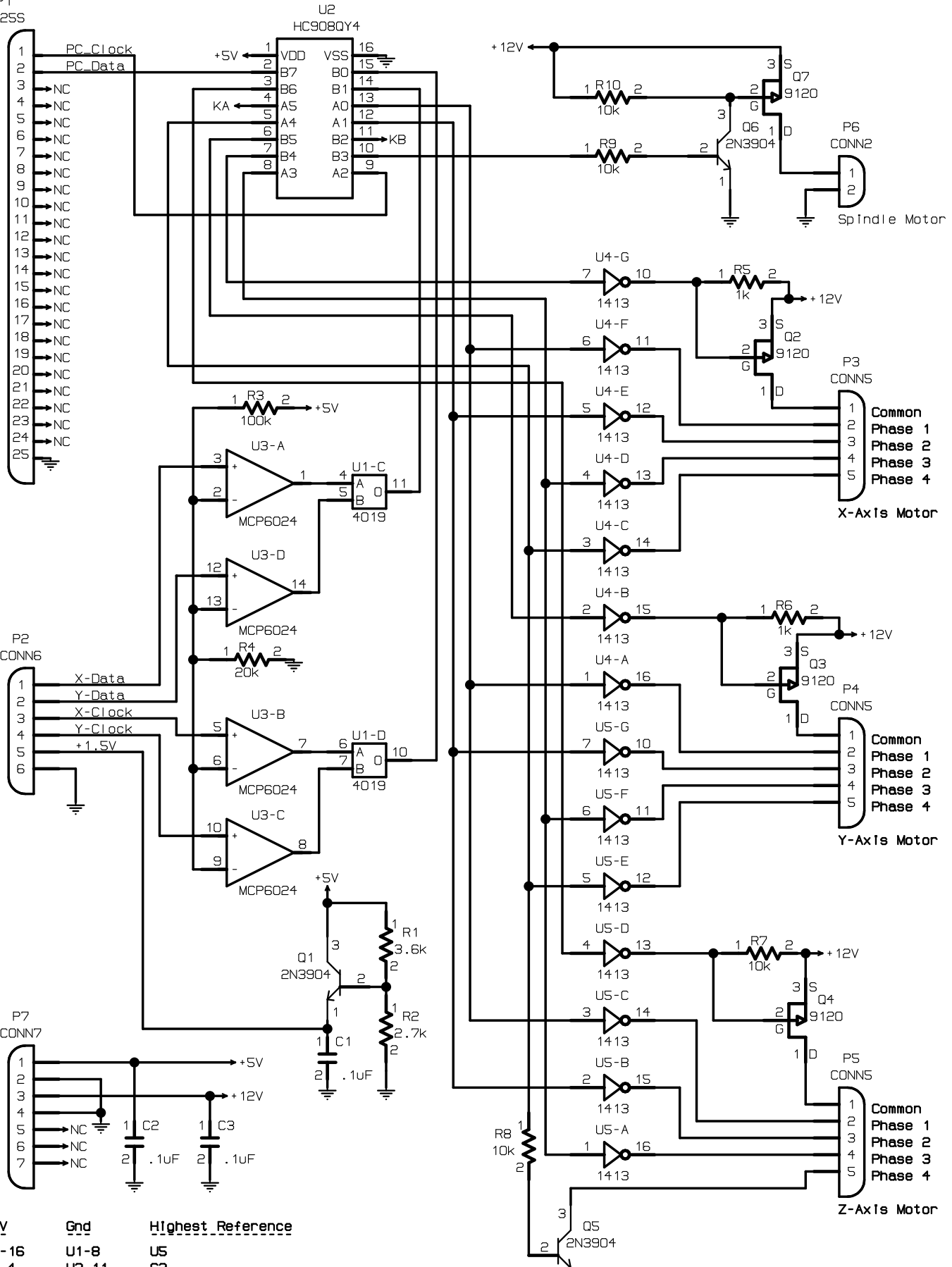
Motor:   lda   PCCmnd           ; This procedure decodes the data received from
        and   #$70           ; the PC and actuates the selected motor the
        sta   PORTB          ; specified direction and distance.
        clrh                    ;
        clr   Diff0          ;
Mtmove:  ldx   MSave          ;
        lda   MTable,X       ; Move the motor one step forward or backward
        sta   PORTA          ; depending on D2 of Status.
        Dly2  16,35          ;
        brclr 2,Status,Mtrev ;
        incx                    ;
        bra   Mtfwd          ;
Mtrev:   decx                    ;
Mtfwd:   txa                    ;
        and   #7             ;
        tax                    ;
Tstmove: stx   MSave          ; If further movement, continue. If not, exit.
        clc                    ;
        clr   Diff0,X        ;
Rdiff:   lda   Diff0,X        ;
        sbc   Scale,X        ;
        sta   Diff0,X        ;
        incx                    ;
        cbeq  #4,Cntinue     ;
        bra   Rdiff          ;
Cntinue: bcc   Mtmove         ;
Motxit:  rts                    ; Return from Motor.

```

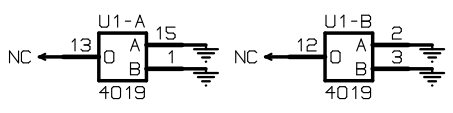
PC DRILL
PROJECT F2019



P1
DB25S



+5V	Gnd	Highest Reference
U1-16	U1-8	U5
U3-4	U3-11	C3
	U4-8	P7
	U5-8	Q7
		R10



PCDRILL
PROJECT F2019