WHAT IS THIS ?

This is a software for a Microchip PIC16C84 used for testing the PI metal detector published on the Geotechnology page. The software is written so it is possible to adjust some parameters from outside the PIC and then store them in the PIC's internal EE register.

WHAT DO I HAVE TO CHANGE ?

There is three major change to the original project.

1. Use a 16C84 instead of 16C54
2. You must add some pulldown resistors (5 pcs) to the original PCB, its easy because there is already some minor unused PCB connections already (See Fig. 1)
3. To make sure you have a stabile working uP you must add a Dallas DS1233. Its a power up/down reset circuit in a 3 pin TO-92 house and can easily be glued somewhere on the PCB. The output of the DS1233 (or equil) should be connected to pin 4 (MCLR) of the PIC (see fig. 1). This circuit is very important.

WHAT DO YOU NEED ?

You need 6 different things.

1. 5 x 10K resistor
2. 5 x micro switch
3. 1 x DS1233 or another equal type CPU supervisor.
4. 1 x program (is included) PI84-4r.hex
5. 1 x programmer for the PIC (see URL to build one yourself.. peace of cake)
6. a oscilloscope (dual beam)

Also you might need some kind of micro switches for changing the parameters if you like. It is very easy to build this on to the existing board but you could also use a piece of Vero board (PCB for experiments) to build it on.

HOW DO YOU START ?

1. Connect the all five resistor and the DS1233 (see fig.1), remember to remove original existing parts to pin 4 (16C54/84) on PCB.
2. Program the device with the hex code.
3. Place the PIC on the PCB (use a 18 pin socket)
4. Connect a dual beam scope one channel for the PIC output to the puls transistor (RB0) and one for the output (RB3) that open and close the receiver.
5. Run as dual channel Check that there is a pulse on both channels.
6. Connect micro switch to the RA0..RA4
7. Now try press the RA0 micro switch and the receiver time is increasing press RA1 and it decrease.
8. Press switch for RA4 shortly (1 sec.) and the change you made is stored insight the chips EE prom. Next time you switch on the power it will start up with the timing you just saved.
9. Read the program description carefully so you understand what is going on. And you are ready to adjust you circuit to be as good as possible and match your coil the best way.

HOW DOES THE PROGRAM WORK ?

This software is written for Microchip PIC16C84 which is pin compatible with 16C54. The reason for the chose of 16C84 is that it is EEPROM based meaning that it is possible to change its program and data space as many times you like. The 16C84 has 64 bytes user EE memory cells that can be changed when the chip is running a program. A few of those is used to store information about puls width (PW), Delay before receiver open DBRO), the time you wand to receive (RT) and finally the wait time between the pulse (WTBP) in praxis equals the number of pulses. This means that you can adjust the circuit to open and close the receiver as a window of a known length for instance 50 uS and then move this 50 us windows backwards and forwards to select exactly the part of the reflected puls you would like to use as output. It is possible to adjust the circuit to optimal sensitivity and best stability the step rate is approximately 2 us/step. I have heard that on the original circuit you must be very careful creating the coil because the timing can not be adjusted, so this problem is easy to handle in my one. To do all this functionality we need some extra pins and if you look at the original PCB the connections is already there. Be aware that some of the pins is multi functional and care must be taken to make it work probably. First you must connect pulldown resistors to the unused pins RA0..RA4.
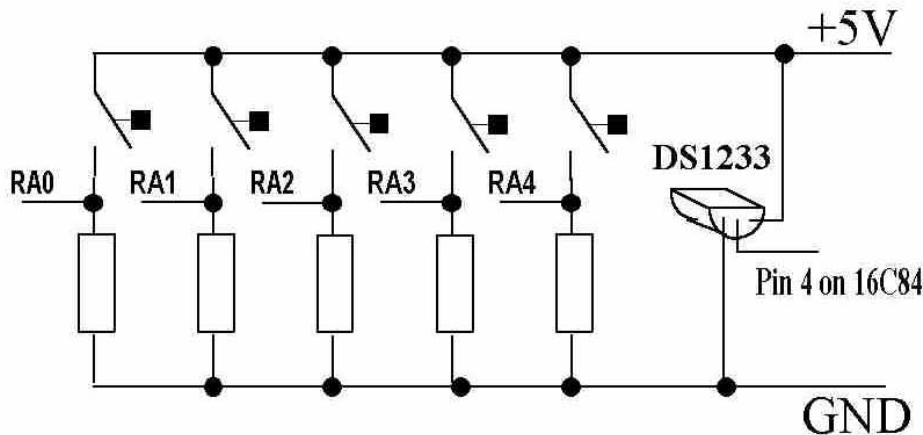
WHAT IS THE DIFFERENT PINS FOR:

RA0 (pin 17)
Press micro switch for this input if you wand to increase time for sampling reflected puls (see fig.2).

RA1 (pin 18)
Press micro switch for this input if you wand to decrease time for sampling reflected puls (see fig.2).

Schematic for microswtches and DS1233

RA2 (pin 1)
Press micro switch for this input if you wand to increase time before sampling reflected puls (see fig.2).

RA3 (pin 2)
Press micro switch for this input if you wand to increase time before sampling reflected puls (see fig.2).

RA4 (pin 4):
The most complex pin is A4, this one is multifunctional with tree different options. If raised high when uP is already running it stores all the values PW, DBR and RT. The Second option is when pulling A4 high (processor running) and then at the same time dragging RA0 or RA1 high then you can adjust puls width (see fig.1).

The third function is to power off the circuit and then connect A4
to the +5V on the board and switch it on again. Then remove the +5V
again and the Circuit is back to the default timing like the first
time you put power on it.

Or explain shortly
+ to RA4   stores data
+ to RA4 and + to RA0   increase the output puls time
+ to RA4 and + to RA1   decrease the output puls time
+ to RA4 when power on   Restore initial values
                              (d1..d4 in the PI84-4r.asm)

Fig. 2

THE ASSEMBLER CODE
The assembler is very straight forward, remember this code was not
wrote for publishing or very optimised but simply for testing this
PI design to see how effective it is. It should be possible to mod-
ify this assembler very easy to change the code the way you wish it
to work. Unfortunately I do not have the time for it at the moment.
Some ideas could be to make some mode switches on the unused I/O's
in PORT B so it is possible to select modes with many narrow pulses
or fewer wider ones. I have included the assembler code with my
half Danish, and half English comments and I hope you can solve it
out from that. You can freely download the PIC compiler from the

Microchip homepage http:/www.microchip.com.
There is plenty of device programmers around the web.


WHY THE DS1233 ?
The DS1233 from Dallas is a standard power up/down component for uP circuits. It reset the circuit for a few 100 mS (Low) and then Release the uP. When powering down and that's the problem without the DS1233 (Or equal) the voltage is going very slowly down due to the large capacitor for stabilising. This very slowly dying voltage could and will make the 16C84 malfunction around 2-2.3 volt and can erase part of internal program. During power down the DS1233 stop the uP when voltage is 5 volt minus 10% so no harm is done. You can find further information on:
http:/dalsemi.com/Prod_info/CPU_Super/econo.html
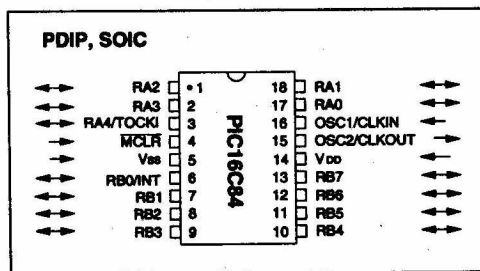
Fig. 3

ABOUT ME
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