General Design Sketches

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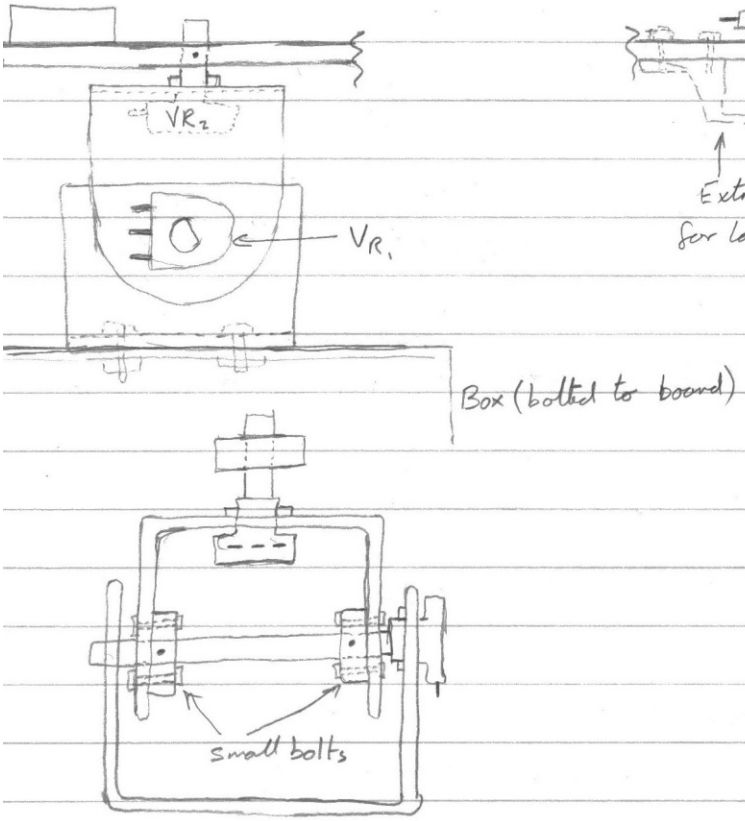
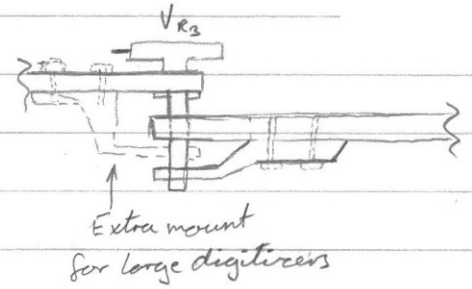
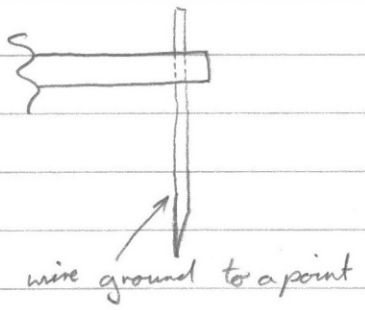
Base



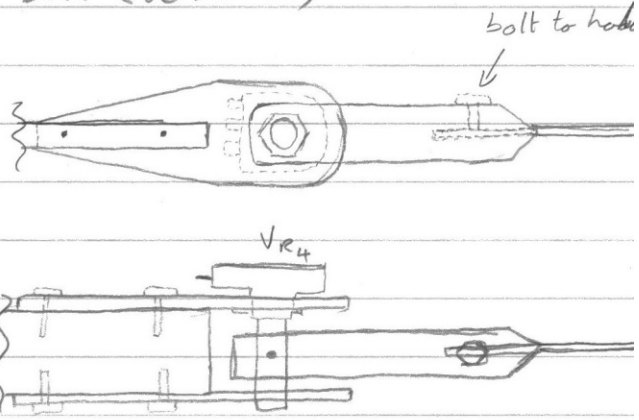
Middle



End (Version 1)

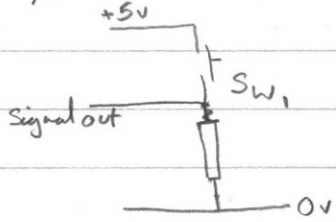


End (Version 2)



The exact sizes and design will depend on the parts available.

Optionally include a push-switch somewhere with the circuit



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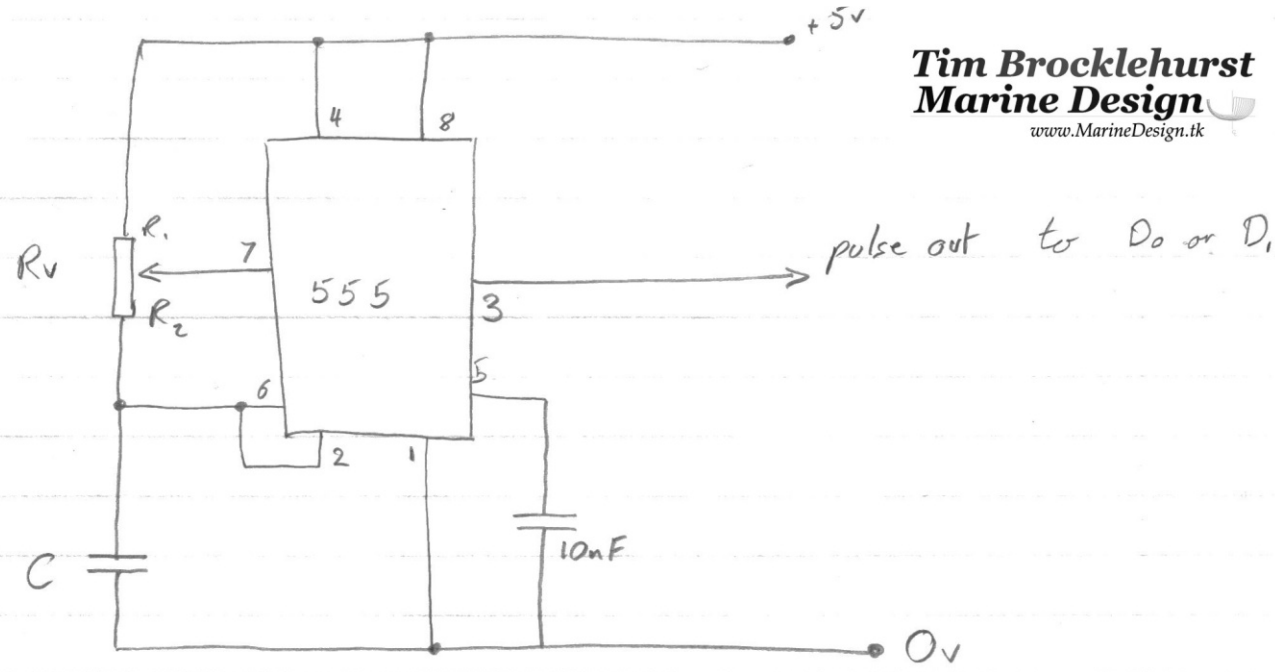

$$f = \frac{1.44}{(R_1 + 2R_2) \times C}$$

High time $= 0.69 (R_1 + R_2) \times C$

Low time $= 0.69 (R_2 \times C)$

$R_V = R_1 + R_2 \approx 4.7\,k$

$C \approx 5\,\mu F$

giving a high time of 0.016 s

frequency of 31.25Hz $\rightarrow$ 62.5 Hz

a small bias resistor may be needed next to R_2.

Circuit board layout

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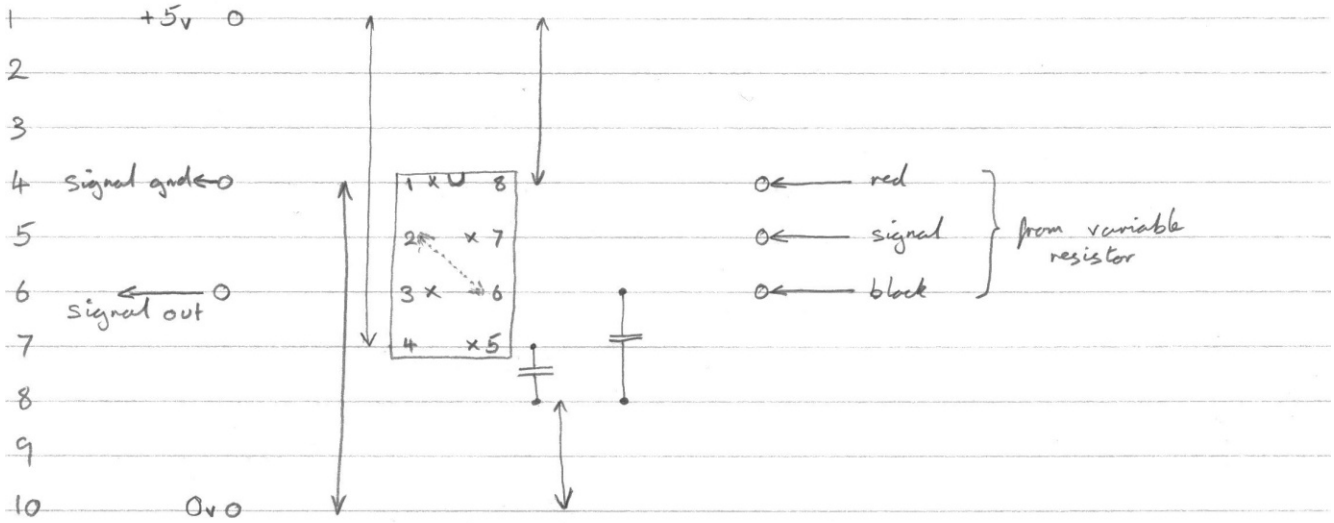
Strip-board



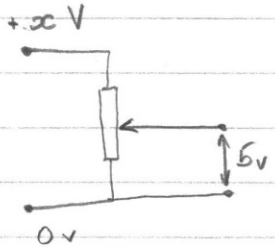
x signifies a cut

+5v may be taken from $\overline{\text{INIT}}$ output (pin 16) as long as no more than 4mA is drawn from the port. In this case use,

$$R_i = \frac{5}{4 \times 10^{-3}} \times N$$

where R_i is the resistance of each variable resistor and N is the number.

A better way to supply power would be to have a seperate power supply (eg. from a portable CD player) and use the following circuit to give a 5 volt supply.



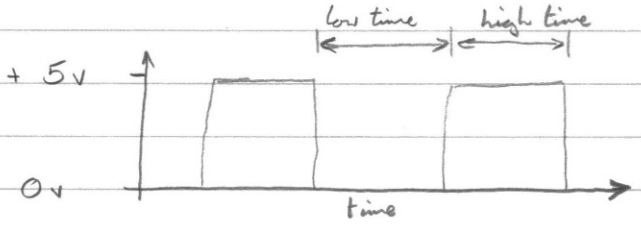
where $x > 5v$

The signal outputs are pulses with the high time

$$0.69(R_1 + R_2)\,C$$

where R_1 is between pins 7 and 8
R_2 is between pins 6 and 7
C is between pin 6 and ground

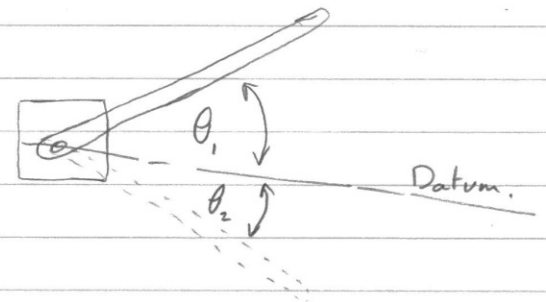
The low time of the pulse is $0.69\,R_2\,C$



signal output

the position of the variable resistor is derived from the low time by calibration in the computer code.

Calibration requires the lengths between variable resistors (centres) the offset of the two main arms (from V_{R_1} to the main arm; and the distance between the two arms). All the variable resistors must then be calibrated to at least two angles (say $\pm 45°$ from a datum) the datum should then be cross-checked. ie.



The following signal out connections should be used:

$VR_1 \rightarrow D_0$ (pin 2) $VR_2 \rightarrow D_1$ (pin 3) $V_{R_3} \rightarrow D_2$ (pin 4) $V_{R_4} \rightarrow D_3$ (pin 5)
$Sw_1 \rightarrow D_4$ (pin 6) Signal gnd / 0v $\rightarrow$ pins 18 $\rightarrow$ 25

Port Locations and Values

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Data lines = Port + 0

Status lines = Port + 1

Control lines = Port + 2

Typically the port is LPT1 and may be found at an adress 888 (or 0x0378 (hex)) this appears to be static between operating systems on standard hardware.

Data lines	value returned
D_0	1
D_1	2
D_2	4
D_3	8
D_4	16

if D_1, D_2 and D_3 are high 2+4+8 = 14 will be returned

if used, $\overline{\text{INIT}}$ is on port+2 (ie. 890) and has value 4. $\overline{\text{INIT}}$ is an output only.

Commands: In C; #include <asm/io.h>

Outb(value, port)

value = inb(port)

In Qbasic; OUT port, value

value = INP(port)

Use these to write to the port. Only use at the beginning of the code to clear the port of data.