Synthesised sinewave generator + tachometer for turntable motors

v1.0   Richard Balmford

This project consists of a PCB and Arduino firmware to generate 2 or 3 phases of sinewaves suitable for driving turntable motors, along with a tachometer function to display the turntable speed. The PCB mounts directly on the Arduino Uno, with one required for 2 phases, and 2 for 3 phases.

The sinewave outputs are a nominal 1.3v peak-peak and will require amplification to the voltage required by the motor.

The tachometer requires any sensor that generates 5v pulses.

Features

- 31.4kHz PWM synthesis + 2-stage low-pass filter

- suitable for 50Hz or 60Hz motors (selectable in firmware)

- generates 2 (0° and 90 °) or 3 (0 °, 120 ° and 240 °) phases of sinewave

- electronic speed switching for 33/45rpm

- tuneable frequency and relative phase, stored in non-volatile memory

- buttons, and Bluetooth + RemoteXY App interfaces

- integrated tachometer, displayed via Bluetooth interface

- tachometer has selectable pulses-per-rev and averaging (in firmware)

- selectable start ON or OFF (in firmware)

TITLE: supaspin

REV: 1.0

Company:

Sheet: 1/1

Date: 2021-01-15   Drawn By: R.Balmford

BOM

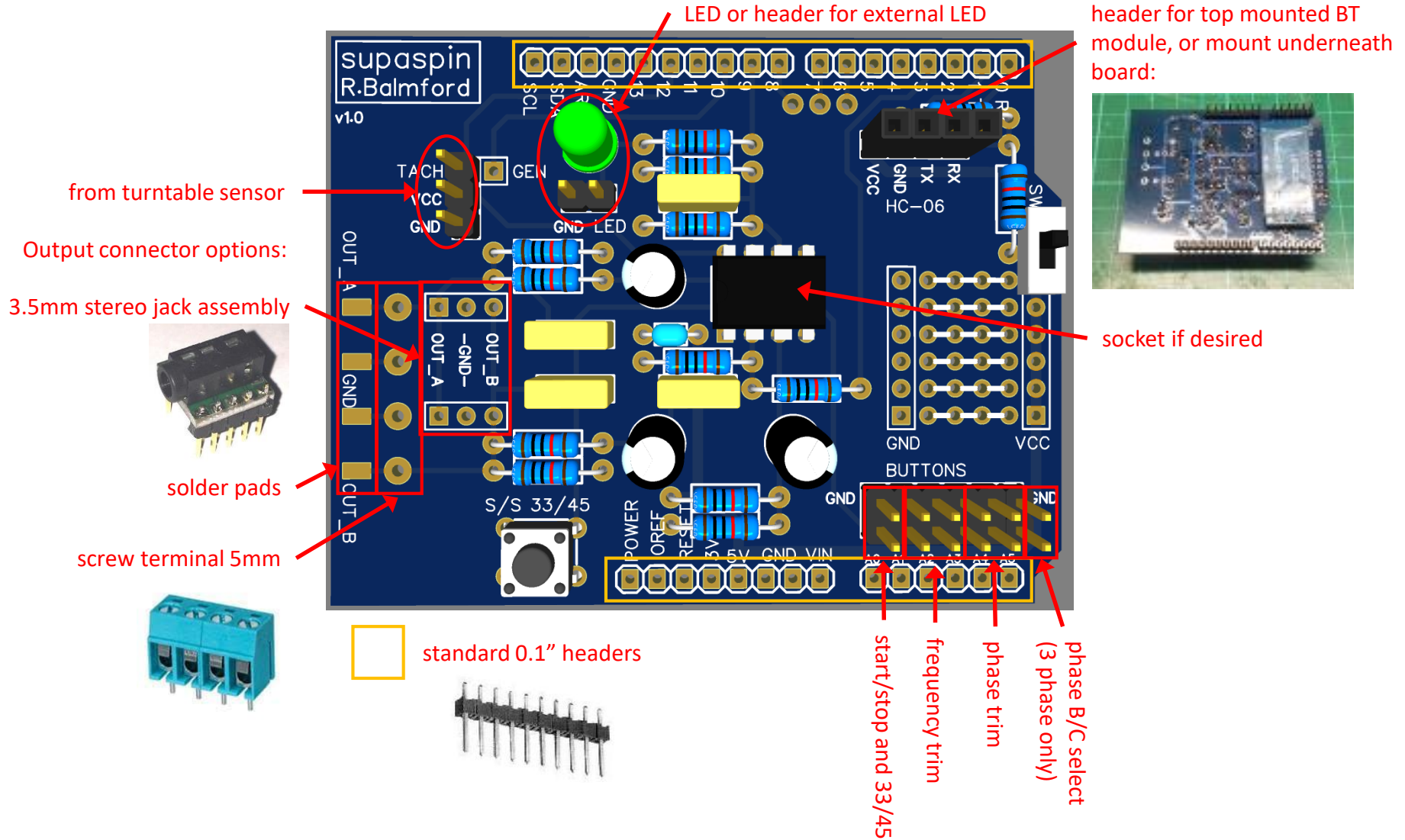| Designation	Part	Quantity, 2-phase	Quantity, 3 phase
	Arduino UNO	1	1
P1	PCB	1	2
U1	OPA2134	1	2
	DIL socket, 8-pin	1 *	2 *
R1, R2, R12	10kΩ	3	5
R3, R4	12kΩ	2	3
R5, R6	3.3kΩ	2	3
R7, R8	1kΩ	2	3
R9, R10	220kΩ	2	3
R11	4.7kΩ	1	1
R13	470Ω (1)	1	1
C1	10µF, electrolytic, 6.3v+, 0.1" spacing	1	2
C2, C3, C7, C8	100nF, 0.2" spacing	4	6
C4, C5	4.7µF, electrolytic, 6.3v+, 0.1" spacing	2	3
C6	0.1µF, decoupling, 0.2" spacing	1	2
KEY1	miniature momentary push switch	1	1
J7	miniature SPDT slide switch	1	1
LED	LED	1 *	1 *
H2	4-pin header, female	1 (2)	-
	0.1" header strip, male (3)		
	0.1" stacking headers, 6 + 8 + 8 + 10 pins	-	1
	screw terminal, 5mm, 4 way	1 *	1 *
	screw terminal, 5mm, 2 way	-	1 *

* optional

(1) choose for desired LED brightness

(2) for removable mounting of BT module on top of board; alternatively mount permanently underneath

(3) sufficient for PCB-Arduino, tachometer + button headers

PCB

- 2 phase board (all builds)

LED or header for external LED

header for top mounted BT module, or mount underneath board:

from turntable sensor

Output connector options:

3.5mm stereo jack assembly

solder pads

screw terminal 5mm

standard 0.1" headers

socket if desired

start/stop and 33/45

frequency trim

phase trim

phase B/C select (3 phase only)

PCB

- 3rd phase board (3 phase builds only)

LINKS

Place R3 as shown

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v1.0

Output connector options:

solder pads

screw terminal 5mm

socket if desired

capacitors 8mm max
height or lay horizontally

stacking 0.1" headers
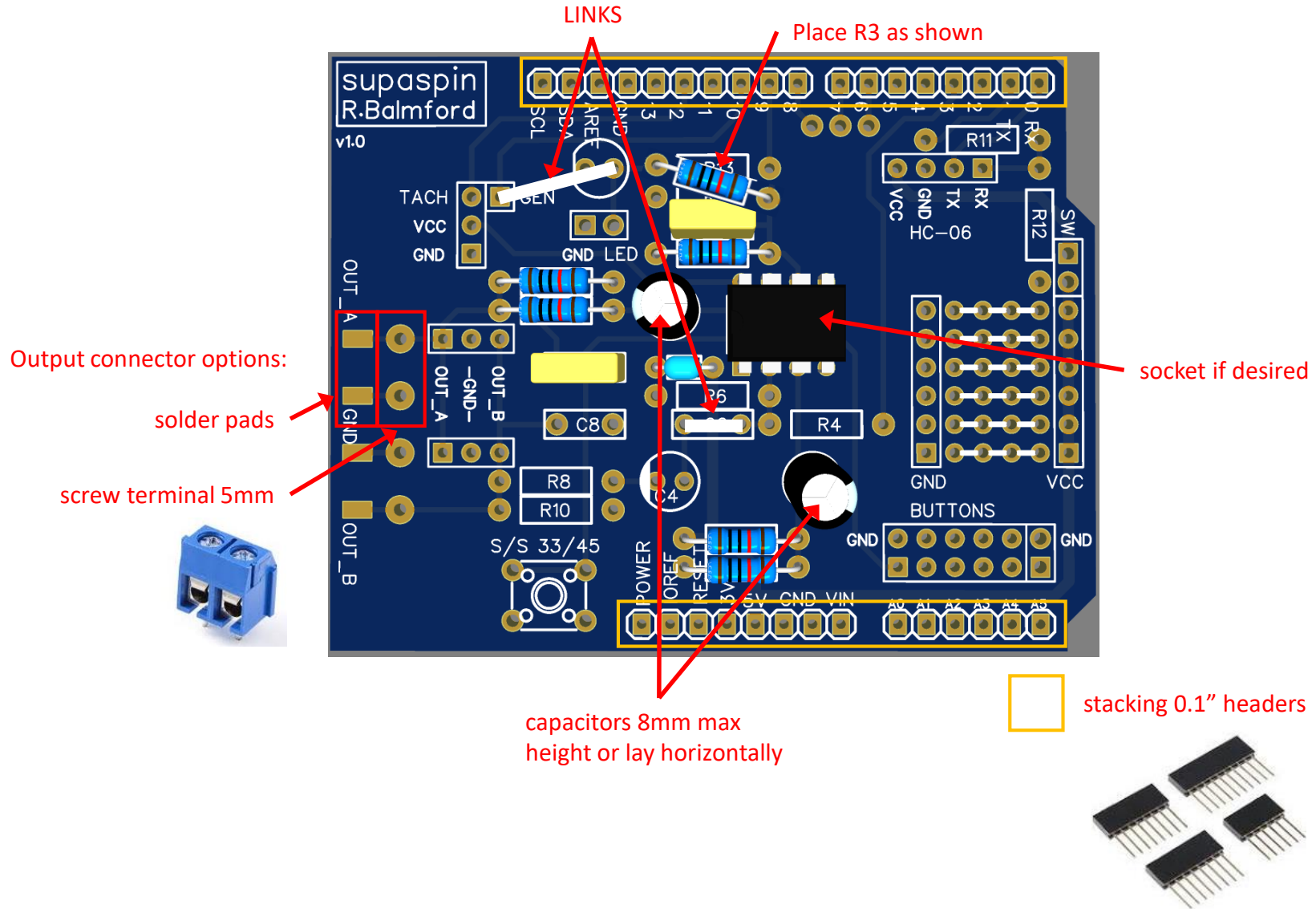
Firmware

You will need to upload the firmware to the Arduino board, using the standard Arduino IDE. Before doing so, there are some setup choices to be made at the top of the file.

BT_SPEED: must match the serial BAUD rate of the HC-06 Bluetooth module

For sinewave synthesiser:

NR_PHASES: 2 or 3; choose according to your application

INIT_RUN_STATE: choose whether to power up in ON state (1) or OFF state (0)

For tachometer:

CP_REV: number of pulses per revolution

NR_AVG: number of measurement of which to average (1 = no averaging, 2+ = averaging)

You will also need to load your board with the nominal defaults for the frequencies according to whether yours is a 50Hz or 60Hz motor. On first uploading, uncomment the corresponding line from:

#define SET_EE_50   for 50Hz motors

#define SET_EE_60   for 60Hz motors

Once uploaded, comment out the line and upload again. The defaults are now set, and any future tuning of the frequency or phase parameters will be stored.

Interface

The Bluetooth + RemoteXY App interface can work alongside the button interface