

# Hardware Design Team Agenda

## Table of Contents

<b>USB Power Supply .....</b>	<b>2</b>
<b>Programming the ATmega328p IC.....</b>	<b>3</b>
<b>Connect the Jacks!.....</b>	<b>4</b>
<b>Connect the Potentiometers!.....</b>	<b>5</b>
<b>Sub-Oscillator .....</b>	<b>6</b>
<b>Three-way Crossfader .....</b>	<b>7</b>
<b>VCA/VCF??? .....</b>	<b>8</b>

## 5-9V Input, +12/-12 Output Module

### Helpful Documentation:

Datasheet

<https://www.mouser.com/datasheet/2/468/RS6-1006283.pdf>

Reference guide:

BUILD GUIDE YOU WILL REFERENCE TO MAKE OUR OWN. (DO NOT USE THEIR VALUES FOR PARTS):

<https://www.synthrotek.com/kit-assembly-instructions/modular-circuit-assembly-instructions/usb-power-assembly-instructions/usb-power-bill-of-materials/>

- USE THE RS6-0512D MODEL FOR THE DC CONVERTER.
- READ THE DATASHEET, THERE IS DESIGN APPLICATIONS.
- WE ARE USING CLASS B, WHICH IS RESIDENTIAL
- FIND THE DESIGN IN THE DATASHEET UNDER: EMC FILTERING - SUGGESTIONS FOR EN55022 CLASS B
- USE THE PARTS LISTED ON THE RS6-05XX LINE. NOTICE THERE IS A N/A NEXT TO MANY OF THEM.

STEPS:

1. READ THE DATASHEET AND CREATE A BOM USING THE INFORMATION ABOVE, SAVE TO AN EXCEL SPREADSHEET.  
(DON'T FORGET THE USB CABLE AND WALWART, MAKE SURE YOUR WALL WART'S OUTPUT VOLTAGE MEETS THE SPECIFICATIONS OF THE INPUT VOLTAGE OF THE DC CONVERTER.
2. CREATE THE DESIGN IN KICAD. LOOKUP HOW TO SET UP KICAD. YOU WILL BE USING ESCHEMA WITHIN KICAD TO CREATE THE CIRCUIT DIAGRAM.
3. BUILD AND TEST THE CIRCUIT ON A BREADBOARD.

## Program the ATmega328p IC

- USE THE ARDUINO NANO TO BOOTLOAD/PROGRAM THE ATMEGA328P IC
- THIS IS SELF-EXPLANATORY, YOU SHOULD BE ABLE TO RESEARCH ONLINE HOW TO DO THIS.
- ONCE PROGRAMMED, REPLACE THE NANO ON OUR CIRCUIT, WITH THE ATMEGA328P IC.
- \*\*\* THE KICAD DIAGRAM NEEDS TO REFLECT THIS! \*\*\*
- TEST THE CIRCUIT TO MAKE SURE IT WORKS.

### STEPS TO TEST CIRCUIT:

1. CONNECT THE +12V OF OUR POWER SUPPLY TO THE VIN PIN ON THE IC, AND THE GND JUMPER CABLE TO THE GROUND RAIL ON THE BREADBOARD.
2. PLUG IN THE POWERSUPPLY FOR THE KEYSTEP PRO MIDI CONTROLLER AND TURN IT ON.
3. CONNECT THE MIDI CABLE FROM MIDI-OUT1, TO THE MIDI SOCKET ON OUR BREADBOARD.
4. PLUG IN THE POWER SUPPLY TO THE WALL WART (AC ADAPTER) TO TURN ON THE CIRCUIT.
5. TEST THAT C1, C2, C3, C4, C5, C6 ARE 1V, 2V, 3V, 4V, 5V, AND 6V RESPECTIVELY.
6. REFER HERE: <https://www.allaboutmusictheory.com/piano-keyboard/music-note-names/>
7. C0 WILL NOT QUITE BE 0V, SO YOU DON'T NEED TO TEST THIS. USE THE OCTAVE BUTTONS ON THE LEFT SIDE TO CHANGE THE OCTAVE.
8. UPDATE THE KICAD SCHEMATIC WITH THE APPROPRIATE IC

## Connect the jacks!

- THE 1/8" TS JACK SOCKETS NEED TO BE CONNECTED TO THE INPUTS/OUTPUTS OF OUR BOARD.
- FIND A CLEAN AND EFFICIENT WAY TO DO THIS. I RECOMMEND USING ANOTHER BREADBOARD AND CONNECTING WIRES TO THE BREADBOARD, WHICH CONNECT TO THE APPROPRIATE JACK.

### STEPS:

1. PLUG IN THE JACKS ON A BREADBOARD (OR 2 IF YOU NEED), SEPARATING THE INPUT JACKS FROM THE OUTPUT JACKS.
2. CONNECT THE OUTPUTS/INPUTS FROM THE OSCILLATOR TO THE APPROPRIATE JACK.
3. THINK OF A LABELING SYSTEM, OR MAYBE A REFERENCE SHEET SO WE KNOW WHICH JACK IS WHICH.
4. ON AN ISOLATED LOCATION OF THE BREADBOARD, OR POSSIBLY A NEW BREADBOARD, CONNECT THE OUTPUTS FROM THE MIDI TO CV CONVERTER TO THEIR OWN RESPECTIVE JACKS. (THERE SHOULD BE 7 OUTPUTS)
5. UPDATE THE KICAD SCHEMATIC

## Connect the Potentiometers!

- CONNECT THE POTENTIOMETERS TO VARIOUS AREAS OF THE CIRCUIT.
- REFER TO THE DATASHEET, AND OTHER EURORACK VCO DESIGNS FOR HELP.
- ALL POTS WILL BE LINEAR TAPER 10K POTS, DENOTED AS B10K OR 10K B
- <http://synthesizeracademy.com/voltage-controlled-oscillator-vco/>

## STEPS:

1. ADD A POT FOR THE COARSE TUNE, FINE TUNE, AND MOD.
2. CONNECT THE POTS TO THE MIXER CONTROL SECTION. REFER TO THE MIXER SECTION OF THE DATASHEET
3. THE 5K POT ON THE TOP OF THE CIRCUIT DIAGRAM IN THE DATASHEET IS A PWM CNTRL, SO REPLACE THIS TRIMMER WITH A POT.
4. CREATE THE CIRCUIT IN FIGURE 16 OF THE DATASHEET, WHICH GIVES YOU FULL CONTROL OVER THE PWM.
5. UPDATE THE KICAD SCHEMATIC

## Sub Oscillator

- <https://electricdruid.net/a-study-of-sub-oscillators/>
- CHECK THE LINK FOR REFERENCE
- USE A D-FLIP-FLOP ON THE SQUARE WAVE OUTPUT

### STEPS:

1. CONNECT THE D-FLIP FLOP USING THE OUTPUT OF THE SQUARE WAVE.
2. I SUGGEST CREATING A MULTIPLE OF THE SIGNAL SO YOU CAN HAVE THE ORIGINAL, AND THE OCTAVE DOWN.
3. I WOULD PLACE A BUFFER BEFORE THE MULT, AND A BUFFER FOR EACH OUTPUT. (VOLTAGE FOLLOWERS) USING THE TL072 OR TL074
4. ADD AN EXTRA 1/8" JACK FOR THE SUB-OSC, AND RE-ROUTE AS NECESSARY.
5. UPDATE THE KICAD SCHEMATIC

## Three-way Crossfader

- REFER TO FIGURE 20 OF THE DATASHEET
- YOU WILL NEED 3 OP AMP CIRCUITS, WHICH IS 2 TL072'S, WHICH MEANS YOU NEED JUST 1 TL074 OP AMP (HAS 4 OP AMPS IN ONE IC)

### STEPS:

1. BUILD CIRCUIT ACCORDING TO THE DATASHEET
2. THE 0-1V CV CAN BE OBTAINED BY A DIVIDER AND A POTENTIOMETER TO GROUND.
3. -1V REFERENCE CAN BE OBTAINED BY USING AN INVERTED VREF AND CHANGING THE 20K RESISTOR TO 50K.
4. TL072 SHOULD GET 5V POWER, THOUGH I HAVEN'T LOOKED AT IT IN DEPTH.
5. UPDATE THE KICAD SCHEMATIC

VCA and VCF???? This is all possible