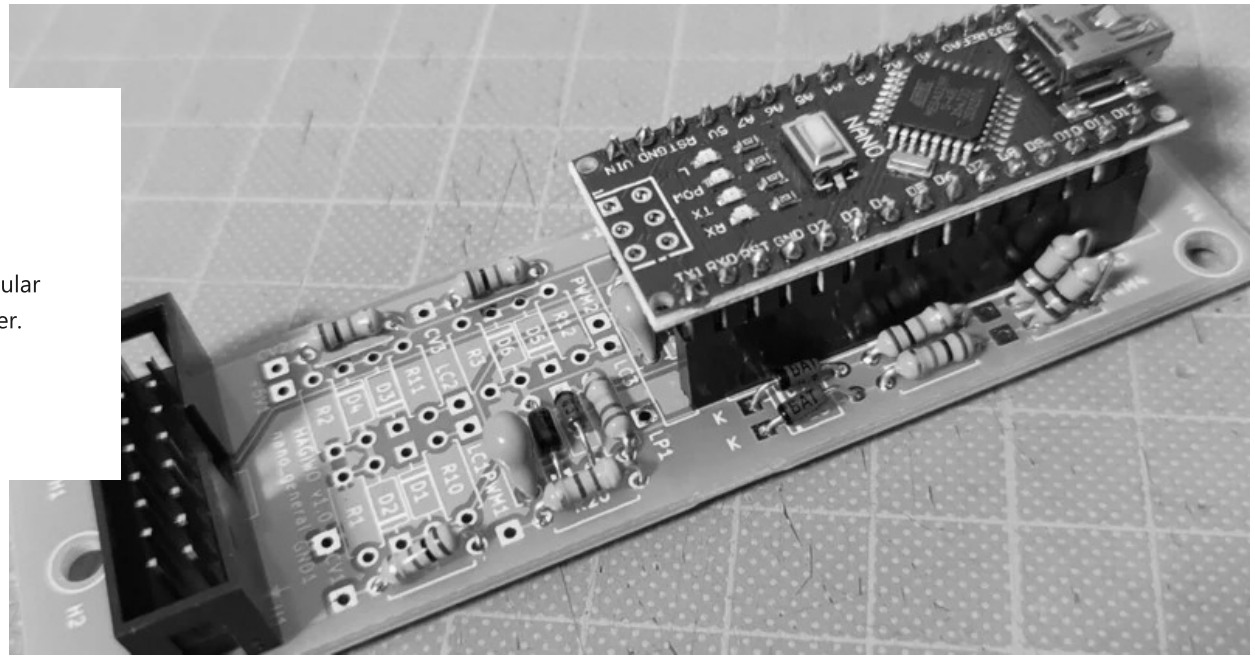

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$8 Dual Envelope generator arduino based-DIY Eurorack Modular Synthesizer

7

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March 21, 2022 5:11 PM

I used the Arduino nano to build my own modular synthesizer Dual Envelope generator (EG), so that's a memoir.

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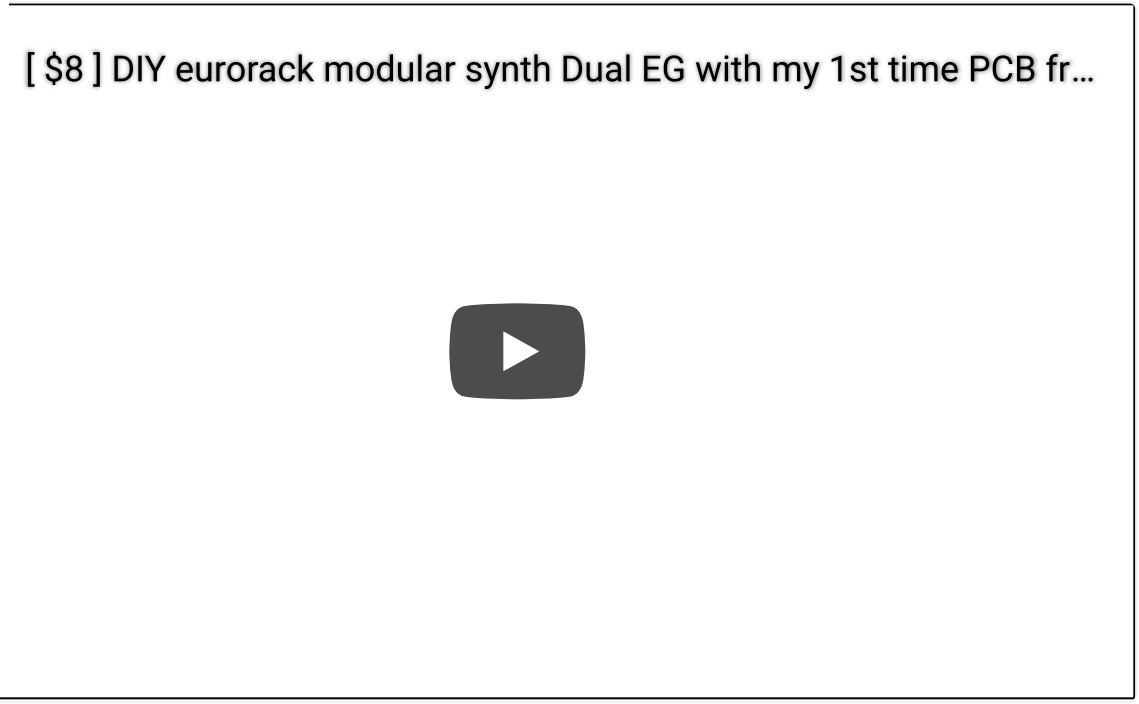

background

This is the 46th work of his modular synth.

I had never designed a printed circuit board (PCB). I've designed a PCB front

panel, but I've never designed a PCB that uses electronic components.
The purpose of my DIY modular synth is to master the technique. In order to learn board design, we planned a project using PCBs.

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nake a PCB manufacturing service like PCBWay, you can make your
oard for about 2,000 yen (including shipping). However, since the
um lot quantity is from 5pcs, it leaves PCB redundant.
time, we decided to design a general-purpose board based on the Arduino nano that can be diverted to multiple modules.

This time we will create a Dual EG. The reason is that programming is easy. This time, we will concentrate on board design. We wanted to minimize the effort required for circuit design and programming.

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:s of the production

:k Standard 3U 8HP Size

Power Supply: Operates from a single 50mA (at5V) / 49mA (at12V)

5V supply. Or can operate from a single 12V supply.

Arduino nano-based.

Attack: Control

Attack Time Release: Control

Release Time Level: Attenuation/Amplification

of Output Voltage τ (Time Constant): Deformation of the envelope curve

Trigger IN: EG trigger (0-5V) OUT: EG voltage output (0-5V)

"τ" is read as "tau" in Greek.

In electrical and electronic engineering, it is used as a symbol to indicate a time constant.

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ıe constant, simply put, is the shape of the voltage curve.

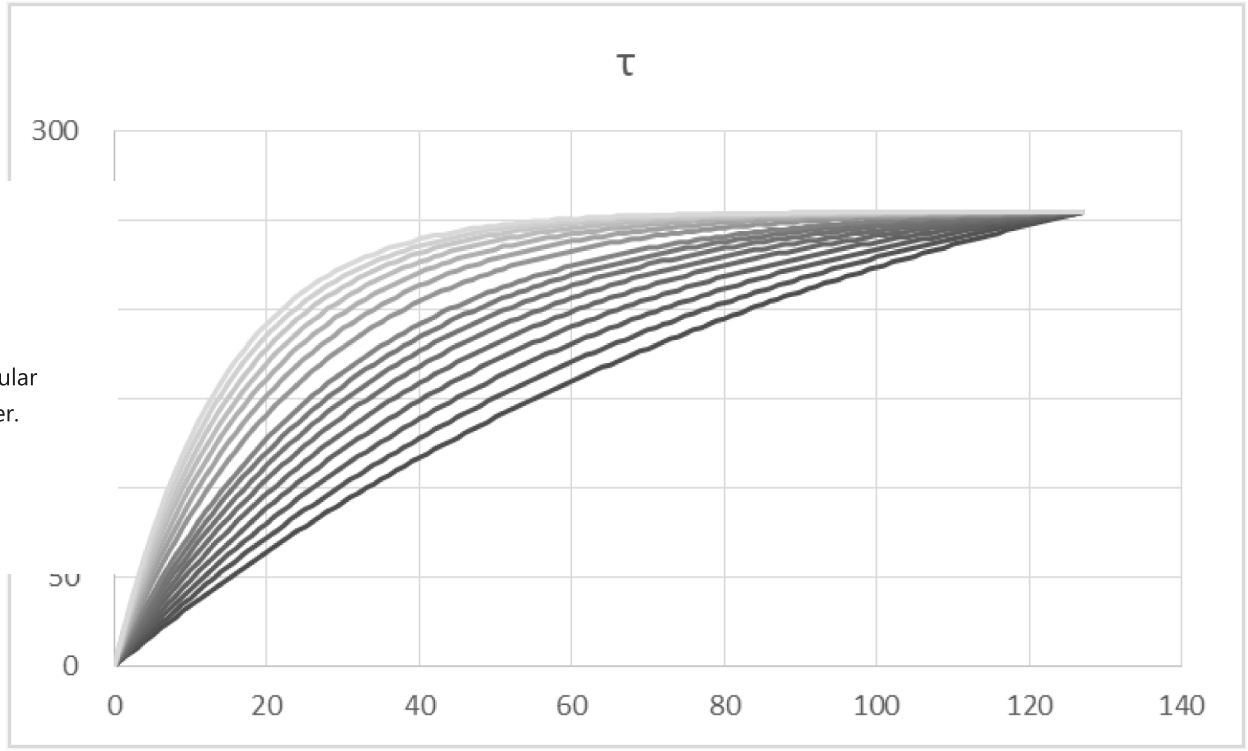
ıme constant - Wikipedia

ɔedia.org

By changing the τ parameter, the voltage curve of the EG can be changed.

The voltage curve is selected from 16 types of graphs.

The resolution is 2 bytes due to the convenience of the flash area of the Arduino.



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Production cost

Total amount about 850 yen (when using a universal board instead of a PCB)

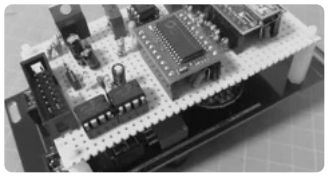
Arduino nano 200 yen front panel 150 yen variable resistance 28 yen * 8pcs

jack 8 yen

* 4

Others (For general-purpose parts, please refer to the link below)

モジュラーシンセ自作で使う安価な部品一覧



メモのついでに。適時更新。コストと品質の観点で記載、主観による。aliexpressはリンクを貼ってもすぐに切れるので、画像で残す。値段は購入当の。昨今は値動きが激しい。品質は私の経験値。よって母数は数...

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HAGIWO/ハギヲ
2021/11/19 16:18

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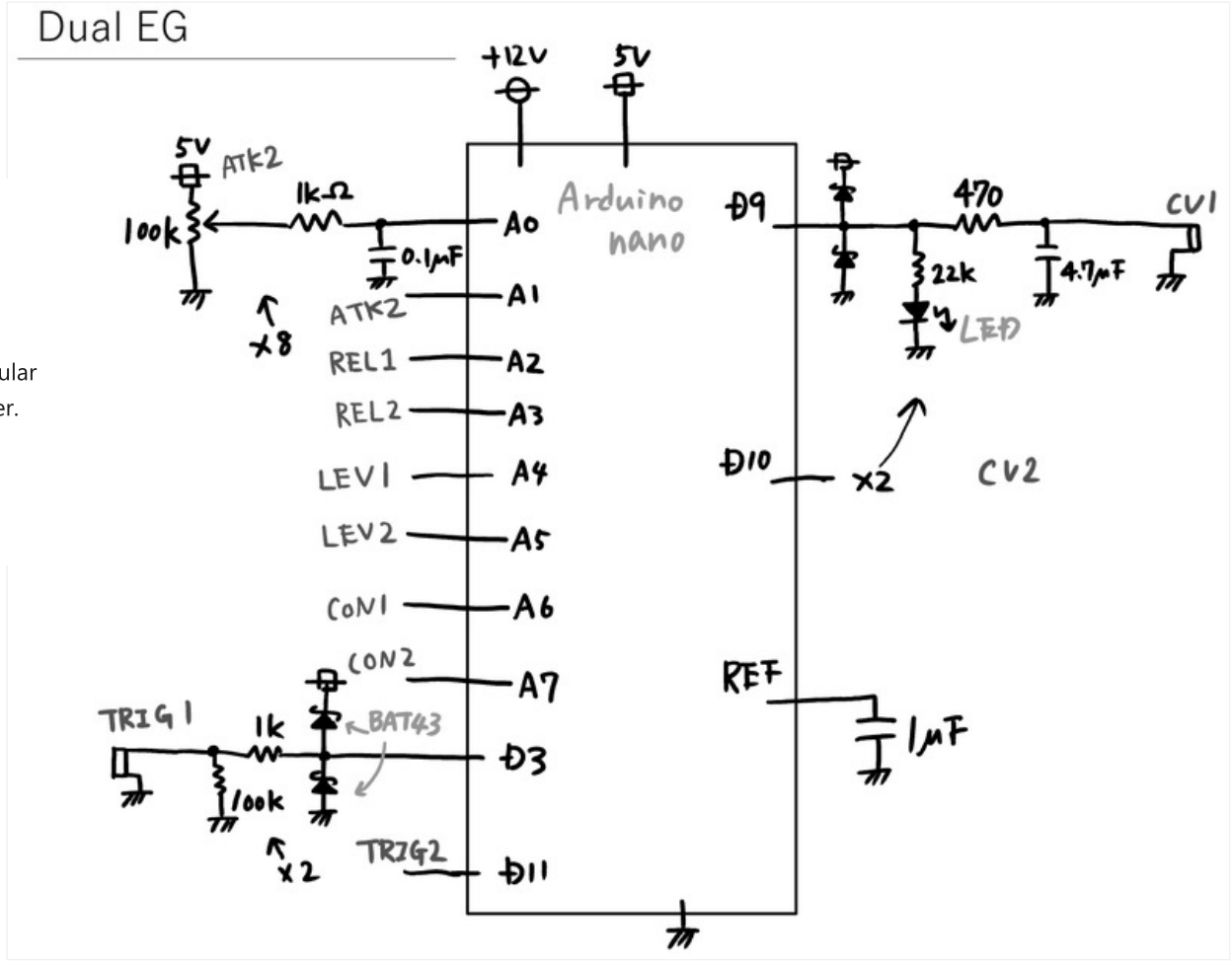
ordering a PCB, 100 yen/pcs + shipping fee will be added.

hardware

circuit



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A simple circuit with 8 variable resistor inputs, 2 gate inputs, and 2 CV outputs.

It's the same configuration as the Arduino nano-based CV modules I've created in the past.

The CV smooths the PWM with an RC low-pass filter.

By increasing the PWM frequency at high speed, the voltage ripple is reduced and the output resistance is reduced.

all output resistance eliminates the need for an op amp buffer.

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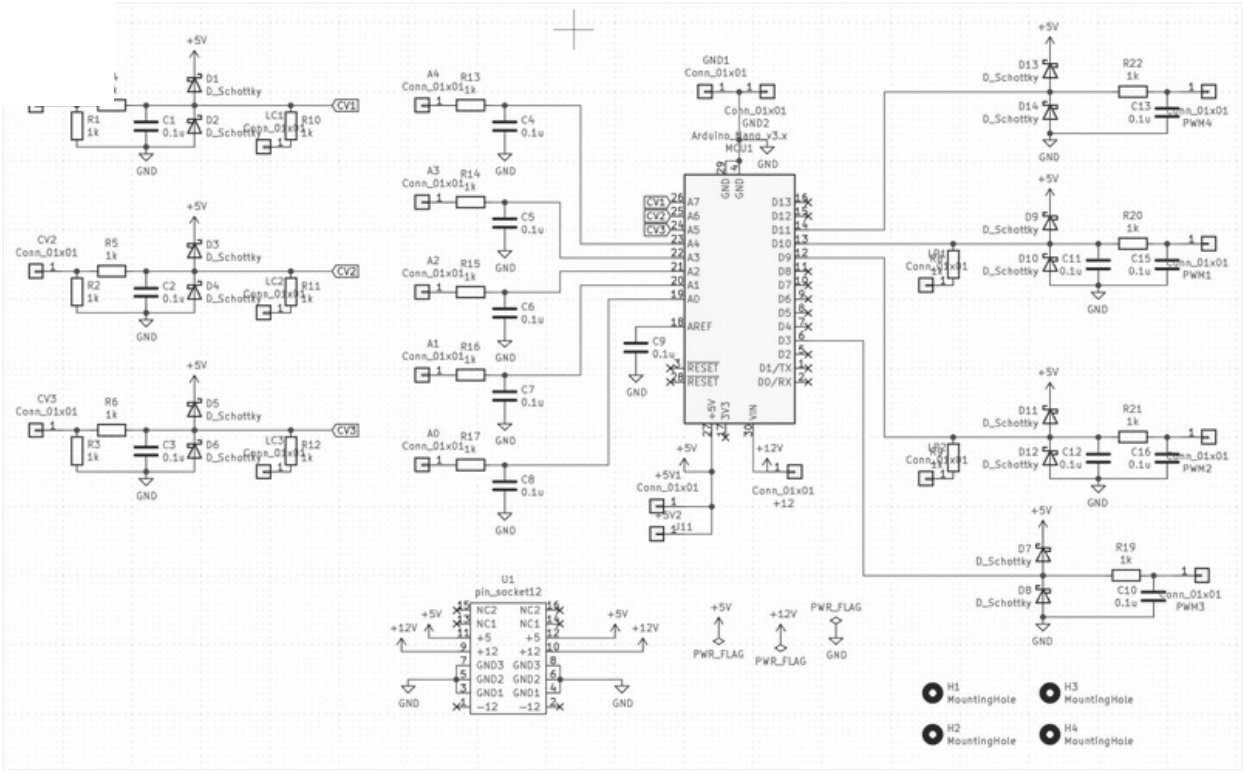
(Printed Circuit Board)



The general-purpose board for the Arduino nano created this time will be called a "Genaral board". As mentioned above, it was designed with the

assumption that it will be used in multiple projects using Arduino nano.

* AD input*8

by variable resistor, CV input*3

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tput*2 (including LED lighting circuit),

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es can be designed by sifting through these functions.

follow

al EG uses

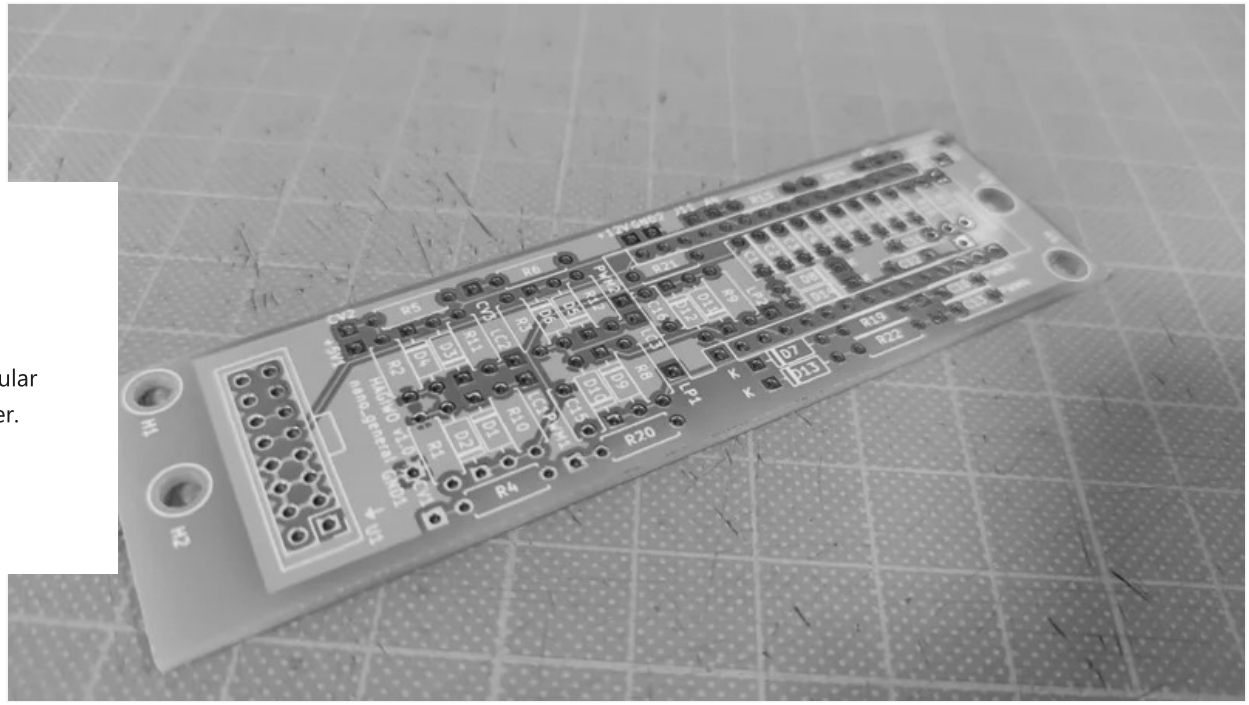
AD input*8

with variable resistors, CV output*2 (including LED lighting circuit),

and I/O*2

.

Electronic components of unused circuits are not mounted.



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follow

KiCAD was used for board design.

The width is 29 mm, and it supports 6 HP modules.

The height is 99mm. Since the price of a PCB rises significantly when it exceeds 100 mm, the cost can be lowered if it is 100 mm or less.

Autorouting uses Freerouter v1.4.5.1, not KiCAD.

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基板設計は今回が初めてだが、問題なく動く基板を作ることが出来た。

製造サービスはいつも通りPCBWayを使用。春節明けてすぐの注文だった

が、デザインレビューも製造も混乱なくスムーズに進んだ。

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基板試作＆製作メーカー - 基板クイック試作

:bway.jp

ガーバーデータはpatreonメンバーに限定公開している。よろしければ是非。

https://www.patreon.com/posts/64079059

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ソフトウェア

特に難しいことはしてない。

高速PWMでCVを作成することについては、過去の私の記事でも説明済みだ。

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Constant)は事前にエクセルで計算した結果を、Arduinoの配列に格納する。CR Time constantの計算はArduinoの様な非力なMCUだと難しい。

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EGカーブの算出式

宣伝:オープンソースプロジェクトの支援をお願いします

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ジュラーシンセのオープンソースプロジェクトを継続するために、

ıというサービスでパトロンを募集しています。

ー一杯の支援をいただけると嬉しいです。

パトロン限定のコンテンツも配信しています。

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ソースコード

粗末だが公開する。悪い点があれば指摘を貰えると嬉しい。

```
#include <avr/io.h>//for fast PWM

int atk1, atk2, rel1, rel2, lev1, lev2, con1, con2, out1, out2, count1, count2;
//count -- 0 is not triggerd , 1 is attack duration , 2 is release duration.
bool in1, in2, old_in1, old_in2;
```

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follow

```
int i = 0;//CH1 count
int j = 0;//CH2 count
int last_out1 = 0; //If retriggered at the release time, the CV voltage will be restartec
int last_out2 = 0;
long timer1 = 0;
   g timer2 = 0;

   st static byte curve[16][128] PROGMEM = {
   0, 4, 7, 10, 14, 17, 21, 24, 27, 31, 34, 37, 40, 43, 46, 49, 52, 55, 58, 61, 64, 67, 7
   0, 4, 8, 12, 16, 20, 24, 27, 31, 35, 38, 42, 46, 49, 53, 56, 59, 63, 66, 69, 72, 75, 7
   0, 5, 9, 14, 18, 23, 27, 31, 35, 39, 43, 47, 51, 55, 59, 63, 66, 70, 73, 77, 80, 84, 8
   0, 5, 10, 16, 20, 25, 30, 35, 39, 44, 48, 53, 57, 61, 65, 69, 73, 77, 81, 85, 89, 92,
   0, 6, 12, 17, 23, 28, 34, 39, 44, 49, 54, 58, 63, 68, 72, 76, 81, 85, 89, 93, 97, 100,
   0, 7, 13, 19, 25, 31, 37, 43, 48, 54, 59, 64, 69, 74, 79, 83, 88, 92, 96, 101, 105, 10
   0, 7, 14, 21, 28, 34, 41, 47, 53, 58, 64, 70, 75, 80, 85, 90, 95, 99, 104, 108, 113, 1
   0, 8, 16, 23, 30, 37, 44, 51, 57, 63, 69, 75, 81, 86, 92, 97, 102, 107, 111, 116, 120,
  {0, 9, 17, 25, 33, 40, 48, 55, 62, 68, 74, 81, 87, 92, 98, 103, 108, 113, 118, 123, 128
  {0, 10, 20, 29, 38, 47, 55, 63, 70, 78, 85, 91, 98, 104, 110, 116, 121, 127, 132, 137,
  {0, 11, 22, 32, 42, 52, 61, 69, 77, 85, 93, 100, 107, 113, 120, 126, 131, 137, 142, 147
  {0, 12, 24, 36, 46, 57, 66, 75, 84, 93, 101, 108, 115, 122, 129, 135, 141, 146, 152, 15
  {0, 14, 27, 39, 50, 61, 72, 82, 91, 100, 108, 116, 123, 130, 137, 143, 149, 155, 160, 1
  {0, 15, 29, 42, 54, 66, 77, 87, 97, 106, 115, 123, 131, 138, 145, 151, 157, 163, 168, 1
  {0, 16, 31, 45, 58, 71, 82, 93, 103, 113, 122, 130, 138, 146, 152, 159, 165, 171, 176,
  {0, 17, 33, 48, 62, 75, 87, 99, 109, 119, 128, 137, 145, 152, 159, 166, 172, 177, 183,
};

void setup()
{
  pinMode(3, INPUT) ;//Z button
  pinMode(11, INPUT) ;//C button
  pinMode(10, OUTPUT) ;//accelx
  pinMode(9, OUTPUT) ;//accely
  timer1 = micros();
  timer2 = micros();
  TCCR1B &= B11111000;//fast pwm setting
  TCCR1B |= B00000001;//fast pwm setting
  //  Serial.begin(9600);
  delay(50);
}

void loop()
```

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```
{
  old_in1 = in1;
  old_in2 = in2;
  in1 = digitalRead(11);// trig input
  in2 = digitalRead(3);// trig input

   f (old_in1 == 0 && in1 == 1) {// if detect trigger
    if (count1 == 2) {
      last_out1 = out1;
    }
    else if (count1 != 2) {
      last_out1 = 0;
    }
    i = 0;//wave table count reset
    count1 = 1;//start attack duration
    atk1 = analogRead(1) * 12;
    rel1 = analogRead(2) * 16;
    lev1 = analogRead(4) / 4;
    con1 = analogRead(7) / 64;
  }

  else if (count1 == 1 && i > 127) {//attack duration end
    count1 = 2;//start release duration
  }
  else if (count1 == 2 && i > 255) {//release duration end
    count1 = 0;
  }

  if (old_in2 == 0 && in2 == 1) {// if detect trigger
    if (count2 == 2) {
      last_out2 = out2;
    }
    else if (count2 != 2) {
      last_out2 = 0;
    }
    j = 0;//wave table count reset
    count2 = 1;//start attack duration
    atk2 = analogRead(0) * 12;
    rel2 = analogRead(3) * 16;
    lev2 = analogRead(5) / 4;
    con2 = analogRead(6) / 64;
```

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```
}

else if (count2 == 1 && j > 127) {//attack duration end
  count2 = 2;//start release duration
}
 lse if (count2 == 2 && j > 255) {//release duration end
  count2 = 0;


 /----------------------CV output buffer CH1-------------------------
 f (count1 == 1) {//attack
  if (atk1 <= 32) {//Minimize atk time
    i = 128;
    count1 = 2;
  }
  out1 = (pgm_read_byte(&(curve[con1][i])));//store output voltage value
  if (timer1 + atk1 <= micros()) {
    i++;
    timer1 = micros();
  }
}

else if (count1 == 2) {//release
  out1 = 255 - (pgm_read_byte(&(curve[con1][i - 128])));//store output voltage value
  if (timer1 + rel1 <= micros()) {
    i++;
    timer1 = micros();
  }
}

//----------------------CV output buffer CH2-------------------------
if (count2 == 1) {//attack
  if (atk2 <= 32) {//Minimize atk time
    j = 128;
    count2 = 2;
  }
  out2 = (pgm_read_byte(&(curve[con2][j])));//store output voltage value
  if (timer2 + atk2 <= micros()) {
    j++;
    timer2 = micros();
  }
```

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```
  }

  else if (count2 == 2) {//release
    out2 = 255 - (pgm_read_byte(&(curve[con1][j - 128])));//store output voltage value
    if (timer2 + rel2 <= micros()) {
      j++;
      timer2 = micros();
    }

   /----------------------CV output-------------------------
   WM_OUT();//CV out

   d PWM_OUT() {//PWM duty setting
   f (count1 == 1) {
    out1 = map(out1, 0, 255, last_out1, lev1);

  else if (count1 == 2) {
    out1 = map(out1, 0, 255, 0, lev1);
  }
  if (count2 == 1) {
    out2 = map(out2, 0, 255, last_out2, lev2);
  }
  else if (count2 == 2) {
    out2 = map(out2, 0, 255, 0, lev2);
  }
  analogWrite(10, out1);//PWM output
  analogWrite(9, out2);//PWM output

}
```