designlines PROTOTYPING

Max's Cool Beans

MSGEQ7-Based DIY Audio Spectrum Analyzer: Construction

Max's Cool Beans
7/8/2014 07:30 PM EDT

Here's a step-by-step guide to constructing a simple 14-band (2 x 7) audio spectrum analyzer using two MSGEQ7s and a chipKIT or Arduino microcontroller development platform.

Modifying the software to drive the LEDs

Once again, the software for the spectrum analyzer is identical for the chipKIT MAX32 and the Arduino Mega. You can access the full source for this code (including comments) by clicking here.

Let's skim through this quickly. The initial declarations are the same as for our first program, except that we've added two arrays of integers called "pwmLEDsLeft[]" and "pwmLEDsRight[]." These are initialized with the numbers of the PWM-capable digital output pins we wish to use.

```
int ctrlReset    = 23;
int ctrlStrobe   = 22;
int channelLeft  =  0;
int channelRight =  1;

int spectrumLeft[7];
int spectrumRight[7];
int pwmLEDsLeft[]  = {12,11,10,9,8,7,6};
int pwmLEDsRight[] = {5,4,3,2,44,45,46};
```

The setup() function is the same as before, so we don't need to cover this again. In the case of the loop() function, we just loop around first calling our readMSGEQ7s() function and then calling a new writeLEDs() function, as illustrated below.

```
void loop()
{
  readMSGEQ7s();
  writeLEDs();
  delay(10);
}
```

With regard to the 10-millisecond delay at the end of the loop, there's no real reason for this to be here. I'm still tweaking things to see if a delay improves the quality of the display.

The readMSGEQ7s() function is pretty much the same as for our first program. As shown below, the only real difference is that we've added a couple of lines to filter any noise out of the

"bottom" of the signals; this prevents the LEDs from flickering when there isn't any music playing.

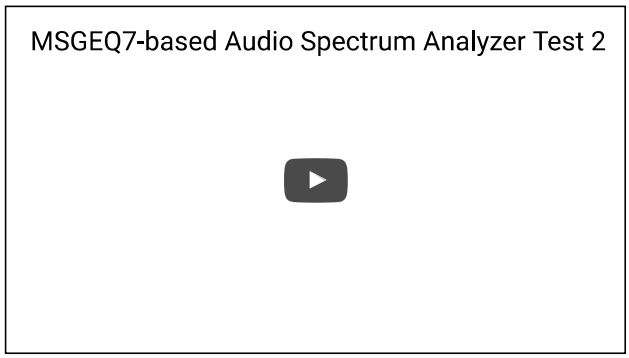
```
void readMSGEQ7s()
// Read seven spectrum bands from MSGEQ7 chips
{
  digitalWrite(ctrlReset, HIGH);
  digitalWrite(ctrlReset, LOW);
  delayMicroseconds(75);

  for(int i=0; i <7; i++)
  {
    digitalWrite(ctrlStrobe,LOW);
    delayMicroseconds(40);

    spectrumLeft[i] = analogRead(channelLeft) / 4;
    spectrumRight[i]= analogRead(channelRight) / 4;

    // Filter any noise out of bottom of signals
    if (spectrumLeft[i] < 30) spectrumLeft[i] = 0;
    if (spectrumRight[i] < 30) spectrumRight[i]= 0;

    digitalWrite(ctrlStrobe,HIGH);
    delayMicroseconds(40);
  }
}
```

The main addition to this program is a new writeLEDs() function, as shown below.

```
void writeLEDs()
// Write 14 spectrum bands to 2x7 banks of LEDs
{
  for(int i=0; i <7; i++)
  {
    analogWrite(pwmLEDsLeft[i],spectrumLeft[i]);
    analogWrite(pwmLEDsRight[i],spectrumRight[i]);
  }
}
```

This function loops around seven times, outputting the PWM values corresponding to each of the frequency bands to the appropriate LEDs. In this case, the analogWrite() functions are used to apply our PWM values to the PWM-enabled digital pins.

Thus we end up where we started, with this video showing everything in action. In this case, we're listening to a track from Supertramp's *Breakfast in America* album.



See also my step-by-step test guide, in which I describe the various test procedures I employed while getting everything up and running. Also, you may be interested in my follow-up column on software and timing. As always, of course, I would very much appreciate your comments and feedback.

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— Max Maxfield, Editor of All Things Fun & Interesting

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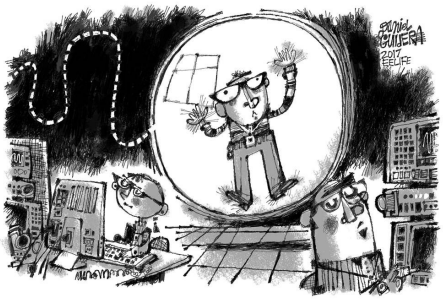

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Re: lacking vocals?
Clive"Max"Maxfield 9/9/2015 11:41:59 AM

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USER RANK
AUTHOR

@antedeluvian: *ROTFL- autocomplete, typo, modegreen or Freudian slip?*

My bad LOL

Even worse, when I first saw the Deja Vu album cover when I was a lad -- with all the arty-farty caligraphy, I read it as "Crosby Stills Nash & Donny" (instead of "Crosby Stills Nash & Young") ... so that's how I always think of them LOL

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Re: lacking vocals?
antedeluvian 9/9/2015 11:28:03 AM

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USER RANK
AUTHOR

Max

*I've played "**out** house" by Crosby Stills & Nash*

ROTFL- autocomplete, typo, modegreen or Freudian slip?

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Re: lacking vocals?
sunneh 9/9/2015 10:00:25 AM

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ROOKIE

Thanks for the quick response!

I havent scoped it yet, have bought a cheap version it should be on its way now.

do you think the timing could be the problem? i got everything set on 1000us (i figured hey it works) haha!!!

im using avr... so i think coding is a little different. my email is shangss@gmail.com thank you in advance :D

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Re: lacking vocals?
Max The Magnificent 9/9/2015 9:43:33 AM

NO RATINGS
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AUTHOR

@sunneh: *I was wondering if you know of any problems with the msgeq7.*

Hi there -- I haven't had any problems with my MSGEQ7s -- check out this blog (with embedded video) showing my BADASS Display http://ubm.io/1FxDPE2.

I'm puzzled by your vocals problem -- I've played "out house" by Crosby Stills & Nash -- which is lagely vocals -- and it works great -- have you put a 'scope' on the input signal to see what's going in?

If you email me at max@clivemaxfield.com -- I'll send you the Arduino code I'm using to drive my BADASS display -- this includes the part that reads the data from the MSGEQ7s with the correct delays in it).

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lacking vocals?
sunneh 9/9/2015 7:52:23 AM

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ROOKIE

Hi there, saw your post, great vu meter :D

i was wondering if you know of any problems with the msgeq7.

So far mine is working great, but the led display does not move when there are vocals.

it only goes up and down when there is instrumentals. maybe it filtered out a frequency range? i am using lm386 to amplify the signal, otherwise the voltage would be too small

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Re: Input level for the MSGEQ7
Clive"Max"Maxfield 6/11/2015 1:31:29 PM

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AUTHOR

@jreza: *I just watched your BADASS display and I have to say it discouraged me from building my own analyzer*

It was that bad?

LOL

In the Coding Competition blog there's a link to the code I'm using for the BADASS Display. You could certainly create a much smaler version of the physical beast.

I agree that I feel really lucky being able to get components so easily.

I would love to see photos and video of your creation(s) -- maybe we could create a column around them...

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Re: Input level for the MSGEQ7
jreza 6/11/2015 1:18:52 PM

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ROOKIE

Max
Thanks for your quick response and all the info.
I just watched your BADASS display and I have to say it discouraged me from building my own analyzer :(, I know I'll never get close to that (just kidding! Baby steps).
About the function generator and the shield, I live in Mexico, so it's kind of hard for me to try to get any of those (I barely got the MSGEQ7, I envy you and the way you get everything practically from around the corner :( )
I'll take a deeper look at the posts when I get home.
When it is done I'll share some photos or video on what you've helped to build :)
Thanks a lot.
jreza

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Re: Input level for the MSGEQ7
Clive"Max"Maxfield 6/11/2015 11:38:21 AM

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USER RANK
AUTHOR

@Jezra: ...*I have a question though*...

You might also be interested in these related columns (I've inccluded the link to this one because they form a set)

Building a Low-Cost Frequency/Function Generator

Determining the Signal Characteristics of the iPad/iPod/iPhone Headphone Output

MSGEQ7-Based DIY Audio Spectrum Analyzer for BADASS Display

MSGEQ7-Based DIY Audio Spectrum Analyzer: Construction

MSGEQ7-Based DIY Audio Spectrum Analyzer: Testing

MSGEQ7-Based DIY Audio Spectrum Analyzer: Software & Timing

BADASS Display Coding Competition

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AUTHOR

Re: Input level for the MSGEQ7
Clive"Max"Maxfield 6/11/2015 11:33:24 AM

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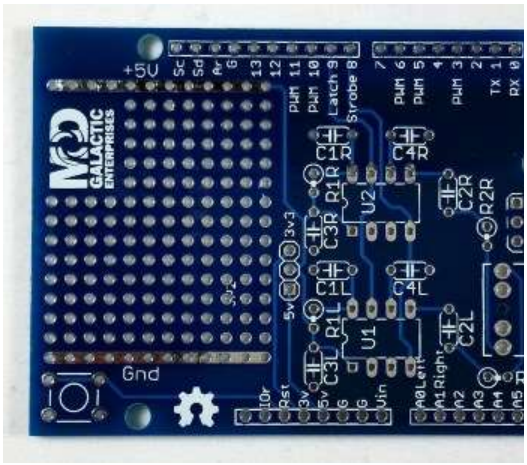
@Jreza: *What is the input level required by the MSGEQ7? Is it enough with just the output signal from a regular portable player? (from your tutorial it seems it does). Is it enough with the output level of a regular mic?*

Hi there -- I think you're going to really enjoy playing with this chip. Take a look at This YouTube Video showing two of these chips driving my BADASS Display.

I'm using the output from the headphone jack from my iPod (sometimes my iPad) with no problems at all -- typically I set the iPad to about 3/4 full volume to drive this chip -- then I control the actual sound volume using the amplifier driving the speakers.

I started off by creating a prototype using a breadboard (see This YouTube Video), but later my chum Duane Benson took my circuit and generated a special printed circuit board (PCB) for an Arduino Shield (this uses two MSGEQ7 chips -- one for each channel).



You can buy one of these boards from Duane from his SteelPuppet.com website if you wish.

Are you using an Arduino? If so, one of the things I do when I've just built a new sound analyzer card (I've now constructed three using Duane's shield for different projects) is to use the Serial I/O to display the numerical values on the screen so I can see what's happening -- you could use this technique to see how your microphone was working.

If you want to see some example Arduino code for this, email me at max@clivemaxfield.com and I'll send it to you.

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ROOKIE

Input level for the MSGEQ7
jreza 6/11/2015 10:14:43 AM

NO RATINGS
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Hi there.
I'm getting all the components to start this proyect. Thanks for the tutorial.
I have a question though, What is the input level required by the MSGEQ7? Is it enough with just the output signal from a regular portable player? (from your tutorial it seems it does). Is it enough with the output level of a regular mic?
Thanks
jreza

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