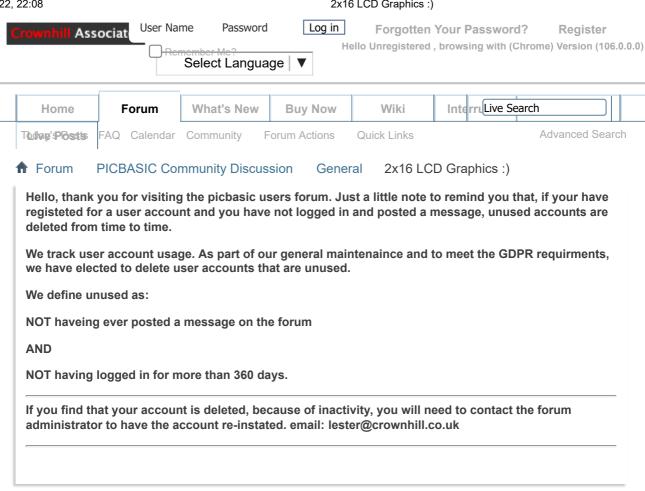
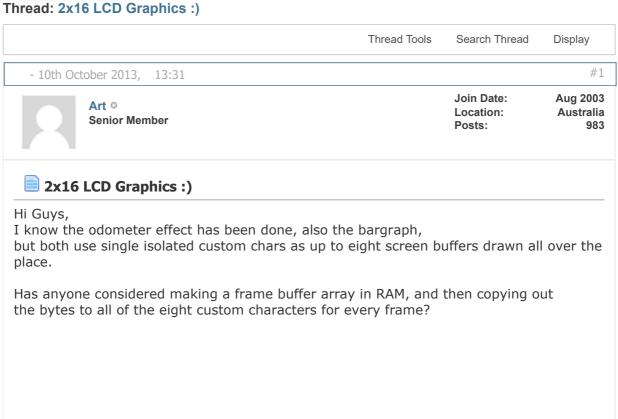
Page 1 of 2

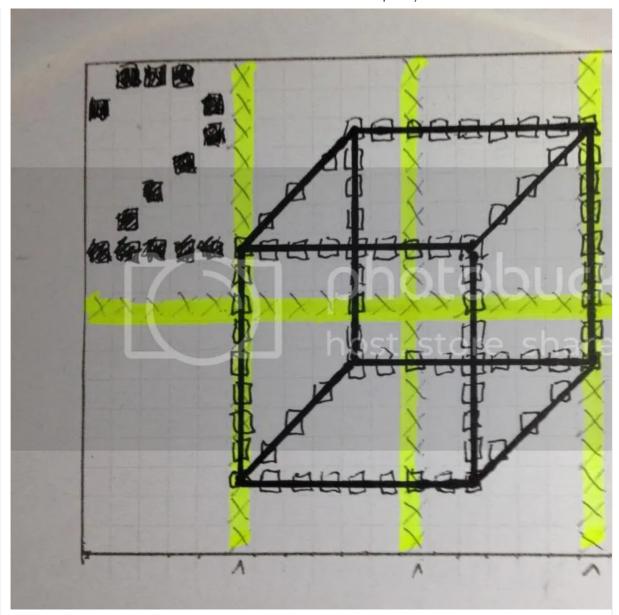
1 2 Last >>>



+ Reply to Thread



Results 1 to 40 of 52



It's probably five years too late with the price of gfx LCDs now, but I think a nice exercise, and think the rotating 3D cube is doable. I was thinking do a real 23x17 frame buffer, and just accept that the inbetween lines are invisible pixels, so long as the display is animated.



Most of the points on the cube are duplicates of another with different initial 2D offsets. I can't do the point rotation without trig, but can use another program to generate the pre rotated list of points of 36 or so different angles around each axis. The lines should be right to draw locally since they only need square root. Also proper balls bouncing off walls at inverted angles should be ok locally.

Pixel resolution horizontal scrolling should be also possible on an 8x1 display.

Any ideas suggestions? Has someone done this?

Last edited by Art; - 10th October 2013 at 13:42.

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 

- 11th October 2013, 14:58



Art o Senior Member Join Date: Location: Posts:

Aug 2003 Australia 983

Did you find this post helpful?





Re: 2x16 LCD Graphics :)

Having to send the command to change lines halfway though the drawing is a tragedy, and so is setting the LCD home, but the latter doesn't interrupt drawing halfway through. It would be better to waste the same amount of time between sending every character.

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 

- 12th October 2013, 08:11



Art o Senior Member

Join Date: Location: Posts:

Aug 2003 Australia 983

Did you find this post helpful?





Re: 2x16 LCD Graphics :)

Ok, now I can set pixel coordinates, and no longer have to think about custom characters



It was hard because each line for a custom char is still a byte, but only five bits of it are used,

and the LCD wants them in the least significant bits, but my framebuffer is a continuous stream of bits.

I'll try the line drawing, and calculating proper angles for balls.

A smaller (single pixel) ball works better in the small space, but didn't make for a good video.

Last edited by Demon; - 13th October 2013 at 15:08. Reason: video removed at user's request - Robert

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 

- 12th October 2013,

Art o Senior Member

12:20

Join Date: Location: Posts:

Aug 2003 Australia 983

#4

Did you find this post helpful?





Re: 2x16 LCD Graphics :)

Line drawing (almost):

Last edited by Demon; - 13th October 2013 at 15:07. Reason: video removed at user's request - Robert

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 

- 12th October 2013, 15:20



Art o Senior Member Join Date: Location: Posts:

Aug 2003 Australia 983





Re: 2x16 LCD Graphics :)

One more:

. . . .

Last edited by Demon; - 13th October 2013 at 15:07. Reason: video removed at user's request - Robert

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 

- 12th October 2013, 16:18 #6



srspinho o Junior Member

Nov 2003 Join Date: Location: Sao Paulo - Brazil Posts:

Did you find this post helpful?



Re: 2x16 LCD Graphics :)

Impressive! .... Really.

Last edited by srspinho; - 12th October 2013 at 16:18. Reason: Error

**Reply With Quote** 

- 12th October 2013, 21:21 #7



Demon o SuperMod

Join Date: Jan 2005 Location: Montreal, Quebec, Canada

Posts: 2,256

Did you find this post helpful?





Re: 2x16 LCD Graphics :)

Very!

Robert



**Reply With Quote** 

- 13th October 2013, 03:17

Join Date: Aug 2003



Location: Australia Posts: 983







# Re: 2x16 LCD Graphics :)

Thanks Guys,

I am having some trouble with diagonal lines and circles.

When you use a real qfx display with PBP, is it usually the display that handles the lines and circles, or is it done in PBP?

I'm finding the algorithms are usually in C, and all seem to want to look for values below zero (signed integer variables), where one of these variables would wrap back to 0xFF if you decremented from zero using PBP

For the only diagonal lines in the video, I was able to do a trick and check a value is above #128, pretending that value is zero. This is so far only working if the destination point of the line has higher x and y coordinates than the start point..

(ie. I can draw a line at any angle from x-0,y-0, to anywhere).

Here is the difference in the code.

#### Code:

```
x0 = 3 : y0 = 3

x1 = 21 : y1 = 11

gosub drawline
```

#### Code:

```
drawline:
        stepx = 0
        stepy = 0
frac = 0
         'a line is x0,y0 to x1,y1.
        dy = y1 - y0 
 dx = x1 - x0
         IF dy > 128 THEN
         dy = dy - 1
         stepy = stepy - 1
         ELSE
        stepy = 1
ENDIF
         IF dx > 128 THEN
         dx = dx - 1
         stepx = stepx - 1
         ELSE
         stepx = 1
         ENDIF
         dy = dy \ll 1
        dx = dx \ll 1
    'draw pixel
        px' = x0 : py = y0
         gosub setpixel
         IF (dx > dy \mid | dx > 128) THEN
```

... and the original C

Code:

```
static void drawLine(int x0, int y0, int x1, int y1, int color, Color* destinati
         int dy = y1 - y0;
int dx = x1 - x0;
         int stepx, stepy;
         if (dy < 0) { dy = -dy; stepy = -width; } else { stepy = width; } if (dx < 0) { dx = -dx; stepx = -1; } else { stepx = 1; }
         dy <<= 1;
         dx <<= 1;
         y0 *= width;
          y1 *= width;
          destination[x0+y0] = color;
         if (dx > dy) {
    int fraction = dy - (dx >> 1);
                   while (x0 != x1) {
    if (fraction >= 0) {
                                        y0 += stepy;
                                        fraction -= dx;
                              x0 += stepx;
                              fraction += dy;
                              destination[x0+y0] = color;
          } else {
                    int fraction = dx - (dy >> 1);
                    while (y0 != y1) {
    if (fraction >= 0) {
                                        x0 += stepx;
```

I wonder what of the C compilers that are for 16F pics. Maybe they don't do signed integers either? If I could compile the original C source in a pic C compiler, and then disassemble it, I could have the result in RISC asm.

Last edited by Art; - 13th October 2013 at 03:19.

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 



Did you find this post helpful?



#9

Nov 2005

Bombay, India



### Re: 2x16 LCD Graphics :)

#### Originally Posted by Art

I am having some trouble with diagonal lines and circles. When you use a real gfx display with PBP, is it usually the display that handles the lines and circles, or is it done in PBP?

In a real graphic LCD, it is the user who draws the lines / circles using Bresenhams algorithm or a variant. PBP, C or ASM is just a matter of choice.

I am curious to know why you want to use a character lcd this way other than for the thrill of doing it. You only get 8 programmable characters which is about a 4th of the

16x2 display. Your demos too show repeated patterns. It is much more challenging and fun to get a graphic lcd come upto video speed (20fps and more).

**Reply With Quote** 

- 13th October 2013, 06:18 #10



Art 0 Senior Member Join Date: Location: Posts:

Aug 2003 Australia 983

Did you find this post helpful?





### Re: 2x16 LCD Graphics :)

It is for the thrill.. and I figure the work is not wasted, because these LCDs do still get

I already did an LED matrix display with games, scroller etc., and I don't think it is getting any faster.

Also, I have not written for pics in some time, and needed something to get going. There is room to duplicate the graphics screen, but for a practical application, I figure the rest of the screen would have some text on it.

I have solved the line drawing, but if you have a way to draw circles in PBP it would be appreciated  $\bigcirc$  At the moment my circles are perfect squares of the correct radius, but I'm keeping that for squares since it beats defining all the corner coordinates 📆

I would not buy a qfx LCD if I couldn't do the graphics, so it's a good way to come up

the routines now. I would still like to do my own hardware/software mapping GPS one day.

I do plan to give it away when it's finished and cleaned up.

ps to mods, it would be great if you could delete every video posted here (can seem to delete/edit my posts)

I've done the C-64/Amiga style Megademo 📆

Last edited by Art; - 13th October 2013 at 06:22.

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 

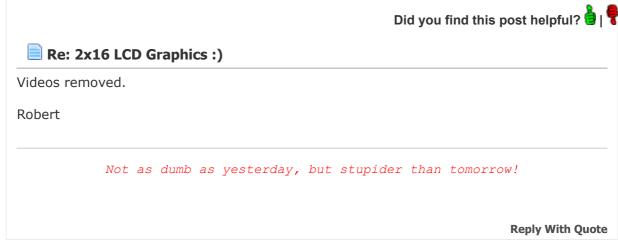
- 13th October 2013, 15:09 #11

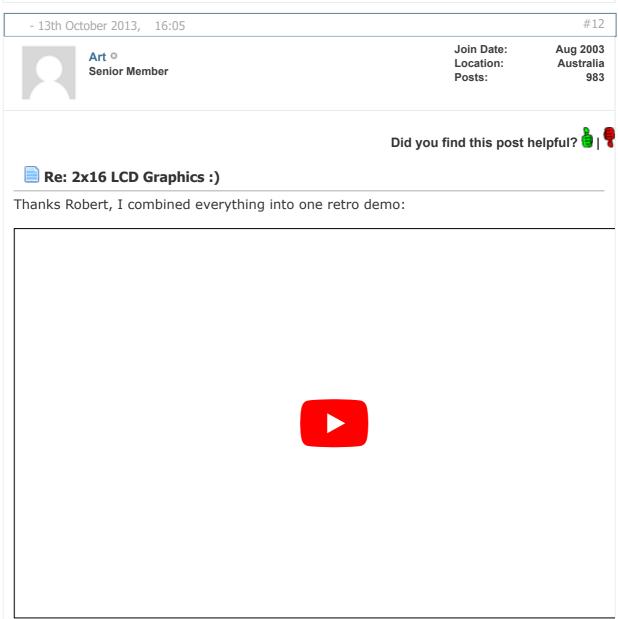


Demon o SuperMod Join Date: Jan 2005 Location: Montreal, Quebec,

Canada

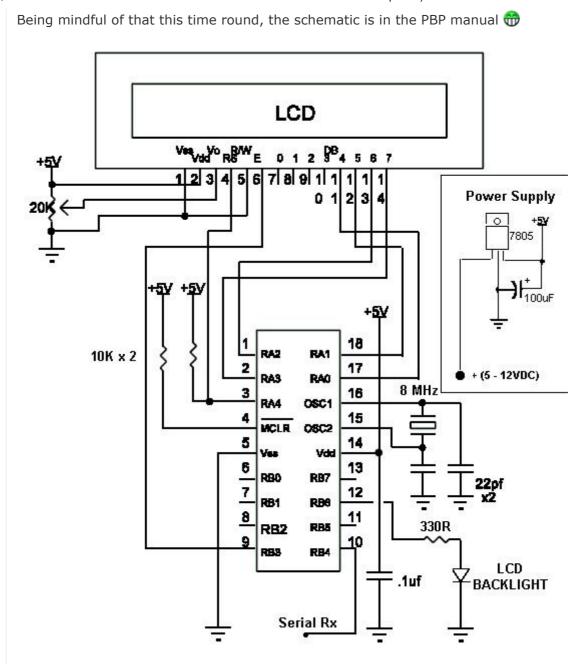
Posts: 2,256





I robbed the circle drawing from a GLCD code sample here, and added a bit more. There are 10 sections to the demo, but they only last a few seconds each. The trick at the end is what I should have started with to trick people to thinking I had the entire display  $\ensuremath{\mathfrak{S}}$ 

It is almost ready to go, I just have to make sense of the source for others. Last time I released a project, there were three different revisions of matching hardware and software improvements with schematics, and although others got it working, it caused confusion, and years of follow up for me.



The only differences are this is a 16F628A (instead of 16F84/A in the manual), the LCD backlight is powered by the pic (RB6) for the strobe effect in the video, and the pic is driven with an 8MHz crystal to match the speed in the video. The clock speed is not critical though.

The serial Rx pin in the familiar looking diagram is not implemented.

If you make a board for this, it's still tentative.

LCD R/W pin may need to be accessed later, so it might pay to wire it to somewhere accessible before wiring it to ground to mod later (I heard you can rip all of the character graphics from the LCD itself). It should also get a couple of buttons.

Cheers, Art.

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 

- 13th October 2013, 18:36



Demon o SuperMod

Join Date: Jan 2005 Location: Montreal, Quebec,

Canada

Posts: 2,256

Did you find this post helpful?







Re: 2x16 LCD Graphics :)

WARNING: Video may trigger epyleptic seizure in some viewers.

Use 3D glasses under welding goggles as protection.



Awesome stuff Art.

Robert

Not as dumb as yesterday, but stupider than tomorrow!

**Reply With Quote** 

- 14th October 2013, 07:01 #14



Art o Senior Member

Join Date: Location: Posts:

Aug 2003 Australia 983

Did you find this post helpful?







Re: 2x16 LCD Graphics :)

http://www.freewebs.com/defxev/LC2D.zip

Interestingly... I realised this is one of the two LCDs I bought off Melanie here ages ago: http://www.picbasic.co.uk/forum/show...=2298#post2298

Funny that. There was not much fancier at the time, but now the options are endless.

I always get that last little nice feature working AFTER the distribution



https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 

- 15th October 2013, 02:04

Join Date: Aug 2006 Location: Look, behind you. 2,818 Posts:



Did you find this post helpful?





## Re: 2x16 LCD Graphics :)

Pretty fancy stuff there Art, He He Imagine that display on the bank's ATM machine, make a good video.

## If you do not believe in MAGIC, Consider how currency has value simply by printing it, and is then traded for real assets.

Gold is the money of kings, silver is the money of gentlemen, barter is the money of peasants - but debt is the money of slaves

There simply is no "Happy Spam" If you do it you will disappear from this forum.

**Reply With Quote** 

04:08 - 15th October 2013,

#16



Art o Senior Member

Join Date: Location: Posts:

Aug 2003 Australia 983

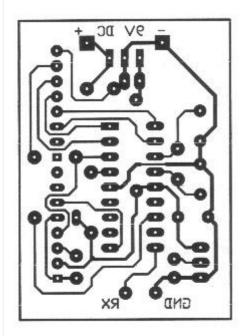
Did you find this post helpful?

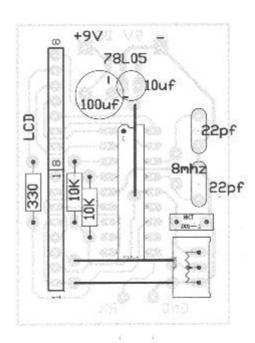




# Re: 2x16 LCD Graphics :)

### Forgot this:





Credit to Centrex of Whirlpool forum (Australia). Suitable for this, and whatever logging LCD circuit based on the PBP manual LCDOUT example circuit.

I will do a more bare source code, more intended for people using their own programs, and am also getting an 8x1 or 8x2 LCD so I either get a whole line or a whole display to work with.

The reason being, I hear by connecting the LCD R/W line to an IO pin, you can access the LCD's CGROM, and rip the character set. That would be great for the pixel perfect text scroller.

Up until now, the character data has been stored on EEPROM or on-chip EEPROM for these sort of tricks.

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 

- 15th October 2013, 08:52 #17



Ioannis o SuperMod

Join Date: Location: Posts:

Nov 2003 Greece 3,317

Did you find this post helpful?





Re: 2x16 LCD Graphics :)

You are kidding me, right?

Unbelievable graphics on this LCDs!!! Wow, Art. Supercalifragilisticexpialidocious!

Ioannis

www.signalcom.gr

**Reply With Quote** 

- 15th October 2013, 09:33 #18



Art 0 Senior Member

Join Date: Location: Posts:

Aug 2003 Australia 983

Did you find this post helpful?





Re: 2x16 LCD Graphics:)

Originally Posted by Ioannis

You are kidding me, right?

Unbelievable graphics on this LCDs!!! Wow, Art. Supercalifragilisticexpialidocious!

**Ioannis** 



I always get that last little nice feature working AFTER the distribution

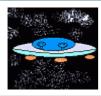
Happens every time on every platform.

I suggest, if you would like some cool new feature in a program you write, that you upload a distribution, and give it away to the public. Then within a day or two, you have changed the way you think about it, and have a moment of insight <sup>30</sup> Oh, and the implementation is a breeze also.

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 

- 16th October 2013, 17:06 #19



Archangel SuperMod

Join Date: Aug 2006 Location: Look, behind you. Posts: 2.818

Did you find this post helpful?





Re: 2x16 LCD Graphics :)

#### **CONGRATULATIONS ART:**

You have been featured on Hackaday http://hackaday.com/2013/10/16/teach...s/#more-105170

If you do not believe in MAGIC, Consider how currency has value simply by printing it, and is then traded for real assets.

Gold is the money of kings, silver is the money of gentlemen, barter is the money of peasants - but debt is the money of slaves

There simply is no "Happy Spam" If you do it you will disappear from this forum.

**Reply With Quote** 

- 16th October 2013, 17:40



Demon o SuperMod Join Date: Jan 2005 Location: Montreal, Quebec, Canada

Posts: 2,256

Did you find this post helpful?





Re: 2x16 LCD Graphics :)

Congrats Art!

**Reply With Quote** 

- 17th October 2013, 00:01 #21



andywpg o Member

Join Date: Location: Posts:

Jan 2012 **Grid EN19MV** 157

Did you find this post helpful?





Re: 2x16 LCD Graphics :)

Been following this thread with interest. Congrats on an awesome job AND your HackaDay feature!

"I have noticed that even those who assert that everything is predestined and that we can change nothing about it still look both ways before they cross the street"

-Stephen Hawking

**Reply With Quote** 

- 17th October 2013, 02:47 #22



Art o Senior Member

Join Date: Location: Posts:

Aug 2003 Australia 983

Did you find this post helpful? 🧯 |





Re: 2x16 LCD Graphics :)

Thanks Guys 🙂

I finally joined their forum, they would have got it from that.

I've been watching H-A-D for years... certainly some interesting stuff.

My 144 LED game ended up there too back when I was doing that.

Anyways that'll be some nice traffic for ya!

It makes me wish I'd waited tho the

I'll have to do a version 2.

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 

- 18th October 2013,

#23



Art o Senior Member Join Date: Location: Posts:

Aug 2003 Australia 983

Did you find this post helpful?





Re: 2x16 LCD Graphics :)

# LCD Graphics MegaDemo HD44780



Changes for LC2D Version 2 - 18/10/13

### Base code:

Reduced program memory, and RAM consumption (approximately ten more bytes of RAM are freed). This leaves more RAM in BANKO for the user program. Performance win on base code (first version is still on the site for comparison). When the demo program is removed, there's much more resource for your program.

#### Demo User Program:

Extra resource freed by improved base code is consumed by the new demo. Now has fifteen demo sections! The first demo sections are identical, except that the first demo section inverts the LCD on it's first cycle for LCD test. The new demo sections expand on a trick appearing to control the entire LCD display when run on a 2x16 LCD. Fixed graphic invader animation frame B sprite (legs).

Classic Rolling Odometer Effect 🙂

One of the new demo sections is the rolling odometer effect that also moves around the display.

It looks like a penalty, but is not. It's delayed because it is the most prone to messing up the display with lag trails when run on slow LCDs such as the one in the video. The user program doesn't have to move it around, or delay any sprite drawing routines.

I ran out of memory in the process of making it able to reverse direction properly for counting backwards. Currently, the variable must be incrementing by one.

New Notes:

Pic run at 8MHz telling PBP compiler it's running at 4MHz

results in only 600ms pause time for LCD start up delay. PBP manual suggests PAUSE 1000 delay to accomodate slower starting LCDs. If your LCD doesn't start, change to PAUSE 2200 before compiling the program, or insert the pic into the socket after powering the circuit with the LCD.

Sloppy bounds checking on demo user program demonstrates crash proofing in base code. The user program is allowed to draw off screen. Base code does not check bounds on the individual X,Y coords, rather that their calculated destination in the first frame buffer is within bounds of the array. Crazy shape or line drawing could still have consequence. I don't know what those routines will do in unusual circumstances.

http://www.freewebs.com/defxev/LC2D.htm

Enjoy 🙂

Last edited by Art; - 18th October 2013 at 03:14.

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 

- 18th October 2013, 13:41



Art o Senior Member Join Date: Location: Posts:

Aug 2003 Australia 983

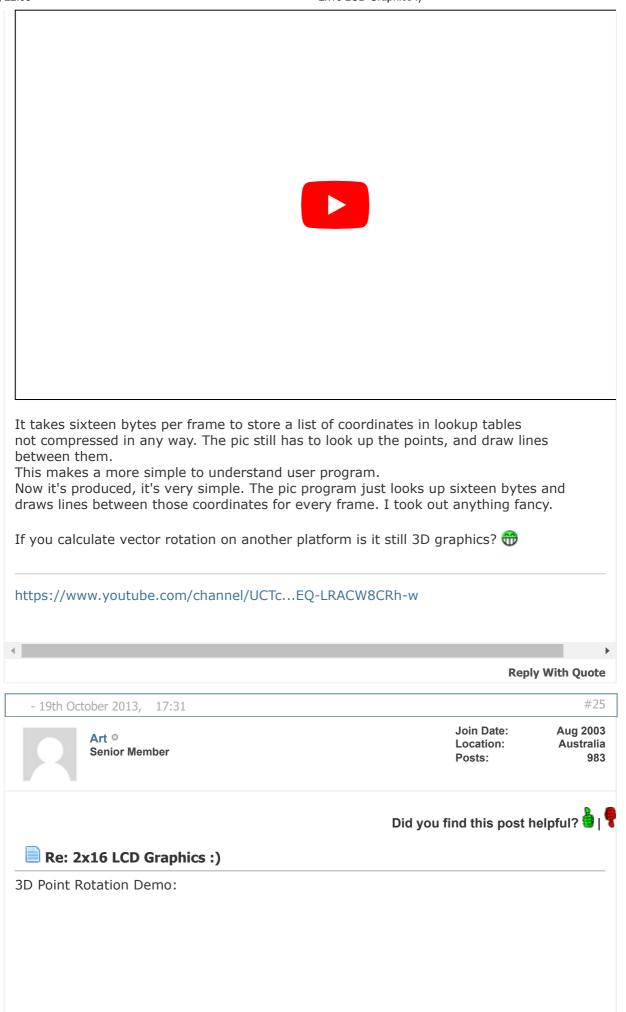
Did you find this post helpful?

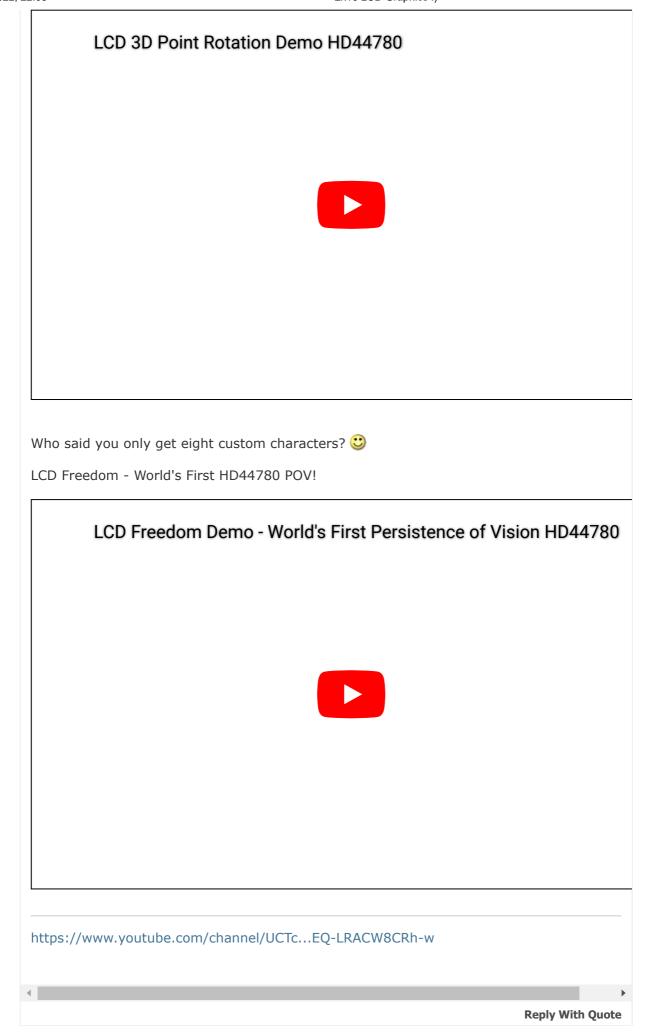




Re: 2x16 LCD Graphics :)

I had to write an iPhone simulator App to do the vector rotation on the 3D cube but got it:







spcw1234 o Member

Join Date: Location:

Apr 2007 Pennsylvania,

Posts:

**USA** 141

Did you find this post helpful?





# Re: 2x16 LCD Graphics :)

Wow, awesome job Art! Quite impressive!

Shawn

**Reply With Quote** 

- 24th October 2013, 09:02 #27



Art o Senior Member

Join Date: Location: Posts:

Aug 2003 Australia 983

Did you find this post helpful?





# Re: 2x16 LCD Graphics :)

Thanks 🙂

It took a 20MHz clock to control the entire display, with all four cubes different, but I could make videos forever the

Since the video framerate is not synced to the pic's clock in any way, and therefore the LCD backlight strobe frequency, it looks better here than the video comes up.

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 

- 27th October 2013,

#28



Art o Senior Member

Join Date: Location: Posts:

Aug 2003 Australia 983

Did you find this post helpful?





## Re: 2x16 LCD Graphics :)

Normally, Noritake will provide you with a dot matrix VFD sample to play with, but only if you live in US or Canada:

http://www.noritake-elec.com/evalkit-sample.php

That's really quite nice, so ppl should be aware of that.

Suspecting that POV will work great with VFD, I promised a great demo including their logo, in return for them sending me some 2x16 character modules.

They have replied with a suggestion display which is a HD44780, so it looks good  $\bigcirc$ 



I don't think I'm finished with them.

I think it's possible to do greyscale graphics on a monochrome dot matrix VFD.

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 

- 17th March 2015, 16:44





sougata o Contributor

Join Date: Location: Posts:

Feb 2005 Kolkata-India 563

Did you find this post helpful?





Re: 2x16 LCD Graphics :)

I didn't find the source for your AWESOME 2D LCD Graphics on the link you provided. I do not do PBP much nowadays but your demo is so cool, I want to try it out. Cheers

Regards

Sougata

**Reply With Quote** 

- 18th March 2015, 03:04 #30



Art o Senior Member

Join Date: Location: Posts:

Aug 2003 Australia 983

Did you find this post helpful?





Re: 2x16 LCD Graphics :)

Freewebs canned my free web hosting. If you pm me an email address I'll send it. Cheers, Art.

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 

#31 - 18th March 2015, 03:33



sougata o Contributor

Join Date: Location: Posts:

Feb 2005 Kolkata-India







Re: 2x16 LCD Graphics :)



If you pm me an email address I'll send it. Cheers, Art.

Your Forum Inbox seems to be full. PM not going through.

Regards

Sougata

**Reply With Quote** 

- 23rd March 2015, 13:20



Art o Senior Member

Join Date: Location: Posts:

Aug 2003 Australia

Did you find this post helpful?





Re: 2x16 LCD Graphics :)

Sorry, it should be ok now.

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 

- 24th March 2015, 02:42 #33



sougata o Contributor

Join Date: Location: Posts:

Feb 2005 Kolkata-India 563

Did you find this post helpful?







Re: 2x16 LCD Graphics :)

👥 Originally Posted by Art 🔟

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

Cool, great videos 🙂



Regards

Sougata

**Reply With Quote** 

- 25th March 2015, 05:42

#34



Art o Senior Member Join Date: Location: Posts:

Aug 2003 Australia 983

Did you find this post helpful?





# Re: 2x16 LCD Graphics :)

Email sent...

Also trying attachment on this forum.

LC2D-V2.zip

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 

- 22nd May 2015, 10:21 #35



Art o Senior Member Join Date: Location: Posts:

Aug 2003 Australia

Did you find this post helpful?





### Re: 2x16 LCD Graphics :)

I've been having another play with it, in C, but nothing that can't be done the same way in PBP.

For example to push the cubes off the screen, just count every six movements of a cube and increment the number of spaces following it.

Then you also have the value of the screen position to follow the graphics with text.

The graphics is slowed for debugging. It's something I don't want to have to wait for when it's done.

I don't like to reuse code without adding something to it, so I'm going for a wall of cubes that the LCD window can move around in.

They only have to move up and down as well as sideways.

Also, for the project, I would like to display practical information with graphics (such as a Moon phase), and be able to slide the

graphics area into the display in a fluid motion from any direction.

I scrolled the text vertically to begin with, but am now thinking toward scrolling in two fields sideways with the graphics display in front and stopping for a while when everything is in position, and then scrolling off again. Last edited by Art; - 22nd May 2015 at 10:25. https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w **Reply With Quote** #36 - 22nd May 2015, 15:00 Aug 2003 Join Date: Art o Australia Location: Senior Member Posts: 983 Did you find this post helpful? Re: 2x16 LCD Graphics :) Whoops.. the video above is deleted and I can't edit the post. https://www.youtube.com/my\_videos?o=U https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w **Reply With Quote** #37 - 22nd May 2015, 20:12

www.picbasic.co.uk/forum/showthread.php?t=18416&p=122492



Demon o SuperMod

Join Date: Jan 2005 Location: Montreal, Quebec,

Canada

Posts: 2,256









Re: 2x16 LCD Graphics :)

LOL

I see my own videos with that link.

Not as dumb as yesterday, but stupider than tomorrow!

**Reply With Quote** 

- 23rd May 2015, 02:58 #38



Art o **Senior Member**  Join Date: Location: Posts:

Aug 2003 Australia 983

Did you find this post helpful?





Re: 2x16 LCD Graphics :)

whoops!



叹 Originally Posted by **Demon** 🔃 LOL

I see my own videos with that link.

https://www.youtube.com/channel/UCTc...EQ-LRACW8CRh-w

**Reply With Quote** 

- 26th May 2015, 08:24



Art o **Senior Member** 

Join Date: Location: Posts:

Aug 2003 Australia 983

Did you find this post helpful?





## Re: 2x16 LCD Graphics :)

The current thing I'm working on with it is a transition from one text screen to another.



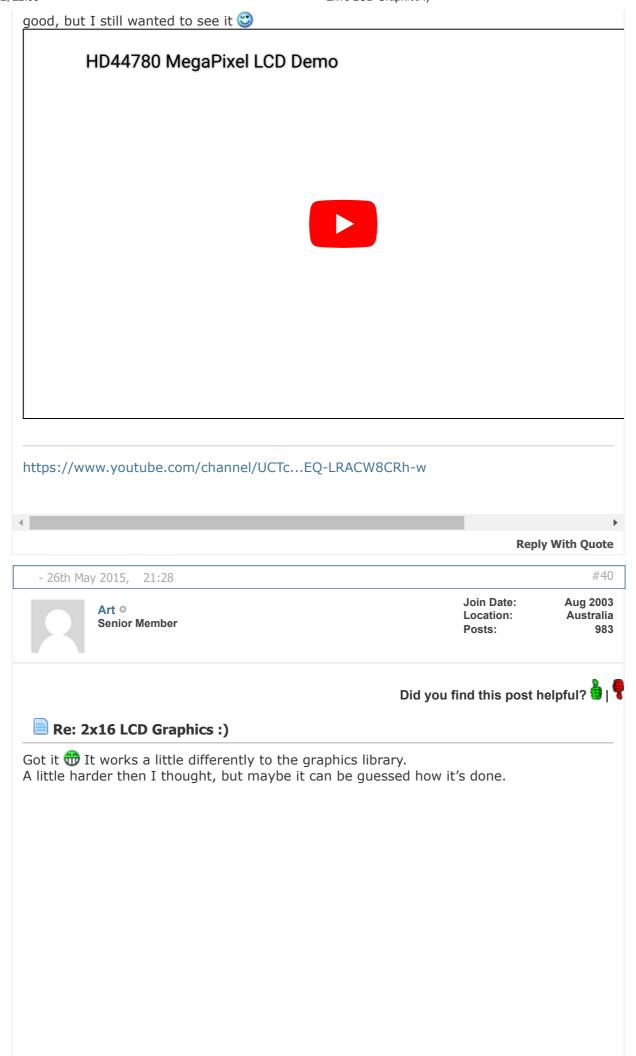
In the next frame or two when the A is completely gone from the screen, it can be replaced by either a space or the new text, and doesn't need to be using a custom character location anymore. Then that location freed by the A, can be used by the G, or whatever the next character to move is, until all text is gone or replaced.

It does mean I have to type a lot of crap to define all of the character set in program memory tho.

So far I've done the symbols and up to the numeral 0 🐸

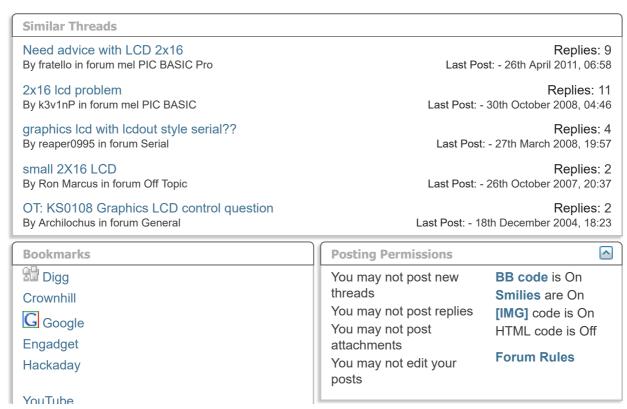


Here's a demo I did with dsPic... much of it is a little too much for the display to look





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