Kronos Robotics and Electronics

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Dios - Serial Graphic LCD

Build a Serial Graphic LCDwith the DiosPro

In this article we will build a Serial Graphic LCD.

What is a Serial Graphic LCD? You've seen those serial character LCD's. They provide you a 2-4 line LCD that you can send text characters using a single IOport from your microcontroller. A serial graphic LCD is very similar except you can display graphic information as well.

Serial Graphic LCD Features

- 8 line of 20 character text.
- 128 x 64 graphics.
- pixel, bitmap, line, and box commands.
- Single IO port serial interface.
- Built-in power regualtor.
- Built-in RS232 Interface for direct PC connection.
- Remote Backlight command.
- 256 byte interrupt driven UART for High Speed interface.
- Contrast Trimmer

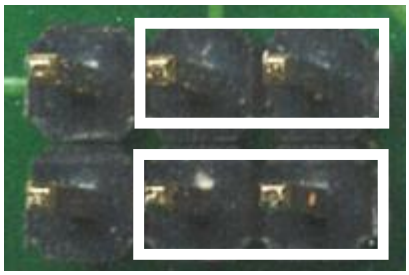


Figure 1

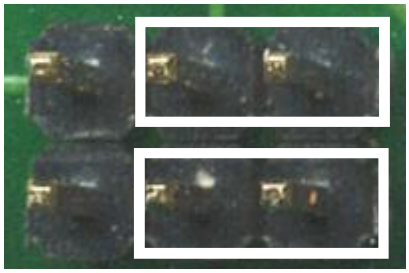


Figure 2

Construction

The construction of the Serial Graphic LCDis a no brainer. You will need the following to build your Serial Graphic LCD:

- Dios 40 Pin Chip
- Dios Universal LCD Carrier
- Sparkfun or Crystalfontz Graphic LCD (Sparkfun Recomended)

We will start by building the Universal Carrier. Build the carrier as shown in chapter 1 of the assembly manual.

Once built set the jumpers as follows:

DB9 Connector Selection Jumper
Set these jumpers as shown in Figure 1. This will tie the built-in RS232 driver into the program port.

LCD Type jumper
Set these jumpers as shown in Figure 2. This will set the

Switch jumper
Place a jumper on the switch header.

Dios Test Program

Before continuing you need to make sure the board is working properly.

Install the free Dios Compiler software. It can be found or the website at www.kronosrobotics.com

Plug a Dios 40 chip into the socket if you have not already done so.

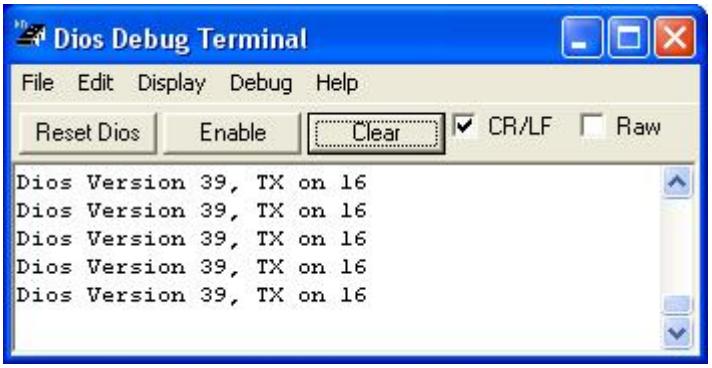
Connect power to the AC adapter input. Remember the adapter must have center positive and be between 7-14 volts DC.

Plug a 9 pin serial cable between your PC and Universal LCDcarrier.

Serial Graphic LCD

Once the serial cable and power has been connected to the Universal LCD board load the Dios Compiler and hit F6 to bring up the Debug Terminal. Every Dios is shipped with a test program that allows you to performa a basic test.

The debug terminal should display the following information. Note that the version may be different.



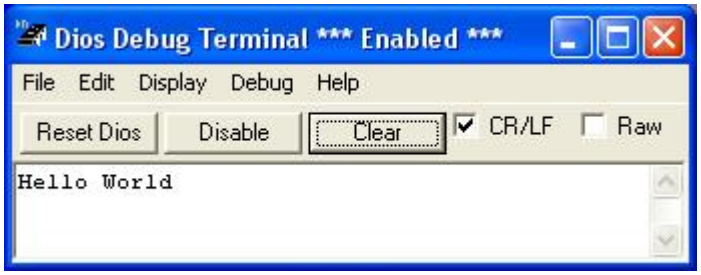
Load the following program into the Dios.

```
func main()

   print "Hello World"

endfunc
```

Once loaded the debug window will display the following information.



This confirms the proper operation of the Universion LCD board and the Dios, Power and RS232 sub sections.

LCD Test Program

Now we are going to test your LCD. Plug the proper graphic LCDinto the main LCD connector.

Load the following program into the Dios.

```
func main()
   dim x,y

   GLCDinit
   GLCDLED 200 'Turn on LCD backlight

   GLCDcharpos chars,3,4,"Hello World"

endfunc

include \lib\DiosUGLCD.lib
```

Once loaded the graphic LCD should display the words “Hello World” on the screen. Note that you may have to adjust the screen contrast with the trimmer.

This completes the testing of the Dios, LCD and Universal Carrier.

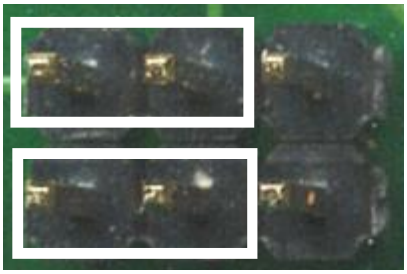
Serial Graphic LCDProgram

Now for the main program. This program will monitor the built-in UART for commands and display information on the LCDas the commands are recieved.

The Serial Graphic LCDprogram is much too large to display here it can be found in the examples directory. It is called SerialGraphicLCD.txt

Load the program into the Dios. Once the Dios is programmed we need to change the RS232 jumpers in order to wire the UART to the onboard RS232 driver.

Set the 9pin connector jumper as follows:



Your Serial Graphic LCD is now complete.

Testing the Serial Graphic LCD

The LCDis set to communicate at 115200 baud. If you want a slower baud rate you can change the hsersetup command at the begging of the program.

You can use the debug terminal to test this serial LCDas long as the speed stays at 115200 baud. If you decide to change the baud rate you can use the utility terminal or the KRConnect program for testing.

Bring up the debug terminal by hitting F6.

You can send normal text characters to the LCD by simply typing them into the debug terminal. If you want to send special codes to the LCD you need to bring up the **Special Characters** form.

To bring up the Special Characters form click the menu item under the display menu.

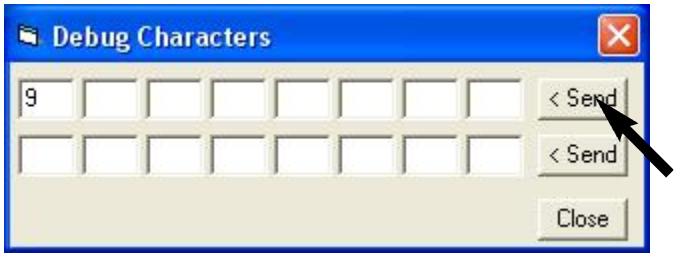


Figure 9

In order to clear the display on the LCD we need to send a code of 9.

Type 9 into the first field and het the send button as shown in Figure 9. This should erase the screen.

To send something a bit more complex lets send the box command.

The box command is command #13. It has 5 parameters which are the upper left corner x and y and the lower right corner x and y pos. The last parameter is the mode in which the box will be drawn. In this case we are just going to set (draw) the box.

All the commands work this way and have various parameters.

Lets break all the commands down that the Serial Graphic LCDcan handle.

Character Commands

1,x Position the next character write at line 1 position x
2,x Position the next character write at line 2 position x
3,x Position the next character write at line 3 position x
4,x Position the next character write at line 4 position x
5,x Position the next character write at line 5 position x
6,x Position the next character write at line 6 position x
7,x Position the next character write at line 7 position x
8,x Position the next character write at line 8 position x

9 Clear entire display

10,1 Clear line 1
10,2 Clear line 2
10,3 Clear line 3
10,4 Clear line 4
10,5 Clear line 5
10,6 Clear line 6
10,7 Clear line 7
10,8 Clear line 8

10,9 Clear character positions 1-10 on line 1
10,10 Clear character positions 1-10 on line 2
10,11 Clear character positions 1-10 on line 3
10,12 Clear character positions 1-10 on line 4
10,13 Clear character positions 1-10 on line 5
10,14 Clear character positions 1-10 on line 6
10,15 Clear character positions 1-10 on line 7
10,16 Clear character positions 1-10 on line 8
10,17 Clear character positions 11-20 on line 1
10,18 Clear character positions 11-20 on line 2
10,19 Clear character positions 11-20 on line 3
10,20 Clear character positions 11-20 on line 4
10,21 Clear character positions 11-20 on line 5
10,22 Clear character positions 11-10 on line 6
10,23 Clear character positions 11-20 on line 7
10,24 Clear character positions 11-20 on line 8

29,x Set character mask x. Default is 0. Only 0 and 255 is valid. When set to 255 the character will be inverted.

LCD Hardware Commands

27 Reset the Board
30,x Set backlight value 0-255

Box Commands

13,x1,y1,x2,y2,mode
Draw a box starting at x1,y1 to x2,y2. The x range is 0-127 and y range is 0-63. Mode can be 0:clear 1:set 2:xor

14,x1,y1,x2,y2,mode
Fill a box. Same as box draw but box is filled in.

Pixel Commands

12,x,y,mode
Set Pixel x = 0-127 y = 0-63 where mode 0:clear 1:set 2:xor

Line Commands

15,x1,y1,y2,mode
Draw a vertical line frome x1,y1 to x1,y2 where mode 0:clear 1:set 2:xor

16,x1,y1,x2,mode
Draw a vertical line from x1,y1, to x2,y1 where mode 0:clear 1:set 2:xor

17,x1,y1,x2,y2,mode
Draw a calculated line from x1,y1 to x2,y2 where mode 0:clear 1:set 2:xor

Strip Commands

11,1,x Fill all of Line 1 with strip data x
11,2,x Fill all of Line 2 with strip data x
11,3,x Fill all of Line 3 with strip data x
11,4,x Fill all of Line 4 with strip data x
11,5,x Fill all of Line 5 with strip data x
11,6,x Fill all of Line 6 with strip data x
11,7,x Fill all of Line 7 with strip data x
11,8,x Fill all of Line 8 with strip data x

11,9,x Fill strip positions 0-63 on Line 1 with strip data x
11,10,x Fill strip positions 0-63 on Line 2 with strip data x
11,11,x Fill strip positions 0-63 on Line 3 with strip data x
11,12,x Fill strip positions 0-63 on Line 4 with strip data x
11,13,x Fill strip positions 0-63 on Line 5 with strip data x
11,14,x Fill strip positions 0-63 on Line 6 with strip data x
11,15,x Fill strip positions 0-63 on Line 7 with strip data x
11,16,x Fill strip positions 0-63 on Line 8 with strip data x
11,17,x Fill strip positions 64-127 on Line 1 with strip data x
11,18,x Fill strip positions 64-127 on Line 2 with strip data x
11,19,x Fill strip positions 64-127 on Line 3 with strip data x
11,20,x Fill strip positions 64-127 on Line 4 with strip data x
11,21,x Fill strip positions 64-127 on Line 5 with strip data x
11,22,x Fill strip positions 64-127 on Line 6 with strip data x
11,23,x Fill strip positions 64-127 on Line 7 with strip data x
11,24,x Fill strip positions 64-127 on Line 8 with strip data x

18,Line,Strippos,stripdata
Draw a single stripdata at line 1-8 at strippos 0-127

19,Line,strippos,numstrips,stripdata
Draw repeating strips into the positions starting at strippos.

28,Line,Strippos,number,data-1,data-2,data-n
Draw a series of strips (bitmap) into positions starting at stripps. Note that you must supply data for the number of strips indicated.

Low Level Commands

25,page,data
Send the raw data to the page

26,page,cmd
Send the raw cmd to the page

Program Specifics

The program is self syncing. This means that if you send a command and don't send the proper data the command will time out after a few milliseconds and prepare itself for the next command.

If you send data out of range the LCD can become corrupted. In this case you may need to reset the board.

Whats Next?

The ULC (Universal LCD Carrier) has many headers. Its possible to add a hex keypad or other device as many of the IOports are not used.

If you plan on doing a lot of development on the ULC you may want to place a DPDT swithc on a 2x3 header so that you can replace the 9-pin connector jumper with the switch. This will allow you to switch back and forth between programming and UART mode.

The Lines jumper is not used in this application so you may want to add a couple lines of code to set the baudrate at start up.

```
if ioport(31) = 1 then
  hsersetup baud,HBAUD115200,start,txon,clear
else
  hsersetup baud,HBAUD9600,start,txon,clear
endif
```

One of the most important commands that you can send the Serial Graphic LCD is command 25. This command allows you to send a series of strips to create a simple or complex bitmap.

Related Products

DiosPro 40 . . . . . http://kronosrobotics.com/xcart/customer/product.php?productid=16428
Dios Universal Carrier . . . . . http://kronosrobotics.com/xcart/customer/product.php?productid=16410

Graphic LCD . . . . . http://www.sparkfun.com (Part # LCD-00710)
Graphic LCD . . . . . http://www.crystalfontz.com (Part # CFAG12864B-YYH-V)
Graphic LCD . . . . . http://www.crystalfontz.com (Part # CFAG12864B-TMI-V)

9 Pin Cable . . . . . http://kronosrobotics.com/xcart/customer/product.php?productid=16259