

LCD Micro Serial/I²C Interface Module for R.G.B backlights

Technical Data

Features

- **New improved version with higher serial speeds and better RGB panel support**
- **Supports LCD panels with RGB backlights*.**
- **Micro size (53 x 29mm) to piggy-back on the LCD module and form a compact solution.**
- **Simple RS232 serial or I²C transfer of characters to the LCD from PC, BASIC Stamp, OOPic & other microcontroller modules.**
- **Serial/I²C selectable Backlight colour and brightness, No. of lines and serial baud rate (1200-57600bps).**
- **LCD contrast variable with on-board control.**
- **Low power operation from 5Volt regulated supply and/or 7-15V supply using on-board regulation.**
- **Supports 16x2, 20x2, 40x2 & 20x4 LCD modules.**
- **No learning curve to get characters on the LCD.**

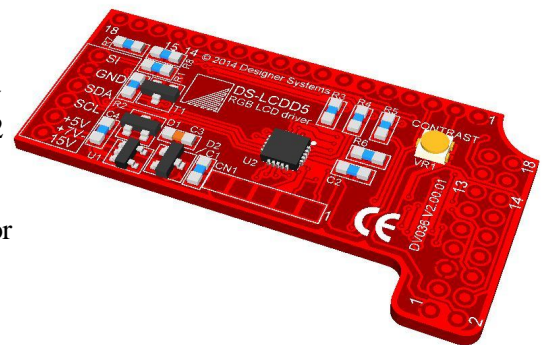
Description

The DS-LCDD5 module provides a simple means of connecting any device capable of standard RS232 serial or I²C communication to a Liquid Crystal Display (LCD) module of 16 x 2, 20 x 2, 40 x 2 or 20 x 4 character/lines featuring a RGB backlight.

The DS-LCDD5 provides complete control of character placement, customisation and cursor movement to ensure that your application is up-and-running in a fraction of the time necessary to implement the standard LCD control protocol.

The DS-LCDD5 also features on-board supply regulation for both LCD supply and backlight, and also includes fully 'jumperless' setup of internal features over the serial/I²C link. These include 256 levels of RED, GREEN and BLUE (RGB) backlight colour, internal backlight colour pulsing with variable speed, serial baud rate (9600 baud default), number of display lines, RGB backlight type and I²C address.

DS-LCDD5



The module simple piggy-backs on the LCD module to form a compact solution.

Controlled by a Microchip PIC FLASH microcontroller the module can be re-programmed from the standard LCD routines with client specific code to form any HID type application e.g. Serial terminal, door entry etc.

Applications

Simple HID applications within robotics, programming, user feedback, industrial control and monitoring.

Visual feedback in both amateur and professional applications.

Selection Guide

| Description | Part Number |
|---|-------------|
| LCD Interface Module with serial/I ² C control and RGB backlight control | DS-LCDD5 |

* Please check with LCD panel provider to ensure compatibility.

Power requirements

The DS-LCDD5 & LCD module requires either an external 5Volt regulated supply and/or a 7-15Volt un-regulated supply; both supplies can be connected simultaneously. The 7-15V supply can be derived from a mains adaptor or a battery pack. Current consumption is approx. 3.5mA excluding backlight, or from 3.5-30mA including backlight (colour/brightness dependant). The six (6) pin header, see table below, is used to connect to either supply by connecting between 5V & GND and/or 7-15V & GND.

Note: Observe polarity to prevent damage!

LCD Contrast

The DS-LCDD5 has a 'CONTRAST' control which is provided to set the display contrast to the desired level.

Note: This control should not be continually adjusted as this may lead to malfunction.

LCD Connections

The DS-LCDD5 features two LCD connections to support both Single-In-Line (SIL) and Dual-In-Line (DIL) LCD modules. Both connections are easily soldered to the required LCD module using an 18 pin SIL pin header, 18 pin (9+9) DIL pin header or alternatively a flexible wire connection.

Note: Incorrect connection may damage the DS-LCDD or LCD module.

RS232 (serial) connection

The DS-LCDD5 supports RS232 serial communication and control. Connection to the module is through a six (6) pin header, pinned as follows:

| Header pin | Connection Designation |
|------------|-----------------------------|
| 1 | SI (Serial input) |
| 2 | GND (Signal ground) |
| 3 | SDA (I2C data) |
| 4 | SCL (I2C clock) |
| 5 | +5V (Regulated Supply) |
| 6 | +7-15V (Unregulated supply) |

There are two popular forms of RS232 interfacing, standard and inverted TTL, the latter not actually being defined under the RS232 specification but being popular with the microcontroller community as no interface IC is required. The DS-LCDD5 supports both formats and can therefore be used with

most microcontroller modules such as the OOpic-R and BASIC Stamp and any modern PC fitted with a serial port.

A readymade PC cable fitted with a DB9 connector is available (P.n. DS-L232CAB3) that will also power the LCD module from the PC serial interface (with backlight disabled).

RS232 (serial) commands

Characters for display on the LCD module are sent to the DS-LCDD5 in the form of ASCII codes of value 32_{decimal} (20_{hex}) to 127_{decimal} (7F_{hex}). These characters are displayed as text on the LCD module at the current cursor position.

Text can be displayed very simply from a PC and many Microcontroller based controllers such as the Arduino, BS2, BASIC Stamp etc. by writing a serial out command with a string value.

The default serial requirements are:

9600 baud
8 Data bits
1 Stop Bit
No Parity
No handshaking (if configurable)

Tip: If character errors appear on the LCD display when sending from a fast PC then set Stop bits to 2.

LCDD5 control commands

To allow the setup of backlight colour/brightness, new serial baud rate etc. the module supports a control command format.

To place the DS-LCDD5 into control command mode 255_{decimal} (FF_{hex}) must be sent before the following instruction codes/values:

| Command | Dec | Hex |
|-----------------------|-----|-----|
| Backlight - OFF | 0 | 00 |
| RED pulsing | 1 | 01 |
| GREEN pulsing | 2 | 02 |
| BLUE pulsing | 3 | 03 |
| BLUE/GREEN pulsing | 4 | 04 |
| RED/BLUE pulsing | 5 | 05 |
| RED/GREEN pulsing | 6 | 06 |
| RGB pulsing | 7 | 07 |
| Not implemented | 8 | 08 |
| Not implemented | 9 | 09 |
| Not implemented | 10 | 0A |
| Not implemented | 11 | 0B |
| Not implemented | 12 | 0C |
| Not implemented | 13 | 0D |
| Colour wheel | 14 | 0E |
| Backlight - ON | 15 | 0F |
| BAUD rate - 1200baud | 16 | 10 |
| BAUD rate - 2400baud | 17 | 11 |
| BAUD rate - 4800baud | 18 | 12 |
| BAUD rate - 9600baud | 19 | 13* |
| BAUD rate - 19200baud | 20 | 14 |
| BAUD rate - 38400baud | 21 | 15 |

| | | |
|-----------------------|-----|-----|
| BAUD rate - 57600baud | 22 | 16 |
| LCD 1 line display | 32 | 20 |
| LCD 2 line display | 33 | 21* |
| RED backlight setup | 48 | 30 |
| GREEN backlight setup | 64 | 40 |
| BLUE backlight setup | 80 | 50 |
| Pulse speed setup | 96 | 60 |
| RGB backlight type | 112 | 70 |

* Factory defaults

Serial baud rate and LCD lines are stored within non-volatile memory to ensure recall upon the next power-up.

The backlight defaults to 'OFF' on every power-up.

Values 0 to 15 control the operation of the RGB backlight to allow it to be turned ON (15_{decimal}), turned OFF (0_{decimal}) or set to a pulsing display. The pulsing speed is controlled by sending a speed value of one (1)_{decimal} (fastest) to 255_{decimal} (slowest) by writing the 'Pulse speed setup' value 96_{decimal} followed by the speed value itself.

Examples:

To turn ON the backlight, and set it to colour scan at slow speed, send decimal values:

255, 15, 255, 14, 255, 96, 255

Turn ON the backlight, and set it to BLUE pulsing at medium-fast speed, send decimal values:

255, 15, 255, 3, 255, 96, 64

The DS-LCDD5 also allows the RGB backlight to be set to any colour in the RGB spectrum.

Examples:

To turn ON the backlight, and set it to the R.G.B value of 254_{decimal}, 128_{decimal}, 192_{decimal} (Pink), send decimal values:

255, 15, 255, 48, 254, 255, 64, 128, 255, 80, 192

To turn ON the backlight, and set it to the R.G.B value of 84_{decimal}, 134_{decimal}, 171_{decimal} (Blue grey), send decimal values:

255, 15, 255, 48, 84, 255, 64, 134, 255, 80, 171

Note: Ambient light conditions may cause differences in colour representation. Experimentation with colour values will deliver the best performance.

The DS-LCDD5 RGB backlight driver output configuration can be configured from the normal R,G,B and common Anode to one of five

different formats and common Anode or Cathode :

| Type | Dec | Hex |
|----------------|-----|-----|
| R,G,B | 0 | 00* |
| G,R,B | 1 | 01 |
| G,B,R | 2 | 02 |
| B,G,R | 3 | 03 |
| B,R,G | 4 | 04 |
| R,B,G | 5 | 05 |
| Common Anode | 16 | 10* |
| Common Cathode | 32 | 20 |

Example:

To reconfigure for G,R,B and common Cathode = 1 + 32 = 33:

255, 112, 33

Note: When configuring for common Cathode the zero ohm jumper R7 must be removed and placed on R8.

LCD control commands

To allow the control of cursor position, clear display and scroll etc. the LCD module also supports a command format. To place the DS-LCDD5 into command mode 254_{decimal} (FE_{hex}) must be sent before the following instruction codes:

| Command | Dec | Hex |
|--------------------------------------|-----|-----|
| Home (abort scroll) | 0 | 00 |
| Clear display | 1 | 01 |
| Blank display (text not cleared) | 8 | 08 |
| Cursor OFF or restore after blanking | 12 | 0C |
| Cursor ON & blinking | 13 | 0D |
| Cursor ON & underline | 14 | 0E |
| Move cursor left | 16 | 10 |
| Move cursor right | 20 | 14 |
| Scroll display left | 24 | 18 |
| Scroll display right | 28 | 1C |

A further two commands allow special characters to be defined and characters to be displayed at particular locations without having to re-write the whole display.

LCD addressing

Each character position on the LCD occupies a memory location with a specific address. These addresses allow one or more characters to be changed on the LCD without having to re-write the whole screen i.e. if you want to update just a temperature value on a display which reads 'Temperature = 25oC'.

To accomplish this the DD address of the character position is written after the command mode request e.g. to write the character 'A' to position

6 of line 1 on a 16 x 2 type display the following would be sent:

254_{decimal}, 134_{decimal}, 'A'_{ASCII}

134 is calculated from the line start address 128, plus 6.

Note: All character based LCD modules use a 40-character per line RAM storage area. This means that if 20 characters were written to a 16-character display then only the first 16 characters would be displayed, with the missing 4 being stored in RAM but not displayed. A scroll-left of the display would then be necessary to view the additional characters.

It should also be noted that once the end of the current line is reached the display does not automatically wrap-around to the next line, a new line start address must be written.

Character Definition

The LCD contains a small amount of Character-Generator or CG RAM to allow the definition of special characters. Only 8 special characters are definable and displayed by writing a value of 0 to 7 into the display e.g. to display 'ohms Ω' the omega must be firstly defined as CG character 0 and be displayed by writing:

RS232.String = "ohms " + CHR\$(0)

To define the omega character in CG RAM eight values are required to make up the character shape. These values consist of the binary representation, or bit map, of the character as follows:

```

□ □ □ □ □ 0
□ ■ ■ ■ ■ 14
■ □ □ □ ■ 17
■ □ □ □ ■ 17
■ □ □ □ ■ 17
□ ■ □ ■ □ 10
■ ■ □ ■ ■ 27
□ □ □ □ □ 0

```

After sending the command code 254_{decimal}, the character address is then sent consisting of:
64_{decimal} + (8_{decimal} x CG character)

where CG character = character to define 0 to 7
for CG 0 address would be 64_{decimal}.

The above bit map values are then sent in the order shown to define the character. Therefore the above character would be defined by sending:

254,64,0,14,17,17,17,10,27,0_{decimal}

To then switch back to display RAM and print the character send 254_{decimal}, DDRAM address i.e. 128_{decimal} (for start of line 1) and 0_{decimal} to display the character defined above.

I²C connection

The DS-LCDD5 also supports I²C serial communication and control. Connection to the module is through the six (6) pin header, pinned as follows:

| Header pin | Connection Designation |
|------------|-----------------------------|
| 1 | SI (Serial input) |
| 2 | GND (Signal ground) |
| 3 | SDA (I2C data) |
| 4 | SCL (I2C clock) |
| 5 | +5V (Regulated Supply) |
| 6 | +7-15V (Unregulated supply) |

The I²C interface is bi-directional and is configured as a slave device which allows a master controller such as the OOPic to write to the LCD display or control the backlight.

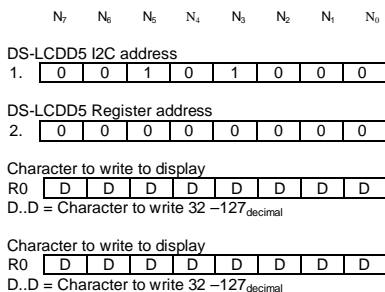
To connect the DS-LCDD5 to the I²C master the SDA, SCL & GND lines must be connected and the master checked to ensure that bus pull-up resistors are present.

I²C commands

The DS-LCDD5 has a device address of 0010100D_{binary}, 28_{hex}, 40_{decimal} (by default), the 'D' bit determining if a read or a write to the DS-LCDD5 is to be performed. If the 'D' bit is set '1' then a register read is performed or if clear '0' a register write.

To write text to the LCD a device write must be undertaken by the Arduino / Raspberry-Pi / I²C Master which consists of a Start condition, device ID ('D' bit cleared), Register address set to zero (0), one or more characters to be displayed and a stop condition (see Figure 1.0 for I²C write protocol). The characters to be displayed are actually written into the same internal register 'R0' before being sent to the display. The following shows the process which sets the register address to R0

and writes two characters:



Example.

To write ‘Hello’ to the display:

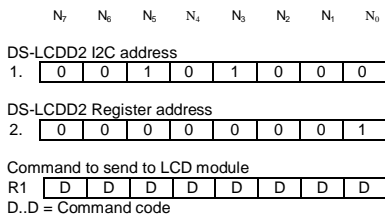
- Byte 1 - 00101000_{binary}, 28_{hex}
- Byte 2 - 00000000_{binary}, 00_{hex}
- Byte 3 - ‘H’_{ASCII}
- Byte 4 - ‘e’_{ASCII}
- Byte 5 - ‘l’_{ASCII}
- Byte 6 - ‘l’_{ASCII}
- Byte 7 - ‘o’_{ASCII}

LCD control commands

To allow the control of cursor position, clear display, scroll & character definition etc. the LCD module also supports a command register (R1) which can be written with the following instruction codes:

| Command | Dec | Hex |
|--------------------------------------|-----|-----|
| Home (abort scroll) | 0 | 00 |
| Clear display | 1 | 01 |
| Blank display (text not cleared) | 8 | 08 |
| Cursor OFF or restore after blanking | 12 | 0C |
| Cursor ON & blinking | 13 | 0D |
| Cursor ON & underline | 14 | 0E |
| Move cursor left | 16 | 10 |
| Move cursor right | 20 | 14 |
| Scroll display left | 24 | 18 |
| Scroll display right | 28 | 1C |

The following shows the process which sets the register address to R1 and writes a command:



etc.

Example.

To clear the display:

- Byte 1 - 00101000_{binary}, 28_{hex}
- Byte 2 - 00000001_{binary}, 01_{hex}
- Byte 3 - 1_{decimal}

A further two commands allow special characters to be defined and characters to be displayed at particu-

lar locations without having to re-write the whole display.

LCD addressing

Each character position on the LCD occupies a memory location with a specific address. These addresses allow one or more characters to be changed on the LCD without having to re-write the whole screen i.e. if you want to update just a temperature value on a display which reads ‘Temperature = 25oC’.

To accomplish this the DD address of the character position is written to register ‘R1’ and then the character to register ‘R0’.

Example:

To write the character ‘A’ to position 6 of line 1 on a 16 x 2 type display:

- Byte 1 - 00101000_{binary}, 28_{hex}
- Byte 2 - 00000001_{binary}, 01_{hex}
- Byte 3 - 134_{decimal}, 86_{hex}

- Byte 1 - 00101000_{binary}, 28_{hex}
- Byte 2 - 00000000_{binary}, 00_{hex}
- Byte 3 - ‘A’_{ASCII}

134 is calculated from the line start address 128, plus 6.

Note: All character based LCD modules use a 40-character per line RAM storage area. This means that if 20 characters were written to a 16-character display then only the first 16 characters would be displayed, with the missing 4 being stored in RAM but not displayed. A scroll-left of the display would then be necessary to view the additional characters.

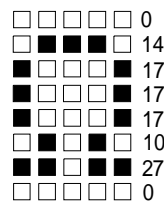
It should also be noted that once the end of the current line is reached the display does not automatically wrap-around to the next line, a new line start address must be written.

Character Definition

The LCD contains a small amount of Character-Generator or CG RAM to allow the definition of special characters. Only 8 special characters are definable and displayed by writing a value of 0 to 7 into the display e.g. to display ‘ohms Ω’ the omega must be firstly defined as CG character 0 and be displayed by writing:

- Byte 1 - 00101000_{binary}, 28_{hex}
- Byte 2 - 00000000_{binary}, 00_{hex}
- Byte 3 - ‘o’_{ASCII}
- Byte 4 - ‘h’_{ASCII}
- Byte 5 - ‘m’_{ASCII}
- Byte 6 - ‘s’_{ASCII}
- Byte 7 - ‘.’_{ASCII}
- Byte 8 - 0_{decimal}, 00_{hex}

To define the omega character in CG RAM eight values are required to make up the character shape. These values consist of the binary representation, or bit map, of the character as follows:



Firstly the character address is written to register ‘R1’ consisting:

64_{decimal} + (8_{decimal} x CG character)

where CG character = character to define 0 to 7 for CG 0 address would be 64_{decimal}.

The above bit map values are then written to register ‘R0’ in the order shown to define the character.

Example:

To define the character omega:

- Byte 1 - 00101000_{binary}, 28_{hex}
- Byte 2 - 00000001_{binary}, 01_{hex}
- Byte 3 - 64_{decimal}, 40_{hex}

- Byte 1 - 00101000_{binary}, 28_{hex}
- Byte 2 - 00000000_{binary}, 00_{hex}
- Byte 3 - 0_{decimal}
- Byte 4 - 14_{decimal}
- Byte 5 - 17_{decimal}
- Byte 6 - 17_{decimal}
- Byte 7 - 17_{decimal}
- Byte 8 - 10_{decimal}
- Byte 9 - 27_{decimal}
- Byte 10 - 0_{decimal}

To then display the omega character at the beginning of line one:

- Byte 1 - 00101000_{binary}, 28_{hex}
- Byte 2 - 00000001_{binary}, 01_{hex}
- Byte 3 - 128_{decimal}, 80_{hex}

- Byte 1 - 00101000_{binary}, 28_{hex}
- Byte 2 - 00000000_{binary}, 00_{hex}
- Byte 3 - 0_{decimal}, 00_{hex}

LCDD5 control commands

To allow the setup of backlight colour/brightness, new serial baud rate etc. the module supports a control command register (R2) which can be written with the following instruction codes/values:

| Command | Dec | Hex |
|--------------------|-----|-----|
| Backlight - OFF | 0 | 00 |
| RED pulsing | 1 | 01 |
| GREEN pulsing | 2 | 02 |
| BLUE pulsing | 3 | 03 |
| BLUE/GREEN pulsing | 4 | 04 |

| | | |
|-----------------------|----|-----|
| RED/BLUE pulsing | 5 | 05 |
| RED/GREEN pulsing | 6 | 06 |
| RGB pulsing | 7 | 07 |
| Not implemented | 8 | 08 |
| Not implemented | 9 | 09 |
| Not implemented | 10 | 0A |
| Not implemented | 11 | 0B |
| Not implemented | 12 | 0C |
| Not implemented | 13 | 0D |
| Colour wheel | 14 | 0E |
| Backlight - ON | 15 | 0F |
| BAUD rate - 1200baud | 16 | 10 |
| BAUD rate - 2400baud | 17 | 11 |
| BAUD rate - 4800baud | 18 | 12 |
| BAUD rate - 9600baud | 19 | 13* |
| BAUD rate - 19200baud | 20 | 14 |
| BAUD rate - 38400baud | 21 | 15 |
| BAUD rate - 57600baud | 22 | 16 |
| LCD 1 line display | 32 | 20 |
| LCD 2 line display | 33 | 21* |

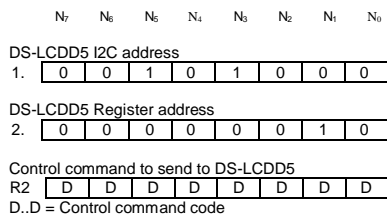
* Factory defaults

Serial baud rate and LCD lines are stored within non-volatile memory to ensure recall upon the next power-up.

The backlight defaults to 'OFF' on every power-up.

Values 0 to 15 control the operation of the RGB backlight to allow it to be turned ON (15 decimal), turned OFF (0 decimal) or set to a pulsing display.

The following shows the process which sets the register address to R2 and writes a command:



There are also a further seven (7) registers (R3-R9) as follows:

- R3 RED backlight setup
- R4 GREEN backlight setup
- R5 BLUE backlight setup
- R6 Scan speed setup
- R7 HUE backlight setup
- R8 SATURATION backlight setup
- R9 BRIGHTNESS backlight setup
- R10 RGB backlight type setup

Each can be accessed in the same manner as register R2 above and allow the backlight colour and colour pulsing speed to be set.

Examples:

To turn ON the backlight:

Byte 1 - 00101000_{binary}, 28_{hex}
 Byte 2 - 00000010_{binary}, 02_{hex}
 Byte 3 - 15_{decimal}, 0F_{hex}

To set the backlight to the R.G.B value of 254_{decimal}, 128_{decimal}, 192_{decimal} (Pink) requires three transactions:

Byte 1 - 00101000_{binary}, 28_{hex}
 Byte 2 - 00000011_{binary}, 03_{hex}
 Byte 3 - 254_{decimal}, FE_{hex}

Byte 1 - 00101000_{binary}, 28_{hex}
 Byte 2 - 00000100_{binary}, 04_{hex}
 Byte 3 - 128_{decimal}, 80_{hex}

Byte 1 - 00101000_{binary}, 28_{hex}
 Byte 2 - 00000101_{binary}, 05_{hex}
 Byte 3 - 192_{decimal}, C0_{hex}

To set the backlight to BLUE pulsing at medium-fast speed requires two transactions:

Byte 1 - 00101000_{binary}, 28_{hex}
 Byte 2 - 00000010_{binary}, 02_{hex}
 Byte 3 - 3_{decimal}, 03_{hex}

Byte 1 - 00101000_{binary}, 28_{hex}
 Byte 2 - 00000110_{binary}, 06_{hex}
 Byte 3 - 64_{decimal}, 40_{hex}

The RGB backlight type setup can be configured using register R10 from the normal R,G,B and common Anode to five different formats and common Anode or Cathode :

| Type | Dec | Hex |
|----------------|-----|-----|
| R,G,B | 0 | 00* |
| G,R,B | 1 | 01 |
| G,B,R | 2 | 02 |
| B,G,R | 3 | 03 |
| B,R,G | 4 | 04 |
| R,B,G | 5 | 05 |
| Common Anode | 16 | 10* |
| Common Cathode | 32 | 20 |

To reconfigure for G,R,B and common Cathode = 1 + 32 = 33:

Byte 1 - 00101000_{binary}, 28_{hex}
 Byte 2 - 00001010_{binary}, 0A_{hex}
 Byte 3 - 33_{decimal}, 21_{hex}

Note: When configuring for common Cathode the zero ohm jumper R7 must be removed and placed on R8. Do NOT place both R7 & R8 at the same time, this will damage the LCDD5.

Finally, there are also registers R11 & R12 which allow the default I²C

address 00101000_{binary}, 28_{hex} to be changed to any required.

The new address must be written into R11 first and then R12 to take effect. The following example shows an address change from 28_{hex} to 2C_{hex} :

Byte 1 - 00101000_{binary}, 28_{hex}
 Byte 2 - 00001011_{binary}, 0B_{hex}
 Byte 3 - 00101100_{binary}, 2C_{hex}

Byte 1 - 00101000_{binary}, 28_{hex}
 Byte 2 - 00001100_{binary}, 0C_{hex}
 Byte 3 - 00101100_{binary}, 2C_{hex}

Note: This procedure should be used with extreme caution, as the new address is effective immediately register R12 is written and may render the DS-LCDD5 un-usable if the new address collides with another on the I²C bus or is forgotten.

The DS-LCDD5 stores the address in non-volatile memory and recalls this on power application.

Testing

The DS-LCDD5 can be tested for operation by shorting the 'SI' input to '+5V' and applying power. The Part Number and firmware version are displayed on the LCD until power is removed, e.g.:

DS-LCDD5 (C)2014
Version 2.00

Note: Ensure that no other serial connection is made to prevent damage to external serial equipment such as the PC.

Table 1.0

LCD Display addresses

16 characters x 2 lines:

| | | | | | | | | | | | |
|------------|-----|-----|-----|-----|-----|-----|-----|-------|-----|-------|--------|
| Line 1 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | ..... | 15 | ..... | 39 |
| DD Address | 128 | 129 | 130 | 131 | 132 | 133 | 134 | ..... | 143 | ..... | 167 |
| | | | | | | | | | | | Hidden |
| Line 2 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | ..... | 79 | ..... | 103 |
| DD Address | 192 | 193 | 194 | 195 | 196 | 197 | 198 | ..... | 207 | ..... | 231 |
| | | | | | | | | | | | Hidden |

20 characters x 2 lines:

| | | | | | | | | | | | |
|------------|-----|-----|-----|-----|-----|-----|-----|-------|-----|-------|--------|
| Line 1 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | ..... | 19 | ..... | 39 |
| DD Address | 128 | 129 | 130 | 131 | 132 | 133 | 134 | ..... | 147 | ..... | 167 |
| | | | | | | | | | | | Hidden |
| Line 2 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | ..... | 83 | ..... | 103 |
| DD Address | 192 | 193 | 194 | 195 | 196 | 197 | 198 | ..... | 211 | ..... | 231 |
| | | | | | | | | | | | Hidden |

40 characters x 2 lines:

| | | | | | | | | | |
|------------|-----|-----|-----|-----|-----|-----|-----|-------|-----|
| Line 1 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | ..... | 39 |
| DD Address | 128 | 129 | 130 | 131 | 132 | 133 | 134 | ..... | 167 |
| Line 2 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | ..... | 103 |
| DD Address | 192 | 193 | 194 | 195 | 196 | 197 | 198 | ..... | 231 |

20 characters x 4 lines:

| | | | | | | | | | |
|------------|-----|-----|-----|-----|-----|-----|-----|-------|-----|
| Line 1 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | ..... | 19 |
| DD Address | 128 | 129 | 130 | 131 | 132 | 133 | 134 | ..... | 147 |
| Line 2 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | ..... | 83 |
| DD Address | 192 | 193 | 194 | 195 | 196 | 197 | 198 | ..... | 211 |
| Line 3 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | ..... | 39 |
| DD Address | 148 | 149 | 150 | 151 | 152 | 153 | 154 | ..... | 167 |
| Line 4 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | ..... | 103 |
| DD Address | 212 | 213 | 214 | 215 | 216 | 217 | 218 | ..... | 231 |

Note : RED boxed values denote line start addresses

Electrical Characteristics (T_A = 25°C Typical)

| Parameter | Minimum | Maximum | Units | Notes |
|---------------------------|---------|---------|-------|-------|
| Supply Voltage (5V) | 4.5 | 5.5 | V | |
| Supply Voltage (7-15V) | 7 | 15 | V | |
| Supply Current | 3 | 3.5 | mA | 1 |
| RS232 RX data input level | -15 | +15 | V | |
| I2C Bus Speed | - | 400 | kHz | |
| I2C Input Voltage | -0.3 | VCC | V | |

Absolute Maximum Ratings

| Parameter | Minimum | Maximum | Units |
|------------------------|---------|---------|-------|
| Supply Voltage (5V) | -0.5 | +6 | V |
| Supply Voltage (7-15V) | -0.5 | 16V | V |

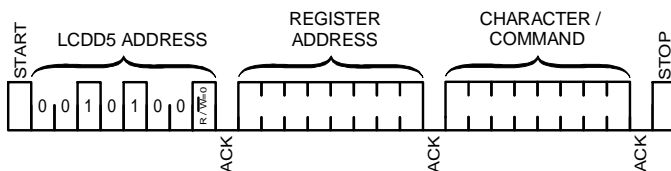
Environmental

| Parameter | Minimum | Maximum | Units |
|-----------------------|-------------------------------|---------|-------|
| Operating Temperature | -5 | 70 | °C |
| Storage Temperature | -10 | 80 | °C |
| Humidity | 0 | 80 | % |
| Immunity & emissions | EMC compliance to 2004/108/EC | | |

Notes:

1. Value given does not include backlight current.

Figure 1.0 (I²C write protocol)



Multiple bytes may be written before the 'STOP' condition. Characters are written to the LCD display at the current cursor position. Each character transfer is acknowledged 'ACK' by the LCDD5 until the 'STOP' condition.

LCD connections:

The DS-LCDD5 features two types of LCD connector, SIL (Single In Line) and DIL (Dual In Line), these being pinned as follows:

- | | |
|-----------------------|-----------------------|
| 18 ● Backlight Blue - | 18 ● Backlight Blue - |
| ● Backlight Green - | ● Backlight Green - |
| ● Backlight Red - | ● Backlight Red - |
| ● Backlight + | ● Backlight + |
| ● Data bit 7 | ● Data bit 7 |
| ● Data bit 6 | ● Data bit 6 |
| ● Data bit 5 | ● Data bit 5 |
| ● Data bit 4 | ● Data bit 4 |
| ● Data bit 3 | ● Data bit 3 |
| ● Data bit 2 | ● Data bit 2 |
| ● Data bit 1 | ● Data bit 1 |
| ● Data bit 0 | ● Data bit 0 |
| ● Enable | ● Enable |
| ● Ground | ● Ground |
| ● Data/Instruction | ● Data/Instruction |
| ● Contrast | ● Contrast |
| ● VCC | ● VCC |
| 1 ● Ground | 1 2 |



WEEE Consumer Notice

This product is subject to Directive 2002/96/EC of the European Parliament and the Council of the European Union on Waste of Electrical and Electronic Equipment (WEEE) and, in jurisdictions adopting that Directive, is marked as being put on the market after August 13, 2005, and should not be disposed of as unsorted municipal/public waste. Please utilise your local WEEE collection facilities in the disposition and otherwise observe all applicable requirements. For further information on the requirements regarding the disposition of this product in other languages please visit www.designersystems.co.uk

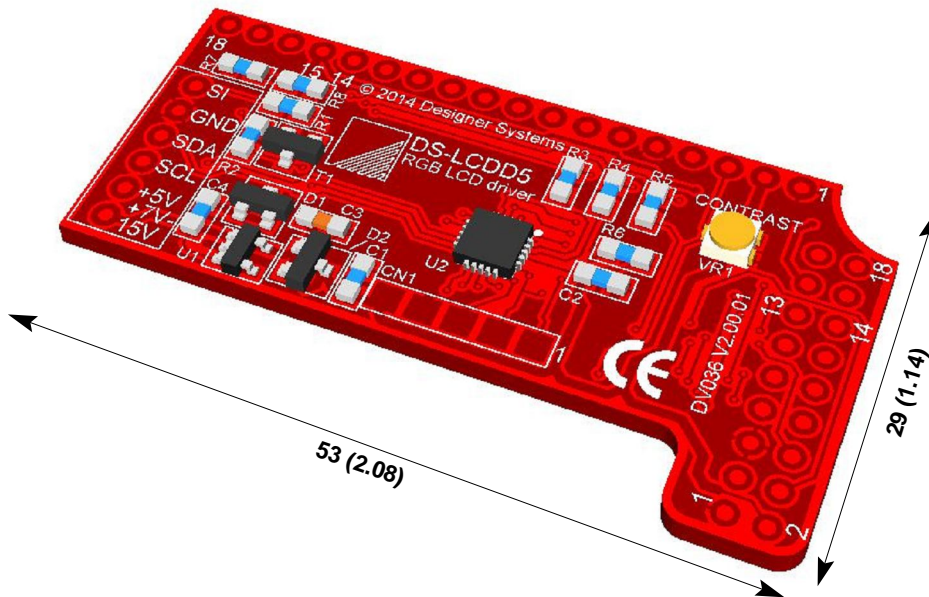


RoHS Compliance

This product complies with Directive 2002/95/EC of the European Parliament and the Council of the European Union on the Restriction of Hazardous Substances (RoHS) which prohibits the use of various heavy metals (lead, mercury, cadmium, and hexavalent chromium), polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE).

Mechanical Specifications – Units millimetres (inches)

Design subject to change without notice.



Declaration of Conformity

Apparatus name / model number DS-LCDD5
Conformity via Generic Standard EN50081-1
Generic Standard EN50082-1

Conformity criteria For use only within commercial, residential and light industrial applications

We certify that the apparatus identified above conforms to the requirements of Council Directive 2004/108/EC & 2006/95/EC

Signed.  **Date** 1/4/05

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Description of apparatus LCD panel interface peripheral

Having made this declaration the CE mark is affixed to this product, its packaging, manual or warranty.

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