CW1602 User Manual

by

Cwlinux Ltd.

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Revision History

Author	*Revision*	*Content*	*Date*
IL	1	Initial released	12/04/03
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Table of Contents

Chapter 1. Introduction

1.1. Introduction

The CW1602 is a character LCD which user can show both text and bar charts via a connection of a computer/appliance/server. The module includes a set of simple commands that allows user to develop their own LCD environment.

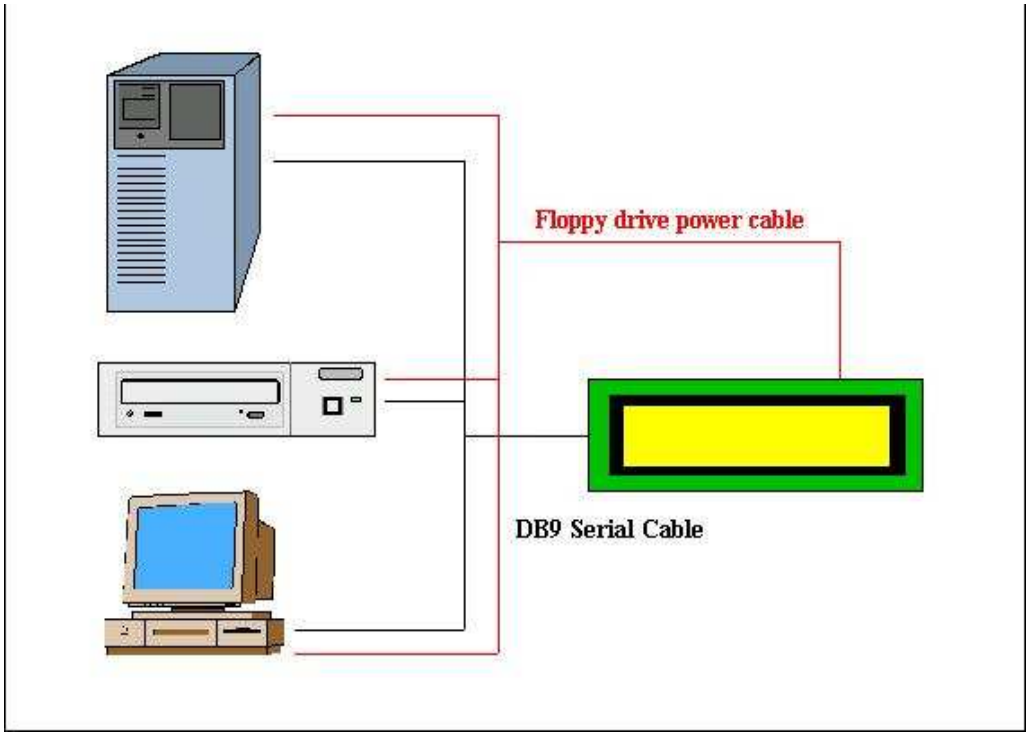
1.2. Features

- 16 columns × 2 lines text display
- Built in characters plus 8 user defined characters
- Communicate over RS232 or USB interface
- Baud rate speed selection between 9600 and 19200 bps
- Programmable brightness and on/off of LED backlight
- Underline and blinking block cursors
- Horizontal and vertical bar charts
- 32 bytes reserved non-volatile memory spaces for user settings
- Non volatile memory spaces for 8 user defined characters
- Non volatile memory spaces for startup screen
- 4 General Purpose I/Os
- 6 buttons keypad input interface
- Fit in a standard half height 5¼ drive bay or 1U rack mount case

1.3. Installation and Connection

1.3.1. Serial Connection

Only simple connection is required. CW1602 obtains power from the PC standard floppy power connector (Drawing 2). User should take extremely care in connecting the power to CW1602. ***Reversing the polarity of the connector may result in burning the CW1602***. Drawing 1 shows how to connect the CW1602 to a Personal Computer, a 1U appliance or a Server Station. For a serial CW1602, user only needed to connect a DB9 cable (Standard COM port cable) together with a power cable (Standard Floppy Drive Power Cable).

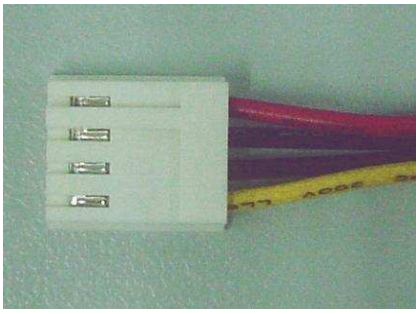


Drawing 1 Serial connection diagram.

1.3.2. Power Connection

Pin	1	2	3	4
Name	12V	GND	GND	5V

Drawing 2 Power connector.



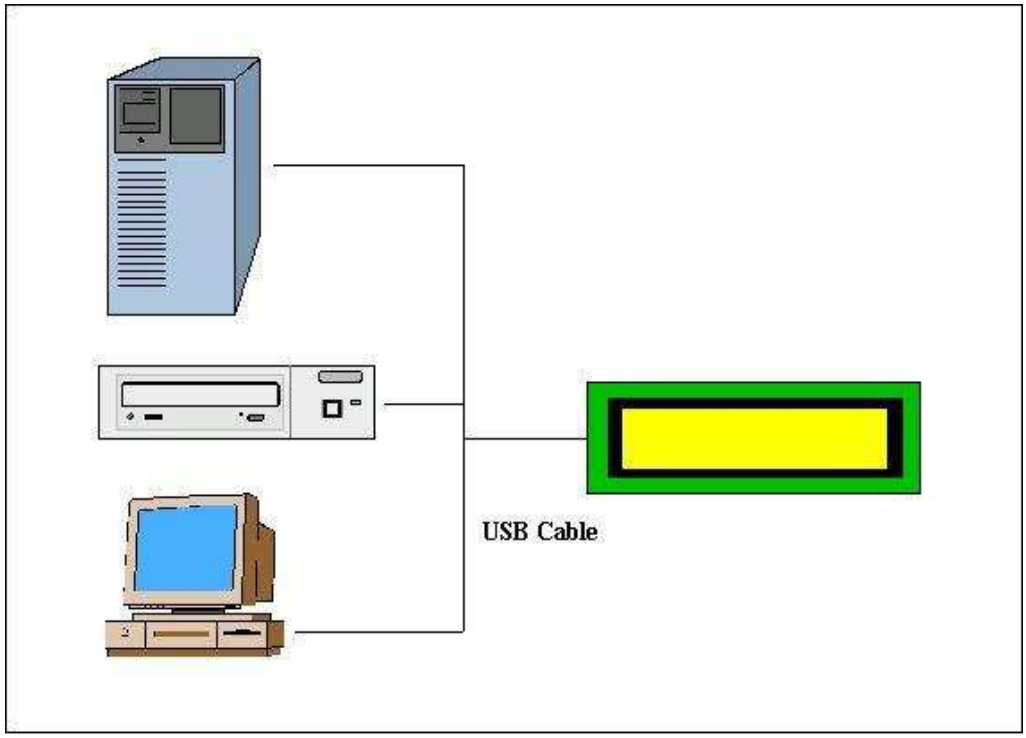
Drawing 3 Proper power plug.

User should take extremely care if he intended to connect it with another type of power supply. ***Please notice the pin assignments of the power connector before plugging the power plug into the CW1602. Improper connection of the power may burn the CW1602.***

The bouncing reset switch SW1 is used to reset the micro-controller whenever necessary. Remote reset switch can also be found in JP1, please refer to the GPIO in session 1.3.7.

1.3.3. USB Connection

The Connection of a USB CW1602 is much more easier. The USB version of CW1602 can be powered up by just connecting a USB cable. No other power supply is required as the power comes from the USB cable itself. The LCD is on once the USB cable is connected.



Drawing 4 USB connection diagram.

1.3.4. USB Driver

Driver of the USB version of CW1602 can be obtained at www.cwlinux.com/eng/downloads. Type in the followings (only in Linux) to load the driver,

```
# tar zxf ld_pl2303_v0213.tar.gz
# cd ld_pl2303_v0213
# make
# modprobe usb-ohci or modprobe usb-uhci
# insmod usbserial.o
# insmod pl2303.o
```

Note: Although the stock version of Linux driver works, it has problem during high speed transfer. This driver fixes the problem. It is recommended to use the above driver instead of the stock driver.

1.3.5. USB driver for Windows

Latest version of USB driver for CW1602 can be downloaded at http://tech.prolific.com.tw. In the website, search for latest driver for PL2303. Then, install the driver according to the readme file.

1.3.6. Keypad Pin Assignments

Drawing 5 Keypad pin assignments

Pin	8	7	6	5	4	3	2	1
Name	GND	Cancel	Confirm	Right	Left	Down	Up	+5V

User may user the keypad, which Cwlinux provides it as an optional feature, or they may connect their keypad according to the pin configuration of JA. The micro-controller returns character only when one of the pins (Up, Down, Left, Right, Confirm or Cancel) is connected to ground (pin 8).

1.3.7. GPIO, Relay Pin Assignments

Drawing 6 GPIO pin assignments.

Pin	1	2	3	4	5	6	7	8	9	10
Name	GPO0	GPO1	GPI0	GPI1	RST	+5V	GND	GND	NC	NC

User can connect their external I/O devices to JP1. Detail description of the GPIO can refer to sessions 5.5.1 to 5.5.3. RST is the reset pin of the CW1602. Connect it to +5V will reset the CW1602. (Notice the top pin is the pin 1.)

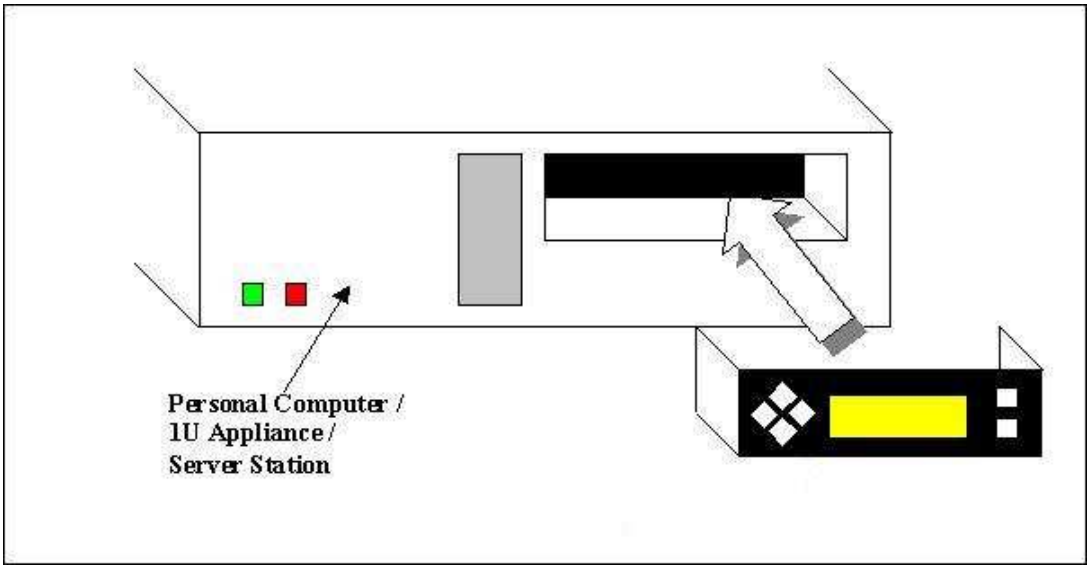
1.3.8. Contrast Adjustment

Drawing 7 Trimpot location.

User can change the contrast of the LCD by adjusting the trimpot R7. Notice the CW1602 is shipped with default adjusted contrast voltage.

1.3.9. Installation

The CW1602 can completely fit into a single 5 ¼ PC bay or a 1U rack mount, which may enhance user to get display information (basically 2x16 characters) in only a small area. The diagram drawn below shows how the module is mounting on a single PC bay insert.



Drawing 8 Installation of the CW1602.

1.3.10. Test the Module

User may test the module in the following way,

1. Open the minicom
2. Press [Ctrl A] then [O] to bring up configuration
3. Choose “Serial port setup” in configuration
4. Change item A to /dev/ttyS0 if user is using the serial CW1602 and is connected to COM1
5. Change item A to /dev/ttyS1 if user is using the serial CW1602 and is connected to COM2
6. Change item A to /dev/ttyUSB0 if user is using the USB CW1602 and is connected to USB port
7. Change item E to 19200 8N1 as this is the default value of CW1602 during power up.
8. Exit “Serial port setup”
9. Choose “Save setup as dfl1” in configuration
10. Exit configuration

11. Re-open minicom
12. Type some characters on keyboard and it should appear on the LCD.

User may test the keypad in the following way,

1. Repeat step 1-11 as above.
2. Press a button on the keypad and it should have character echoed back (5.3.3) corresponding to the button you pressed.

1.3.11. Demo Software

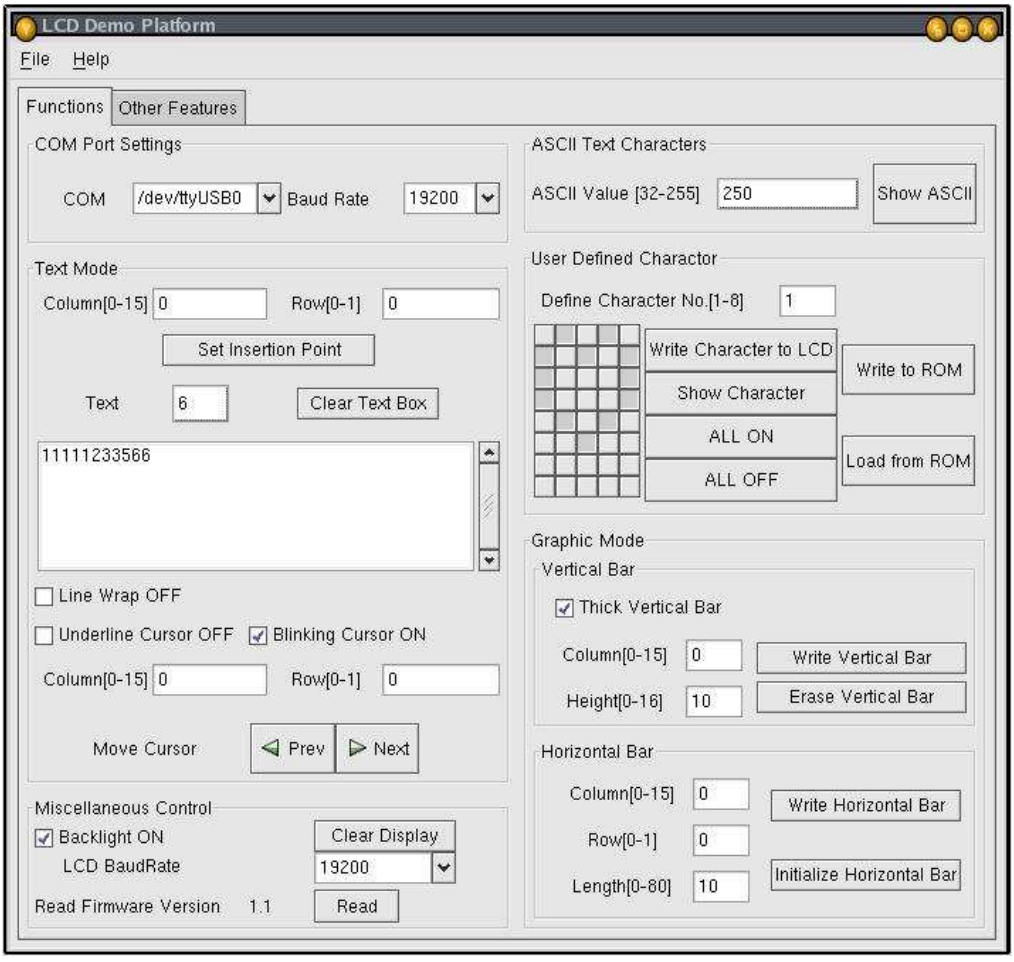
User can download the demo software rpm from www.cwlinux.com/eng/downloads. Run the rpm as the following,

```
$ rpm -Uvh lcdtest-1602-0.1-CWLINUX_1.i386.rpm
```

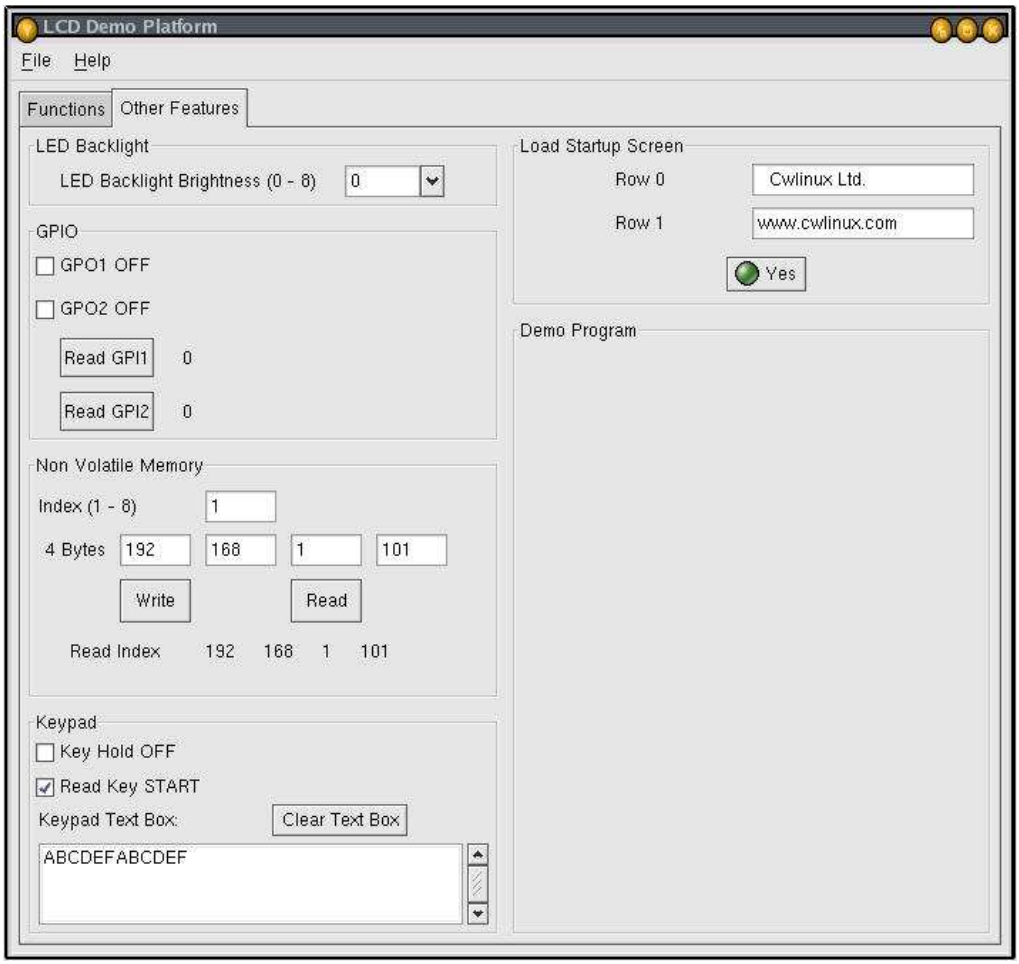
then, run the binary as the following,

```
$ lcdtest
```

With this demo software, user can test all basic functions of CW1602.



Drawing 9 Demo Software page 1.



Drawing 10 Demo Software page 2

1.3.12. Serial Number Notation

We provide different versions of CW1602 for user to choose. User can choose the one which suit to his application. Here listed below is some explanation of a serial number.

CW 1602 Y-KS

Item	***Meaning***
CW	CWlinux
1602	LCD character matrix size
Y	Backlight color
K	Keypad supported
S	S - Serial, U - USB

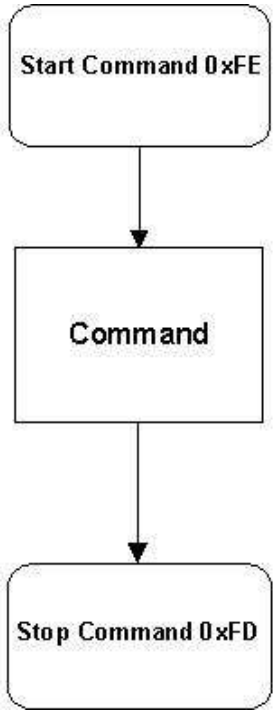
Chapter 2. Module Programming

2.1. Command Sending

Commands are sent via the RS232 port together with 2 other numbers, the command starts with [254] and ends at [253]. For example, in PC, user will need to write the following lines in order to send a complete command to CW1602.

```
Void LCD_Write_Command(BYTE [command])
{……
LCD_Write(254);
LCD_Write([command]);
LCD_Write(253);
……..
};
```

2.2. Flowchart



Drawing 11 Flowchart.

Chapter 3. Text Mode

3.1. Built in Characters

Size of all built in characters is defined by a 5 x 7 dot matrix. User is required to send the ASCII code of the corresponding character in order to display it. Some of the common ASCII characters are listed in the following table. Details of the font table please refer to the appendix. Note: UD stands for User Defined.

ASCII	Character	ASCII	Character	ASCII	Character	ASCII	Character
1	UD	44	,	72	H	100	d
2	UD	45	-	73	I	101	e
3	UD	46	.	74	J	102	f
4	UD	47	/	75	K	103	g
5	UD	48	0	76	L	104	h
6	UD	49	1	77	M	105	i
7	UD	50	2	78	N	106	j
8	UD	51	3	79	O	107	k
9		52	4	80	P	108	l
10		53	5	81	Q	109	m
11		54	6	82	R	110	n
12		55	7	83	S	111	o
13		56	8	84	T	112	p
14		57	9	85	U	113	q
15		58	:	86	V	114	r
16		59	;	87	W	115	s
32	[space]	60	<	88	X	116	t
33	!	61	=	89	Y	117	u
34	“	62	>	90	Z	118	v
35	#	63	?	91	[	119	w
36	$	64	@	92	\	120	x
37	%	65	A	93	]	121	y
38	&	66	B	94	^	122	z
39	‘	67	C	95	_	123	{
40	(	68	D	96	`	124	|
41	)	69	E	97	a	125	}
42	*	70	F	98	b	126	->
43	+	71	G	99	c	127	<-

Table 1 Characters table

Apart from the built in characters listed in the above table, user can also define their own characters in the spaces from [0x01] to [0x08] in CW1602. Details of how to define the character may refer to section 4.2.7.

3.2. Writing Text to CW1602

When user sends a character to CW1602, it displays at the location which defined before. The next character will automatically display at the location next to the previous character. Characters which are drawn please refer to the built in characters table showed above. User wants to display their own characters will need to specify it in the user defined character session.

3.3. Text Commands

User may use the following commands to program CW1602. He may need to read chapter 2 to have better knowledge of how to send these commands accordingly. The numbers showed below are measured in decimal. A summary of different kinds of number system is shown in chapter 6.

3.3.1. Auto Line Wrap ON (254 67 253)

This command enables word wraps to next line when character reaches the end of a line. **Default is OFF**.

3.3.2. Auto Line Wrap OFF (254 68 253)

Disables line wrap. Character will return to the first position of the original line if it reaches the end of a line. **Default is OFF**.

3.3.3. Text Insertion Point (254 71 [column] [row] 253)

This command moves the text insertion point to the location which specified by [column] and [row]. Column has the value ranging from 0 (0x00) to 15 (0x0F) and row has the value ranging from 0 (0x00) to 1 (0x01).

3.3.4. Set Text Insertion Point to Top Left (254 72 253)

This command sets the text insertion point to top left of the LCD. ie. [column] = 0 and [row] = 0.

3.3.5. Turn On Underline Cursor (254 74 [column] [row] 253)

Turns on the underline cursor at position [column] and [row]. **Default is OFF**.

3.3.6. Turn Off Underline Cursor (254 75 253)

Turns off the underline cursor. **Default is OFF.**

3.3.7. Turn On Blinking Block Cursor (254 89 [column] [row] 253)

Turns on the underline cursor at position [column] and [row]. **Default is OFF**.

3.3.8. Turn Off Blinking Block Cursor (254 90 253)

Turns off the underline cursor. **Default is OFF.**

3.3.9. Move Cursor Left (254 76 253)

Moves cursor to left.

3.3.10. Move Cursor Right (254 77 253)

Moves cursor to right.

Chapter 4. Bar Charts, User Defined Characters and Graphics

4.1. Introduction

The CW1602 offers the ability of drawing horizontal graphs, vertical graphs and text simultaneously on the same screen. Details of how to draw the graphs are described as the followings.

4.2. Command List

4.2.1. Initialize Wide Vertical Bar Graph (254 118 253)

This command defines the width of the vertical bar to 5 pixels. **Default is OFF**.

4.2.2. Initialize Narrow Vertical Bar Graph (254 115 253)

This command defines the width of the vertical bar to 2 pixels. **Default is OFF**.

4.2.3. Draw Vertical Bar Graph (254 61 [column] [height] 253)

The vertical bar graph is drawn at position [column] and row = 1 (the lower bottom) with the [height] specified. The height can be ranging from 0 (0x00) to 16 (0x10).

4.2.4. Erase Vertical Bar Graph (254 45 [column] 253)

The vertical bar graph is erased at position [column] and row = 1 (the lower bottom).

4.2.5. Initialize Horizontal Bar Graph (254 104 253)

This command defines the horizontal bar. **Default is OFF**.

4.2.6. Draw Horizontal Bar Graph (254 124 [column] [row] [length] 253)

The horizontal bar graph is drawn at position [column] and [row] with length [length] and goes from left to right. The length can be ranging from 0 (0x00) to 80 (0x7A).

4.2.7. Define Custom character (254 78 [cc] [8 bytes] 253)

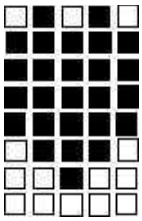
The CW1602 allows user to define 8 extra characters by himself. These defined characters are stored in location starting from [0x01] to [0x08] with the ASCII value in Table 1.

The characters are defined by sending the command 254 78 [cc] followed by 8 bytes. [cc] is the character number starting from [0x01] to [0x08]. The 8 bytes are mapped as the following table.

Data Byte	MSB							LSB
1				5	4	3	2	1
2				10	9	8	7	6
3				15	14	13	12	11
4				20	19	18	17	16
5				25	24	23	22	21
6				30	29	28	27	26
7				35	34	33	32	31
8				40	39	38	37	36

Table 2 User defined characters bit mapping.

A “1” bit represents an **ON** (Dark) pixel while a “0” represents an **OFF** (Clear) pixel. For instance, if user wants to define the following heart in the character space 0x01, he may need to send the following bytes to CW1602.



0xfe [start byte],
0x4e [command byte],
0x01 [character location],
0x0a, 0x1f, 0x1f, 0x1f, 0x1f, 0x0e, 0x04, 0x00 [8 bytes],
0xfd[stop byte]

Once defined, a character is displayed simply by sending a value from (0x01) to (0x08) which is corresponding to the character number.

Chapter 5. Miscellaneous Commands

5.1. General Command List

5.1.1. Read Model Number (254 48 253)

This command enables user to read back the model number of CW1602. 2 bytes 16 [0x10] and 2 [0x02], which represent the character matrix size, will be sent accordingly from CW1602 to the host after this request command is sent.

5.1.2. Read Firmware Version (254 49 253)

This command enables user to read back a 2-byte firmware version. For example, 2 bytes 0x01 and 0x00, which represent version V1.0, will be sent accordingly from CW1602 to the host when it sends this request command to CW1602.

5.1.3. Soft Reset (254 86 253)

This command resets the CW1602. Everything will start from startup screen again.

5.1.4. Clear Display (254 88 253)

This command clears the entire screen and set the text insertion point to top left. ie. [Column] = 0 and [Row] = 0.

5.1.5. Set RS232 port speed (254 57 [speed] 253)

This command sets the RS232 port speed specified by [speed]. [speed] is a single byte which specifies a desired port speed. Details of [speed] can refer to the following table.

Speed Byte	***Baud Rate***
0x20	9600
0x0F	19200

Table 3 Baud rate table. ***Default is 19200****.*

5.2. Backlight Command List

5.2.1. Backlight On (254 66 253)

This command turns on the LED backlight of the LCD with maximum brightness. **Default is ON**.

5.2.2. Backlight Off (254 70 253)

This command turns off the LED backlight of the LCD. **Default is ON.**

5.2.3. Backlight Brightness (254 65 [brightness] 253)

User can adjust the brightness of the backlight LED by sending this command with 7 levels of brightness. [brightness] ranges from 1 to 7 and 7 is the maximum while 1 is the minimum. Please notice the maximum brightness can be obtained by backlight on command and minimum brightness is obtained by backlight off command.

5.3. Keypad Command List

5.3.1. Auto Key Hold On (254 50 253)

This command enables the CW1602 to send character back continuously for every 0.5s if one of the keys on the keypad is continuously hold down. **Default is OFF.**

5.3.2. Auto Key Hold Off (254 51 253)

This command makes the CW1602 only to send a single character back when one of the keys on the keypad is pressed or continuously hold down. **Default is OFF.**

5.3.3. Keypad Mapping

CW1602 produces a single ASCII character while anyone of the keys is pressed. The single bay panel buttons will produce the following characters. Notice all buttons have no direct effect on the display. Characters are only sent to PC's serial input. User must provide a control program in PC such that correlates the button pressed to the desire function.

Key	***Character Return***
Up	"A" (Dec 65, 0x41h)
Down	"B" (Dec 66, 0x42h)
Left	"C" (Dec 67, 0x43h)
Right	"D" (Dec 68, 0x44h)
Confirm	"E" (Dec 69, 0x45h)
Cancel	"F" (Dec 70, 0x46h)

Table 4 Keypad character return.

5.4. Non-Volatile Memory Command List

5.4.1. Save User Defined Character in Non-Volatile Memory (254 79 [cc] 253)

User can save their predefined characters in the non-volatile memory and this will save much time in redefining it again after the power of CW1602 is switched off and on. [cc] is the character number starting from [0x01] to [0x08].

5.4.2. Load User Defined Character in System RAM (254 80 [cc] 253)

During power up, user can load their redefined characters from non-volatile memory into the system RAM by sending this command to CW1602. [cc] is the character number starting from [0x01] to [0x08].

5.4.3. Save User Settings in Non-Volatile Memory (254 83 [ud] [4 bytes] [4 dummy bytes] 253)

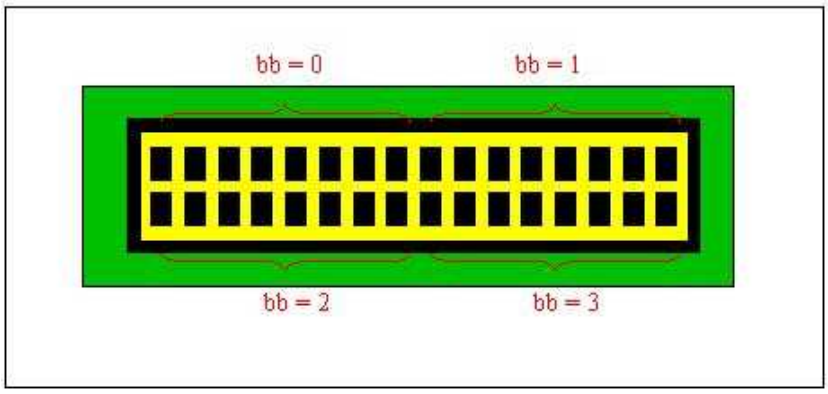
The CW1602 reserves 32 bytes of non-volatile memory for arbitrary use by the host. This memory could be used to store a serial number, IP address, gateway address, netmask or any other data required.

[ud], which starts from 1 [0x01] to 8 [0x08], is the location of a data.

5.4.4. Read User Settings from Non-Volatile Memory (254 84 [ud] 253)

User predefined settings can be retrieved by sending this command to CW1602. [ud] is the location of the data. 4 bytes will be sent from CW1602 to the host right after the command is sent.

5.4.5. Save Custom Startup Screen (254 64 [bb] [8 bytes] 253)



Drawing 12 Startup screen layout

User can define his own startup screen by setting this command. In order to save the whole screen of characters, it is necessary to issue this command FOUR times. [bb] is the byte number corresponding to the location specified as above. [8 bytes] refers to the ASCII value of 8 characters.

For example, user can send the followings to CW1602 if he wants to configure the following as his startup screen.

Drawing 13 Startup screen example

0xfe [start byte],
0x40 [command byte],
0x00 [byte number 0],
0x32, 0x32, 0x43, 0x77, 0x6c, 0x69, 0x6e, 0x75 [8 bytes],
0xfd[stop byte]

0xfe [start byte],
0x40 [command byte],
0x01 [byte number 1],
0x78, 0x32, 0x4c, 0x74, 0x64, 0x2e, 0x32, 0x32 [8 bytes],
0xfd[stop byte]

0xfe [start byte],
0x40 [command byte],
0x02 [byte number 2],
0x32, 0x32, 0x32, 0x53, 0x65, 0x72, 0x69, 0x61 [8 bytes],
0xfd[stop byte]

0xfe [start byte],
0x40 [command byte],
0x03 [byte number 3],
0x6c, 0x32, 0x4c, 0x43, 0x44, 0x32, 0x32, 0x32 [8 bytes],
0xfd[stop byte]

5.5. GPIO Command List

5.5.1. Turn ON General Purpose Output (GPO) (254 99 [gpo#] 253)

User may use the GPOs to turn on other external devices, mechanical relays or electronic devices. [gpo#] specifies which GPO is using. It can be either 0 or 1.

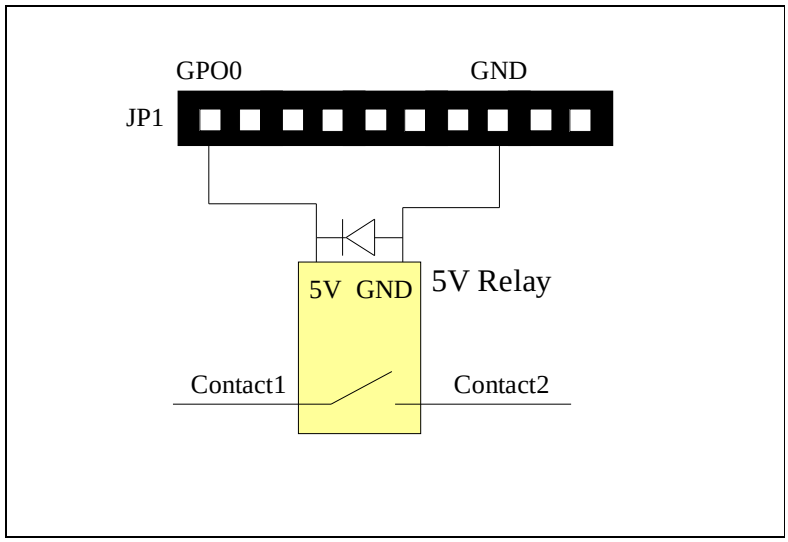
Voltage at GPO is +5V when issuing this command. The maximum current which GPO# can stand for is 100mA, which means the minimum output load should be 50 Ohm. User should take extremely care on the resistance of the load which GPO# is driving. Drawing exceeding current may damage the GPO# or even CW1602.

Below is an example of how GPO0 connects to a mechanical relay (Drawing 14). Again, please make sure the coil resistance is greater than 50 Ohm.

0xfe [start byte],
0x63 [GPO ON command],
0x00,
0xfd[stop byte]

Initially, GPO0 is in low or ground state. The 5V relay is off as the coil voltage is 0V. GPO0 switches to 5V after the above command is issued. The coil voltage now is 5V and Contact 1 and Contact 2 are connected. Notice the diode connected in between GPO0 and GND is to

prevent any back emf from damaging the relay. In addition, a polarized capacitor 4.7μF can also be added between GPO0 and GND in order to reduce any noise spike voltage and back flow of current.



Drawing 14 Typical application of GPO.

5.5.2. Turn OFF General Purpose Output (GPO) (254 100 [gpo#] 253)

GPO# will pull to low (ground) if user sends this command. [gpo#] is the GPO number which can be either 0 or 1.

5.5.3. Read Status of General Purpose Input (GPI) (254 101 [gpi#] 253)

CW1602 has 2 GPIs provided to read the status back through this command. These 2 GPIs are internally pulled up by 5V in CW1602. A '0' will be sent back to the host if the GPI# has a high input, which maybe a TTL 5V or a TTL voltage greater than 2V, or left unconnected. On the other hand, a '1' will be sent back if the GPI# has a low input, which may be ground or a TTL voltage level lower than 0.8V. However, only TTL inputs are allowed to connected to these GPIs. Table 6 below shows the DC characteristics of the GPI. User should notice it may burn the GPIs or CW1602 if the input source is out of the specification of a TTL standard.

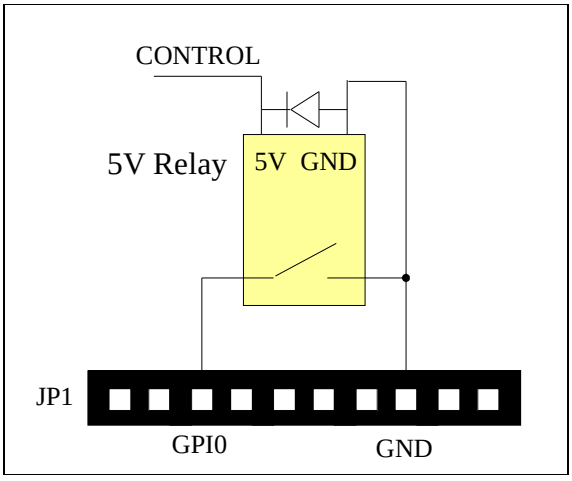
Parameters	*Symbol*	*Min*	*Typ*	*Max*	*Unit*
Input HIGH voltage	V_{IH}	2	5	7	V
Input LOW voltage	V_{IL}		0	0.8	V
Input HIGH current (VIN = 2.7V)	I_{IH}			20	μA
Input HIGH current (VIN = 7V)	I_{IH}			0.1	mA
Input Low current (VIN = 0.4)	I_{IL}			-0.4	mA

Table 5 DC characteristics of GPI

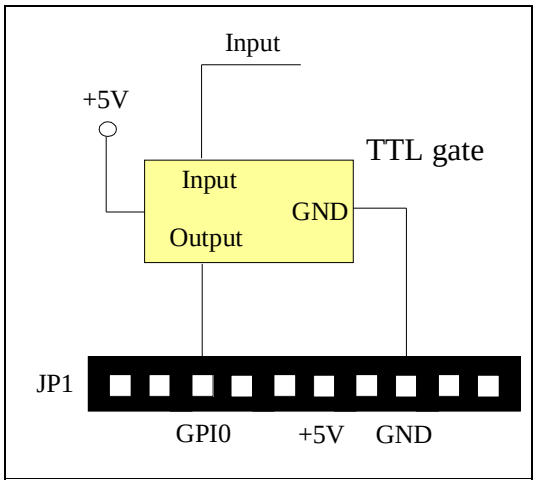
Drawings 15 and 16 showed below describe how GPI0 is connected with 2 different input sources. In drawing 15, GPI0 reads low when the pin CONTROL of the relay is activated. Thus, user will read a '1' if the following command is sent to CW1602,

0xfe [start byte],
0x65 [GPI read command],
0x00,
0xfd[stop byte]

On the other hand, it reads a '0' if the pin CONTROL level is low. Similarly, in drawing 16, GPI0 reads the output of the TTL gate and feedbacks the ***complement*** of it.



Drawing 15 Relay connected to GPI0.



Drawing 16 TTL gate connected to GPI0.

Chapter 6. Command Summary

6.1. Text Command Summary

Command	Syntax	Default	Description
Auto line wrap on	FE 43 FD	off	Enables line wrapping.
	254 67 253		Character will wrap to first position of next line if it
	254 'C' 253		reaches the end of a line.
Auto line wrap off	FE 44 FD	off	Disables line wrapping.
	254 68 253		Character will go to the first position of the original
	254 'D' 253		line if it reaches the end of a line.
Set text insertion point	FE 47 [col] [row] FD	N/A	Sets the text insertion point to [col] and [row].
	254 71 253		
	254 'G' 253		
Set text insertion point home	FE 48 FD	N/A	Sets the text insertion point to [0] and [0].
	254 72 253		
	254 'H' 253		
Underline cursor on	FE 4A [col] [row] FD	off	Turns on the underline cursor and sets it at location
	254 74 [col] [row] 253		[col] and [row].
	254 'J' [col] [row] 253		
Underline cursor off	FE 4B FD	off	Turns off the underline cursor.
	254 75 253		
	254 'K' 253		
Blinking Block cursor on	FE 59 [col] [row] FD	off	Turns on the blinking block cursor and sets it at
	254 89 [col] [row] 253		Location [col] and [row].
	254 'Y' [col] [row] 253		
Blinking Block cursor off	FE 5A FD	off	Turn off the blinking block cursor.
	254 90 253		
	254 'Z' 253		
Cursor left	FE 4C FD	N/A	Moves the underline cursor to left. It will move to the
	254 76 253		end of the same line if it reaches the beginning of a
	254 'L' 253		line.
Cursor right	FE 4D FD	N/A	Moves the underline cursor to right. It will move to the
	254 77 253		beginning of the same line if it reaches the end of a
	254 'M' 253		line.

Table 6 Summary for text commands

6.2. Bar Charts and Graphic Command Summary

Command	Syntax	Default	Description
Initial thick vertical bar graph	FE 76 FD	off	Initializes 5 pixels width as the vertical bar.
	254 118 253		
	254 'v' 253		
Initial thin vertical bar graph	FE 73 FD	off	Initializes 2 pixels width as the vertical bar.
	254 115 253		
	254 's' 253		
Define custom character	FE 4E [cc] [8 bytes] FD	N/A	Defines custom character. [cc] goes from
	254 104 [cc] [8 bytes] 253		[0x01] to 0x08]. The other 8 bytes are
	254 'N' [cc] [8 bytes] 253		described in section 4.2.7
Draw vertical bar graph	FE 3D [col] [height] FD	N/A	Draws vertical bar at position [col] of the last
	254 61 [col] [height] 253		row with height [height]. [height] ranges from
	254 '=' [col] [height] 253		[0x00] to [0x10].
Erase vertical bar graph	FE 2D [col] FD	N/A	Erases vertical bar at position [col].
	254 45 [col] 253		
	254 '-' [col] 253		
Initialize horizontal bar	FE 68 FD	off	Initialize horizontal bar graph.
graph	254 104 253		
	254 'h' 253		
Draw horizontal bar graph	FE 7C [col] [row] [len] FD	N/A	Draws horizontal bar at position [col] and [row]
	254 124 [col] [row] [len] 253		With length [length]. [length] ranges from
	254 '|' [col] [row] [len] 253		[0x00] to 0x7A].

Table 7 Summary for graphic commands

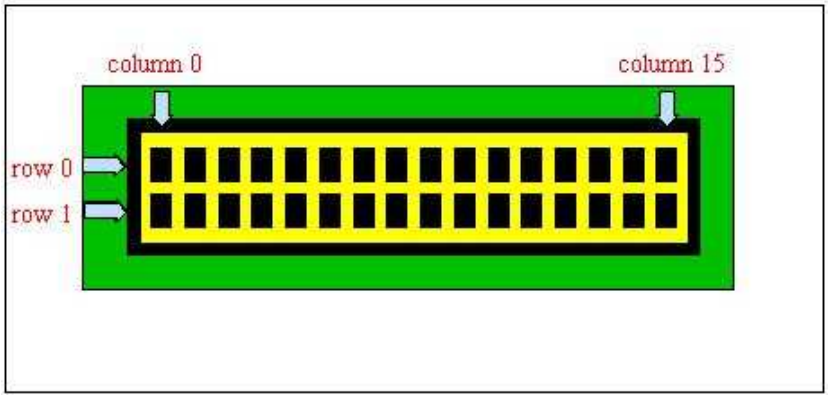
6.3. Miscellaneous Command Summary

Command	Syntax	Default	Description
Read Model Number	FE 30 FD	N/A	Reads 2 bytes back from LCD
	254 48 253		
	254 '0' 253		
Read Firmware Version	FE 31 FD	N/A	Reads 2 bytes back from LCD
	254 49 253		
	254 '1' 253		
Soft Reset	FE 56 FD	N/A	Resets CW12232
	254 86 253		
	254 'V' 253		
Clear display	FE 58 FD	off	Clears screen of LCD and places the text
	254 88 253		insertion point to top left.
	254 'X' 253		
Backlight on	FE 42 FD	on	Turns on the backlight.
	254 66 253		
	254 'B' 253		
Backlight off	FE 46 FD	on	Turns off the backlight.
	254 70 253		
	254 'F' 253		
Backlight brightness	FE 41 [brightness] FD	N/A	Adjust LED brightness. [brightness] ranges from
	254 64 [brightness] 253		1 to 7.
	254 'A' [brightness] 253		
Auto key hold on	FE 32 FD	off	Auto key hold on.
	254 50 253		
	254 '2' 253		
Auto key hold off	FE 33 FD	off	Auto key hold off.
	254 51 253		
	254 '3' 253		
Set RS232 port speed	FE 39 [speed] FD	19200	Sets RS232 port speed. Refer to section 5.1.3
	254 57 [speed] 253		for details.
	254 '9' [speed] 253		
Save user defined characters	FE 4F [cc] FD	N/A	Save user defined characters. [cc] ranges from
	254 79 [cc] 253		1 to 8.
	254 'O' [cc] 253		
Load user defined characters	FE 50 [cc] FD	N/A	Load user defined characters. [cc] ranges from
	254 80 [cc] 253		1 to 8.
	254 'P' [cc] 253		
Save user settings	FE 53 [ud] [4 bytes] [4 dummy bytes] FD	N/A	Save user settings. User is required to save 4 bytes at a time.

Command	Syntax	Default	Description
	254 83 [ud] [4 bytes] [4 dummy bytes] 253		[ud] ranges from 1 to 8.
	254 'S' [ud] [4 bytes] [4 dummy bytes] 253		
Read user settings	FE 54 [ud] FD	N/A	Read user settings. 4 bytes are returned at
	254 84 [ud] 253		each time.
	254 'T' [ud] 253		
Save custom startup screen	FE 40 [bb] [8bytes] FD	N/A	Save custom startup characters.
	254 64 [bb] [8 bytes] 253		
	254 '@' [bb] [8 bytes] 253		
GPO on	FE 63 [gpo#] FD	off	Turn on GPO. [gpo#] must be either 0 or 1.
	254 99 [gpo#] 253		
	254 'c' [gpo#] 253		
GPO off	FE 64 [gpo#] FD	off	Turn off GPO. [gpo#] must be either 0 or 1.
	254 100 [gpo#] 253		
	254 'd' [gpo#] 253		
Read GPI	FE 65 [gpi#] FD	N/A	Read status of GPI. [gpi#] must be either 0 or 1.
	254 101 [gpi#] 253		
	254 'e' [gpi#] 253		

Table 8 Summary for miscellaneous commands

6.4. Text Mode Coordinates



Drawing 17 LCD Layout

Chapter 7. LCD Specifications

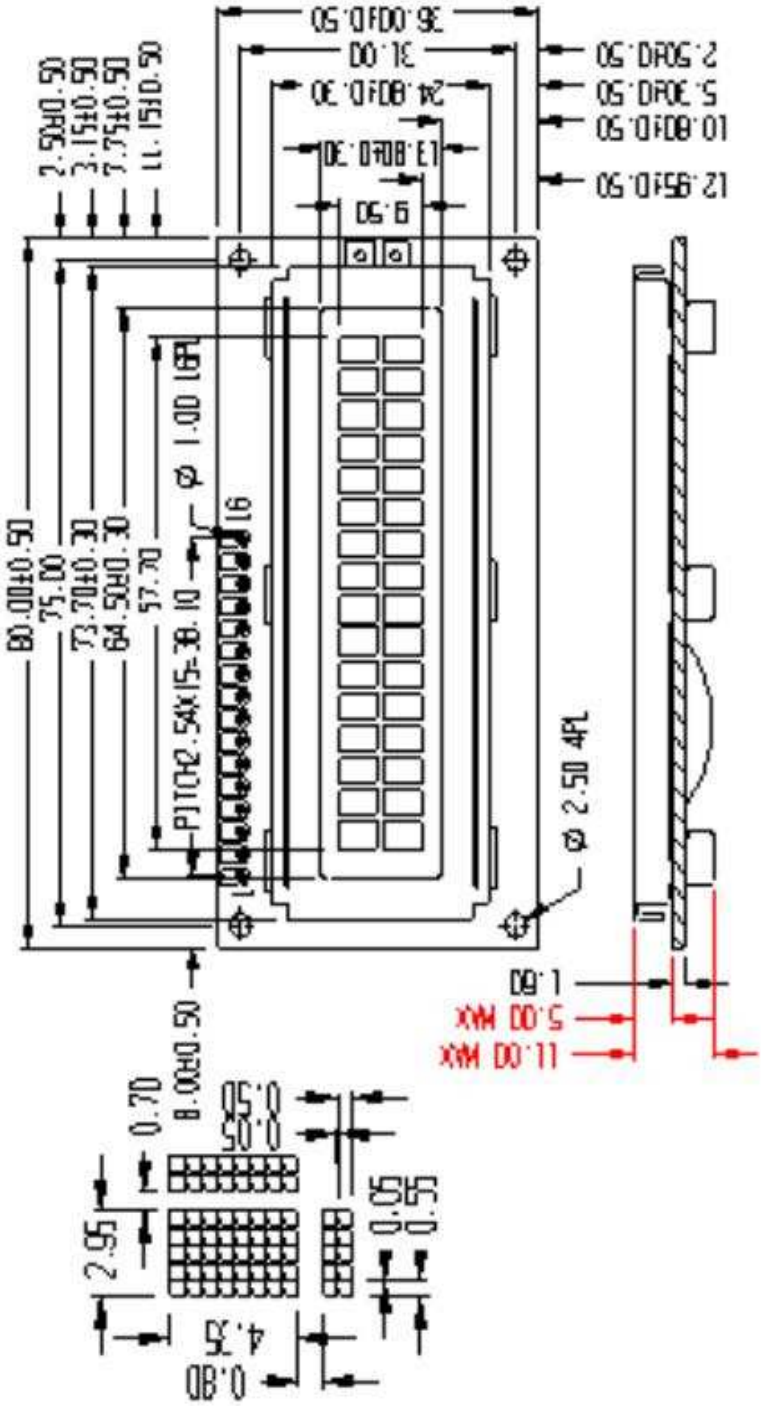
7.1. Physical Data

Item	Contents	Unit
LCD type	STN	---
LCD duty	1/16	---
LCD bias	1/5	---
Viewing direction	6	o'clock
Module size (W×H×T)	80 × 36 × 11MAX (3.15″ × 1.42″ × 0.43″MAX)	mm
Viewing area (W×H)	64.5 × 13.8 (2.54″ × 0.54″)	mm
Number of characters (characters × lines)	16 × 2	---
Character matrix (W×H)	5 × 8	dots
Character size (W×H)	2.95 × 4.35 (0.116″ × 0.171″)	mm
Dot size (W×H)	0.55 × 0.50 (0.022″ × 0.020″)	mm
Dot pitch (W×H)	0.60 × 0.55 (0.024″ × 0.022″)	mm
Backlight	Yellowish green LED	---

7.2. Absolute Maximum Ratings (T_a = 25°C)

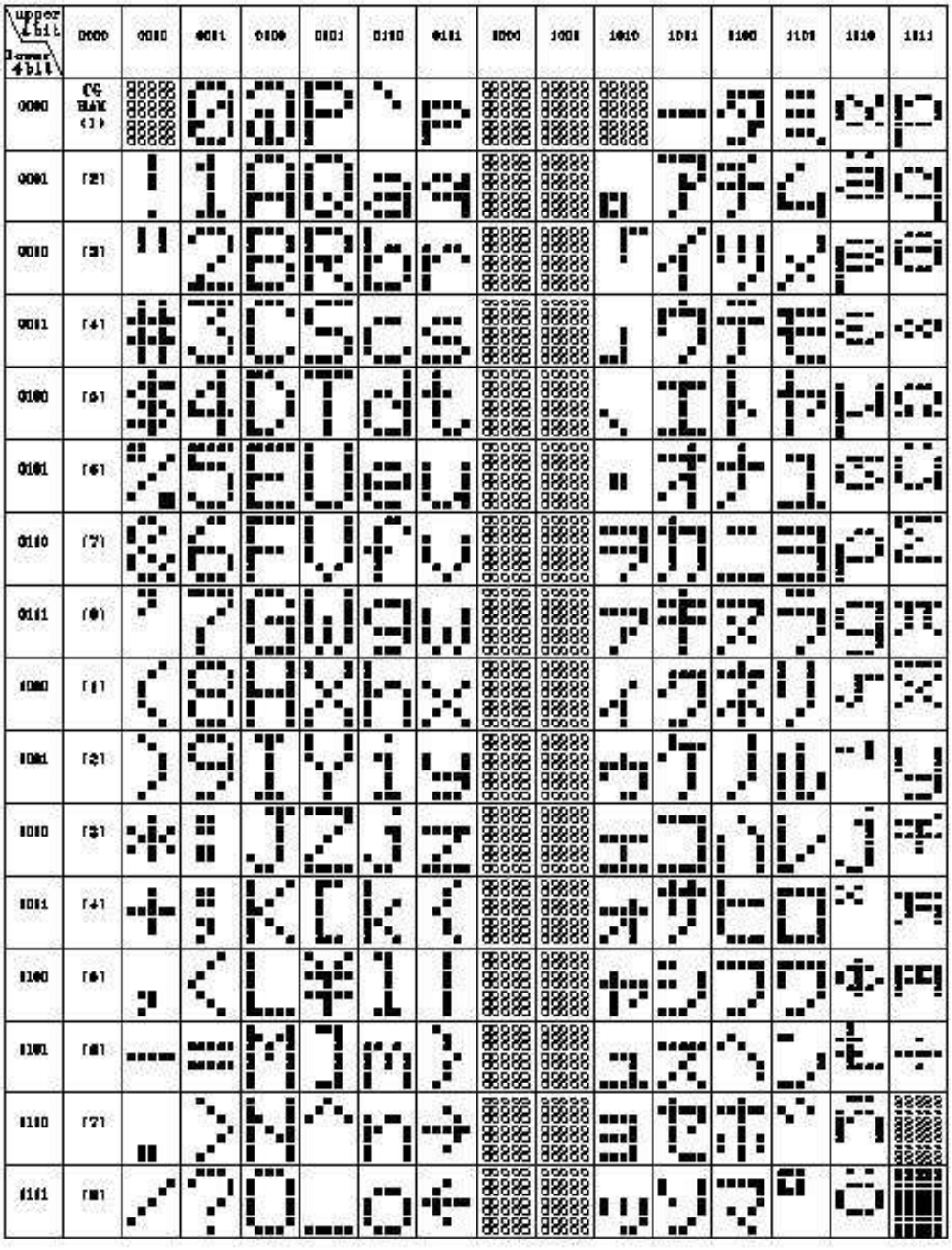
Item	Min.	Typ.	Max.	Unit
Supply voltage	4.5	5	5.5	V
Supply current (BL off)		1.5	3	mA
Supply current (BL on)		121	121.5	mA
Operating temperature		0	50	°C
Storage temperature		-10	60	°C
Humidity			90	%RH

Table 9 Absolute Maximum Ratings

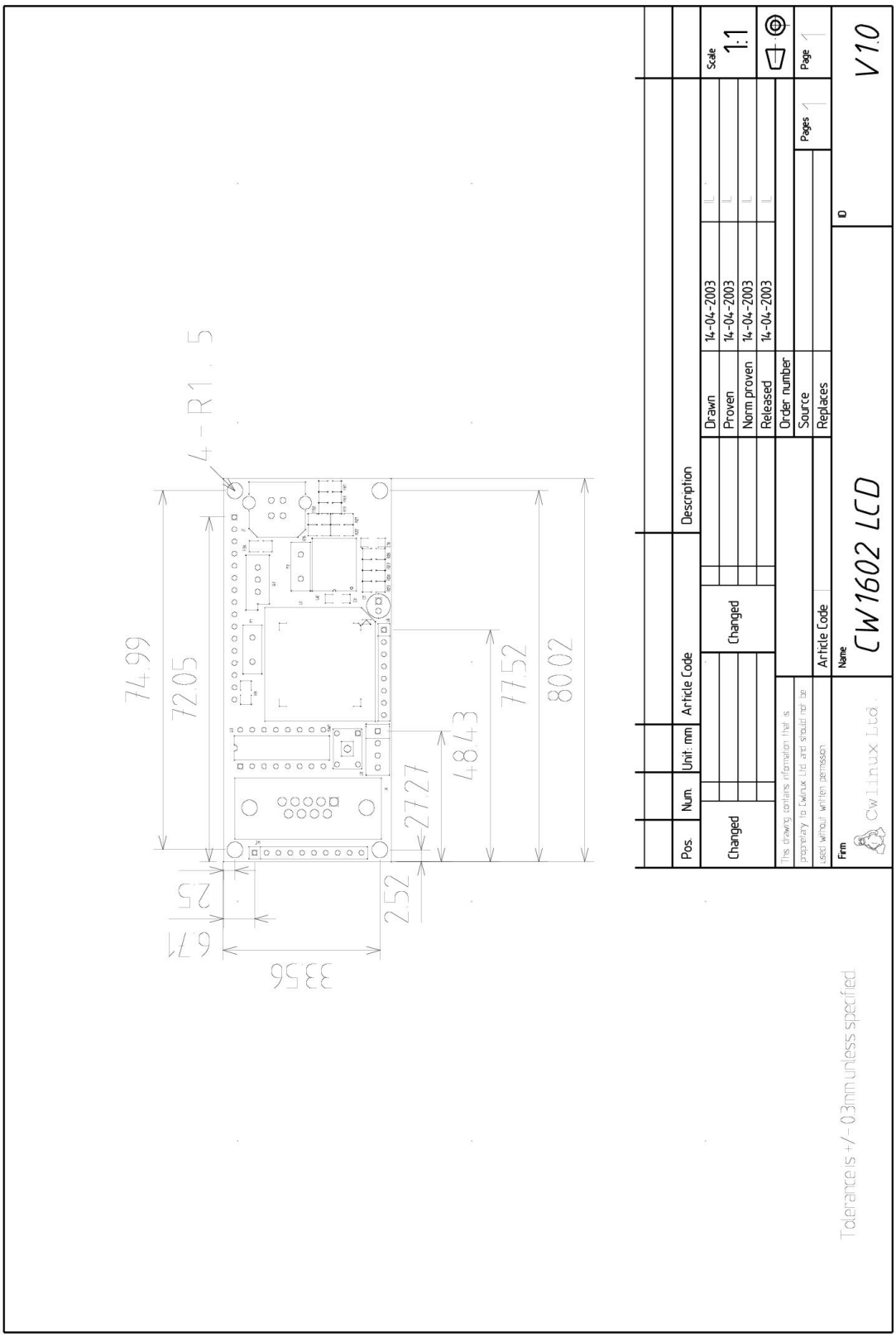


Drawing 18 Mechanical Dimensions

Chapter 8. Appendix



Drawing 19 Default characters.


4-R1.5
74.99
72.05
77.52
80.02
48.43
27.27
2.52
2.54
6.71
33.56
Pos.
Num
Unit: mm
Article Code
Description
Changed
Drawn
Proven
Norm proven
Released
Order number
Source
Replaces
14-04-2003
Scale
1:1
Page 1
Pages 1
This drawing contains information that is proprietary to Cwlinux Ltd and should not be used without written permission
Article Code
Name
CW1602 LCD
Firm
Cwlinux Ltd.
D
V1.0
Tolerance is +/- 0.3mm unless specified