

User's Guide

NHD-0240BZ-**NSW-BTW-P** LCM

(Liquid Crystal Display Module)

RoHS Compliant

NHD- Newhaven Display
0240- 2 Lines x 40 Characters
BZ- Version Line
N- Transmissive
SW- Side Lit White LED B/L
B- STN-Blue
T- 12:00 View
W- Wide Temperature (-20 ~ +70c)

For product support, contact

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September 25, 2007

DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
00	DEC-14-2005	First issue	

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1.Features

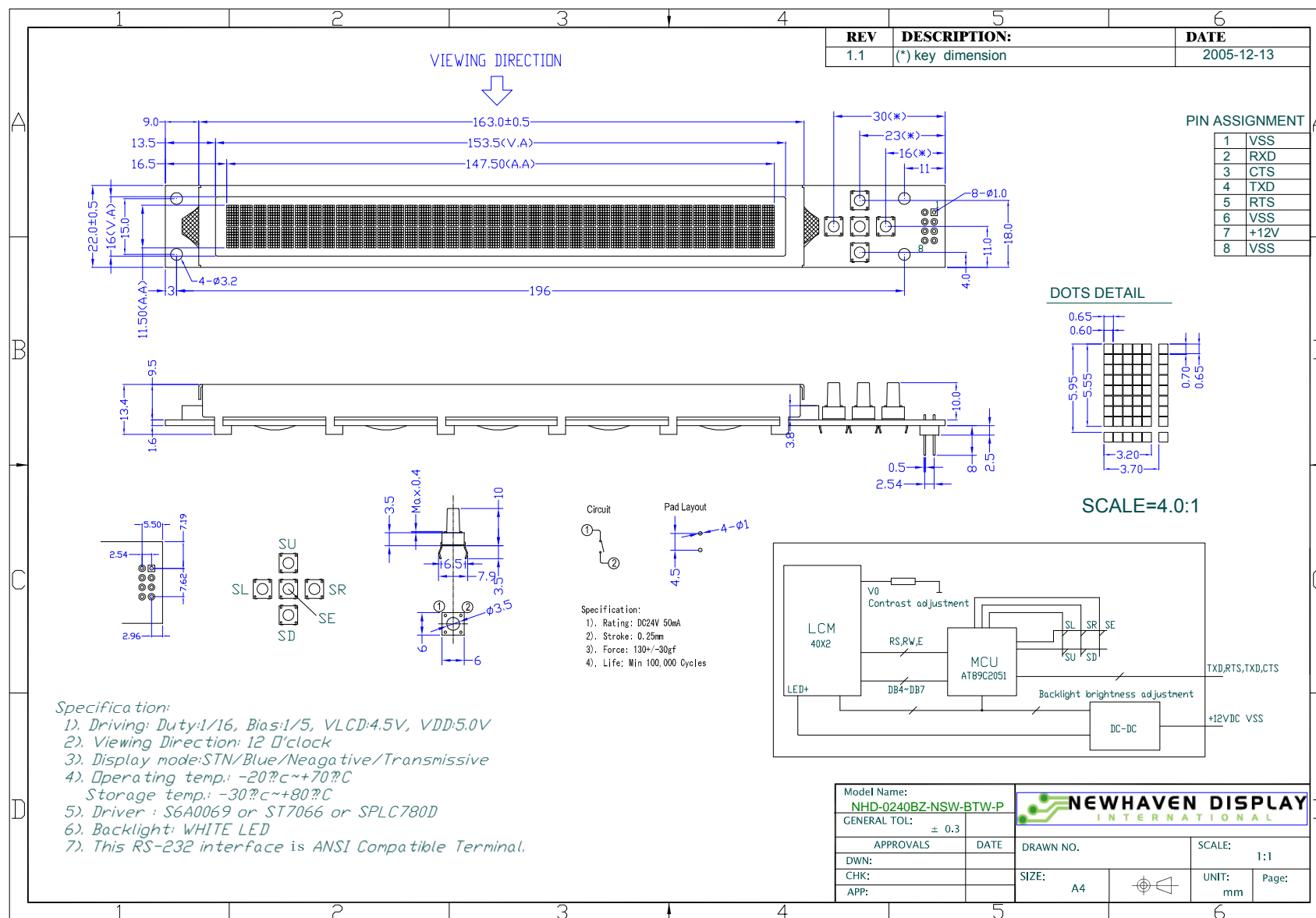
1. 5x8 dots with cursor
2. Built-in LCD controller & MCU
3. +12V power supply
4. STN Blue display mode 1/16 duty cycle;1/5bias
5. With low power consumption white LED backlight.
6. 40characters *2lines display with cursor
7. with RS232 Interface

LCD type	<input type="checkbox"/> FSTN positive		<input type="checkbox"/> FSTN Negative	
	<input type="checkbox"/> STN Yellow Green		<input type="checkbox"/> STN Gray	<input checked="" type="checkbox"/> STN-Blue
View direction	<input type="checkbox"/> 6 O'clock		<input checked="" type="checkbox"/> 12 O'clock	
Rear Polarizer	<input type="checkbox"/> Reflective		<input type="checkbox"/> Transflective	<input checked="" type="checkbox"/> Transmissive
Backlight Type	<input checked="" type="checkbox"/> LED	<input type="checkbox"/> EL	<input checked="" type="checkbox"/> Internal Power	<input type="checkbox"/> 4.2V input
		<input type="checkbox"/> CCFL	External Power	<input type="checkbox"/> 13.8 input
Backlight Color	<input checked="" type="checkbox"/> White	<input type="checkbox"/> Amber	<input type="checkbox"/> Blue-Green	<input type="checkbox"/> Yellow-Green
Temperature Range	<input type="checkbox"/> Normal		<input checked="" type="checkbox"/> Wide	<input type="checkbox"/> Super Wide
DC to DC circuit	<input type="checkbox"/> Build-in		<input checked="" type="checkbox"/> Not Build-in	
EI Driver IC	<input type="checkbox"/> Build-in		<input checked="" type="checkbox"/> Not Build-in	
Touch screen	<input type="checkbox"/> With		<input checked="" type="checkbox"/> Without	
Font type	<input checked="" type="checkbox"/> English-Japanese	<input type="checkbox"/> English-Europen	<input type="checkbox"/> English-Russian	<input type="checkbox"/> other

2. MECHANICAL SPECIFICATIONS

Module size	210.0mm(L)*22.0mm(W)* Max25.0(H)mm
Viewing area	153.5mm(L)*16.0mm(W)
Character size	3.20mm(L)*5.55mm(W)
Character pitch	3.7mm(L)*5.95mm(W)
Weight	Approx.

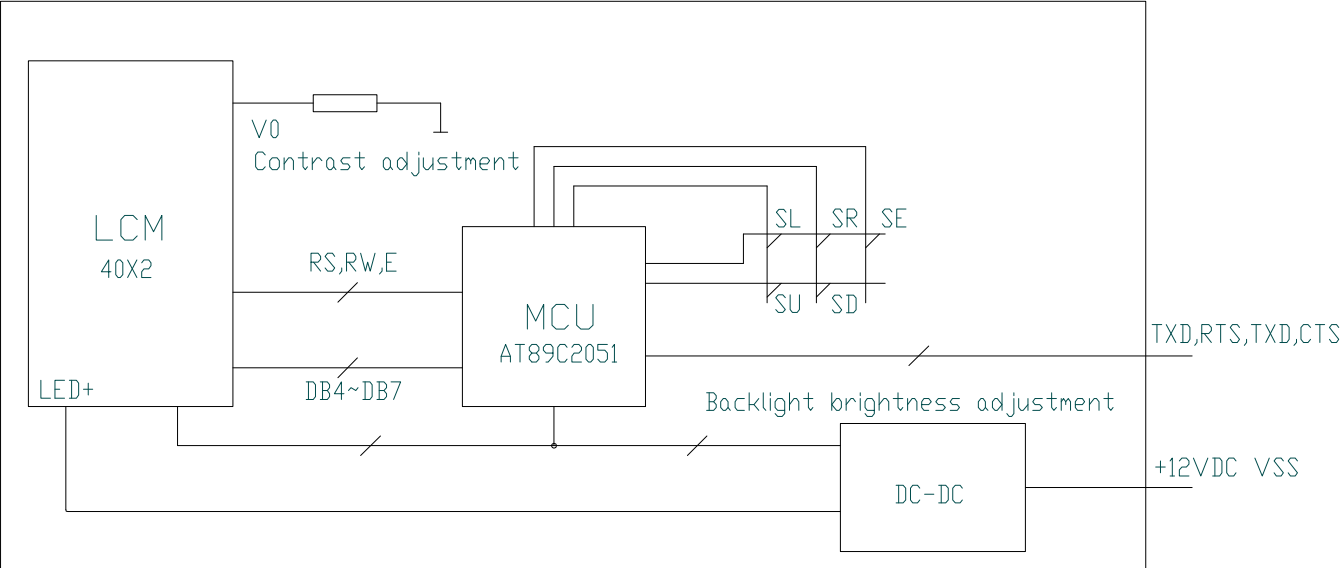
3.Outline dimension



4.Absolute maximum ratings

Item	Symbol	Standard			Unit
Power voltage	$V_{DD}-V_{SS}$	0	-	7.0	V
Input voltage	V_{IN}	VSS	-	VDD	
Operating temperature range	VOP	-20	-	+70	°C
Storage temperature range	VST	-30	-	+80	

5.Block diagram



6.Interface pin description

Pin no.	Symbol	External connection	Function
1	VSS	Power supply	Power supply GND(0V)
2	RXT	RS232 interface	Receive data
3	CTS		NC
4	TXD		Transfer data
5	RTS		NC
6	VSS	Power supply	Power supply GND(0V)
7	+12V		Power supply (+12V)
8	VSS		Power supply GND(0V)

7. Optical characteristics

TN type display module (Ta=25°C, VDD=5.0V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing angle	θ	$C_r \geq 4$	-25	-	-	deg
	Φ		-30	-	30	
Contrast ratio	C_r		-	2	-	-
Response time (rise)	T_r	-	-	120	150	ms
Response time (fall)	T_r	-	-	120	150	

STN type display module (Ta=25°C, VDD=5.0V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing angle	θ	$C_r \geq 2$	-60	-	35	deg
	Φ		-40	-	40	
Contrast ratio	C_r		-	6	-	-
Response time (rise)	T_r	-	-	150	250	ms
Response time (fall)	T_r	-	-	150	250	

8. Electrical characteristics

DC characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage for LCD	$V_{DD}-V_0$	Ta =25°C	-	4.5	-	V
Power Input	V_{CC}		-	12.0	-	
Supply current	I_{CC}	Ta=25°C, VDD=5.0V	-	30	40	mA

Protocol and Keypad function definition

This ANSI subset protocol should allow the display to be used as a limited ANSI terminal with scrolling. The display consists of 2 lines of 40 characters.

The following ANSI protocol commands shall be supported:

Backspace (BS)

Value (ASCII 8 decimal / 08 hex) Receipt of this character causes the display to move the cursor one position to the left.

Horizontal Tab (HT)

Value (ASCII 9 decimal / 09 hex) Receipt of this character causes the display to move the cursor right to the next tab stop.

Moving past the rightmost tab stop causes the cursor to move to the beginning of the following line with display scrolling up

if the cursor was on the last line. There are 4 tab stops per line at positions 4, 8, 12 and 16.

Line Feed (LF)

Value (ASCII 10 decimal / 0A hex) Receipt of this character causes the display to move the cursor down to the next line in

the same column. The display will scroll up if the cursor was on the last line.

Vertical Tab (VT)

Value (ASCII 11 decimal / 0B hex) Receipt of this character causes the display to move the cursor down to the next line in

the same column. The display will scroll up if the cursor was on the last line.

Form Feed (FF)

Value (ASCII 12 decimal / 0C hex) Receipt of this character causes the display to move the cursor down to the next line in

the same column. The display will scroll up if the cursor was on the last line.

Carriage Return (CR)

Value (ASCII 13 decimal / 0D hex) Receipt of this character causes the display to move the cursor left to the first column on

the current line. There is a User Configuration setting that will automatically add receipt of a Line Feed (LF) character after a

carriage return if required.

Cancel (CAN)

Value (ASCII 24 decimal / 18 hex) Receipt of this character causes the display to abort any escape sequence that may be in

process. No other action is taken.

Displayed Characters

Values (ASCII 32 decimal / 20 hex through ASCII 127 decimal / 7F hex) Receipt of these characters cause the display to show the character on the screen at the current cursor location, and then move the cursor right to the next position. There is a User Configuration setting that will automatically wrap the cursor to the beginning of the next line, if required, scrolling up if the cursor was on the last line. The following characters are displayed:

	Upper Bits					
Lower Bits	0010	0011	0100	0101	0110	0111

0000	space	0	@	P	~	p
0001	!	1	A	Q	a	q
0010	"	2	B	R	b	r
0011	#	3	C	S	c	s
100	\$	4	D	T	d	t
101	%	5	E	U	e	u
110	&	6	F	V	f	v
111	'	7	G	W	g	w
1000	(	8	H	X	h	x
1001	)	9	I	Y	i	y
1010	*	:	J	Z	j	z
1011	+	;	K	[	k	{
1100	,	<	L	\	l	|
1101	-	=	M	]	m	}
1110	.	>	N	^	n	?
1111	/	?	O	_	o	?

ANSI Escape Sequences (ESC [)

Values (ASCII 33, 91 decimal / 1B, 5B hex) Receipt of this character sequence causes the display to attempt to decode one or more of the following characters as an ANSI control sequence. These sequences can have 1 or 2 parameters that are expressed as decimal numbers separated by a semicolon. The absence of a parameter in a control sequence causes it to assume a default value of zero.

What you have to do is send the "escape code" to the screen. These codes are often several characters long, but they all begin with ^[. This isn't the two characters ^ and [, but rather a representation of the ASCII code ESC (which is why these are called escape codes).

ESC has the value: ^[and should be sent before the rest of the code, which is simply an ASCII string.

As an example of how to use this information, here's how to clear the screen in C, using the VT100 escape codes:

```
#define ASCII_ESC 27
```

```
printf( "%c[2J", ESC );
```

or

```
puts( "\033[2J" );
```

Reset Display (ESC c)

Values (ASCII 33, 99 decimal / 1B, 63 hex) Receipt of this character sequence causes the display to clear, the cursor position to move to the upper left corner and the backlight to turn off.

Cursor Up n lines (ESC [n A)

Values (ASCII 33, 91, 48-57, 65 decimal / 1B, 5B, 30-39, 41 hex) Receipt of this character sequence causes the display to move the cursor up 'n' lines in the same column. The cursor will not move up past the first line in the display.

Cursor Up n lines to column 1 (ESC [n F)

Values (ASCII 33, 91, 48-57, 70 decimal / 1B, 5B, 30-39, 46 hex) Receipt of this character sequence causes the display to move the cursor up 'n' lines and to the first column. The cursor will not move up past the first line in the display.

Cursor Down n lines (ESC [n B)

Values (ASCII 33, 91, 48-57, 66 decimal / 1B, 5B, 30-39, 42 hex) Receipt of this character sequence causes the display to move the cursor down 'n' lines in the same column. The cursor will not move past the bottom line in the display and the display will not scroll up.

Cursor Down n lines to column 1 (ESC [n E)

Values (ASCII 33, 91, 48-57, 69 decimal / 1B, 5B, 30-39, 45 hex) Receipt of this character sequence causes the display to move the cursor down 'n' lines and to the first column. The cursor will not move past the bottom line in the display and the display will not scroll up.

Cursor Right n characters (ESC [n C)

Values (ASCII 33, 91, 48-57, 67 decimal / 1B, 5B, 30-39, 43 hex) Receipt of this character sequence causes the display to move the cursor right 'n' characters on the same line. The cursor will not move past the end of the current line.

Cursor Left n characters (ESC [n D)

Values (ASCII 33, 91, 48-57, 68 decimal / 1B, 5B, 30-39, 44 hex) Receipt of this character sequence causes the display to move the cursor left 'n' characters on the same line. The cursor will not move past the beginning of the current line.

Move cursor to n (ESC [n G)

Values (ASCII 33, 91, 48-57, 71 decimal / 1B, 5B, 30-39, 47 hex) Receipt of this character sequence causes the display to move the cursor to column 'n' on the current line. The cursor will not move past the beginning or end of the current line.

Move cursor to r, c (ESC [r ; c H)

Values (ASCII 33, 91, [[48-57], 59, [48-57]], 72 decimal / 1B, 5B, [[30-39], 3B, [30-39]], 48 hex) Receipt of this character sequence causes the display to move the cursor to row 'r', column 'c'. The value for 'r' ranges from 0 – 7, the value for 'c' ranges from 0 – 20.

Erase all or part of display (ESC [n J)

Values (ASCII 33, 91, 48-50, 74 decimal / 1B, 5B, 30-32, 4A hex) Receipt of this character sequence causes part or all of the display to clear. If 'n' = 0, the display is cleared from the cursor position to the end. If 'n' = 1, the display is cleared from the beginning to the cursor position. If 'n' = 2 the entire display is cleared, and the cursor is moved to the upper left (0, 0).

For example:

<u>Description</u>	<u>ESC Code</u>
--------------------	-----------------

Clear screen from cursor down	^[J
Clear screen from cursor down	^[OJ
Clear screen from cursor up	^[1J
Clear entire screen	^[2J

Erase all or part of line (ESC [n K)

Values (ASCII 33, 91, 48-50, 75 decimal / 1B, 5B, 30-32, 4B hex) Receipt of this character sequence causes part or all of the line that the cursor is on to clear. If 'n' = 0, the line is cleared from the cursor position to the end of the line. If 'n' = 1, the line is cleared from the beginning to the cursor position. If 'n' = 2 the entire line is cleared. The position of the cursor is not affected by this command.

For example:

<u>Description</u>	<u>ESC Code</u>
Clear line from cursor right	^[K
Clear line from cursor right	^[OK
Clear line from cursor left	^[1K
Clear entire line	^[2K

Save cursor position (ESC [n s)

Values (ASCII 33, 91, 114 decimal / 1B, 5B, 73 hex) Receipt of this character sequence causes the display to save the current cursor position.

Restore cursor position (ESC [n u)

Values (ASCII 33, 91, 116 decimal / 1B, 5B, 75 hex) Receipt of this character sequence causes the display to restore the previously saved cursor position.

Enter alternate keypad mode (ESC =)

Allows the keypad to enter into alternate mode

Enter alternate keypad mode (ESC >)

Exits the keypad from alternate mode

Keypad Codes

These are sent from the LCD display back to the computer when the particular key is pressed. Note that the codes sent in the alternate mode are different codes than in the default mode. See escape codes above to change keypad mode.

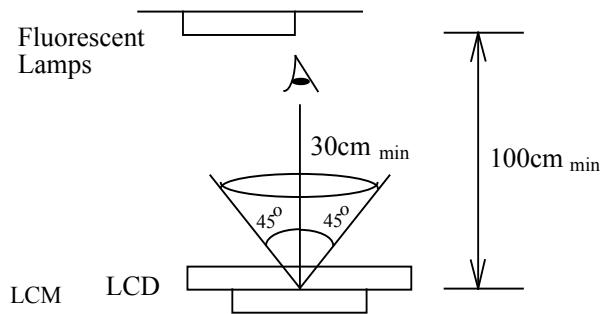
<u>Keypad Key</u>	<u>Default mode (reset)</u>	<u>Alternate (set)</u>
UP (SU in drawing)	ESC A (^[A)	ESC OA (^[OA)
DOWN (SD in drawing)	ESC B (^[B)	ESC OB (^[OB)
RIGHT (SR in drawing)	ESC C (^[C)	ESC OC (^[OC)
LEFT (SL in drawing)	ESC D (^[D)	ESC OD (^[OD)
ENTER (SE in drawing)	^M	ESC OM (^[OM)

10.QUALITY SPECIFICATIONS

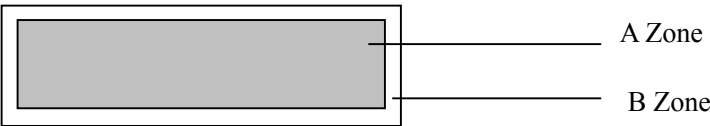
10.1 Standard of the product appearance test

Manner of appearance test: The inspection should be performed in using 20W x 2 fluorescent lamps. Distance between LCM and fluorescent lamps should be 100 cm or more. Distance between LCM and inspector eyes should be 30 cm or more.

Viewing direction for inspection is 45° from vertical against LCM.



Definition of zone:



- A Zone: Active display area (minimum viewing area).
- B Zone: Non-active display area (outside viewing area).

10.2 Specification of quality assurance

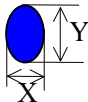
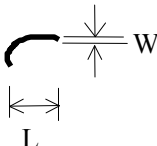
AQL inspection standard

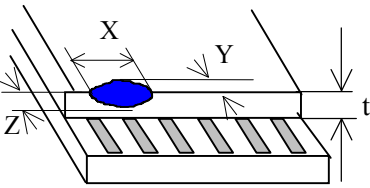
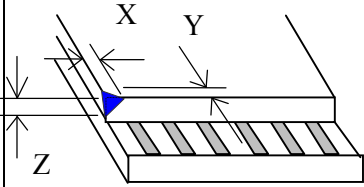
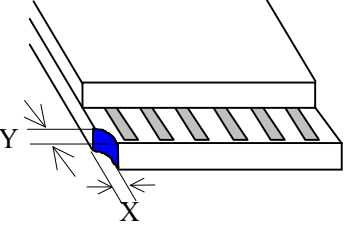
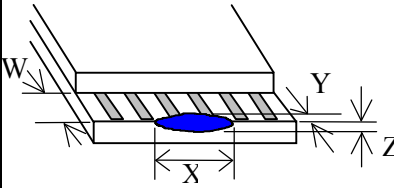
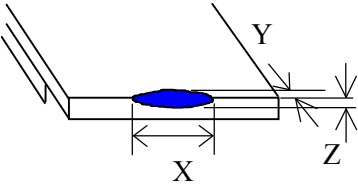
Sampling method: MIL-STD-105E, Level II, single sampling

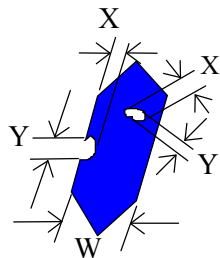
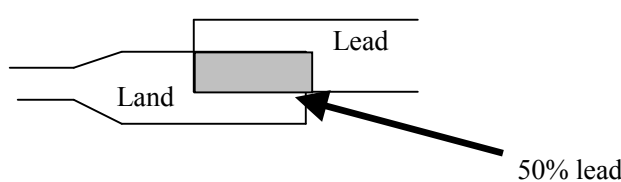
Defect classification **(Note: * is not including)**

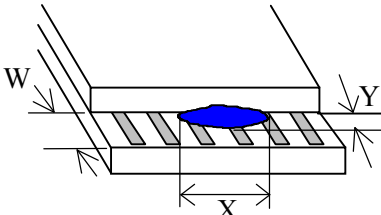
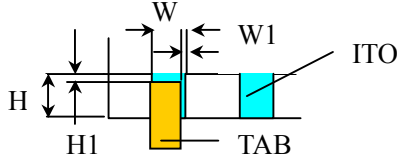
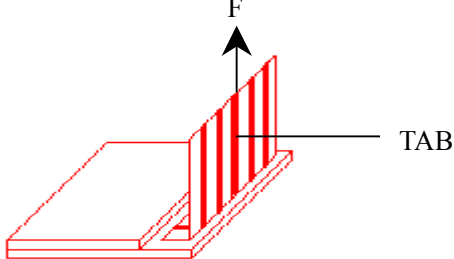
Classify	Item		Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)	2	
		Back-light	1,8	
	Non-display	Flat cable or pin reverse	10	
		Wrong or missing component	11	
Minor	Display state	Background color deviation	2	1.0
		Black spot and dust	3	
		Line defect, Scratch	4	
		Rainbow	5	
		Chip	6	
		Pin hole	7	
	Polarizer	Protruded	12	
		Bubble and foreign material	3	
	Soldering	Poor connection	9	
	Wire	Poor connection	10	
	TAB	Position, Bonding strength	13	

Note on defect classification

No.	Item	Criterion																				
1	Short or open circuit	Not allow																				
	LC leakage																					
	Flickering																					
	No display																					
	Wrong viewing direction																					
	Wrong Back-light																					
2	Contrast defect	Refer to approval sample																				
	Background color deviation																					
3	<div>Point defect, Black spot, dust (including Polarizer)</div> <div>$\phi = (X+Y)/2$</div>	<div></div> <table><tr><th>Point Size</th><th>Acceptable Qty.</th></tr><tr><td>$\phi \leq 0.10$</td><td>Disregard</td></tr><tr><td>$0.10 < \phi \leq 0.20$</td><td>3</td></tr><tr><td>$0.20 < \phi \leq 0.25$</td><td>2</td></tr><tr><td>$0.25 < \phi \leq 0.30$</td><td>1</td></tr><tr><td>$\phi > 0.30$</td><td>0</td></tr></table> <div>Unit: mm</div>	Point Size	Acceptable Qty.	$\phi \leq 0.10$	Disregard	$0.10 < \phi \leq 0.20$	3	$0.20 < \phi \leq 0.25$	2	$0.25 < \phi \leq 0.30$	1	$\phi > 0.30$	0								
Point Size	Acceptable Qty.																					
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$0.25 < \phi \leq 0.30$	1																					
$\phi > 0.30$	0																					
4	<div>Line defect, Scratch</div>	<div></div> <table><tr><th colspan="2">Line</th><th>Acceptable Qty.</th></tr><tr><th>L</th><th>W</th><th></th></tr><tr><td>---</td><td>$0.015 \geq W$</td><td>Disregard</td></tr><tr><td>$3.0 \geq L$</td><td>$0.03 \geq W$</td><td rowspan="2">2</td></tr><tr><td>$2.0 \geq L$</td><td>$0.05 \geq W$</td></tr><tr><td>$1.0 \geq L$</td><td>$0.1 > W$</td><td>1</td></tr><tr><td>---</td><td>$0.05 < W$</td><td>Applied as point defect</td></tr></table> <div>Unit: mm</div>	Line		Acceptable Qty.	L	W		---	$0.015 \geq W$	Disregard	$3.0 \geq L$	$0.03 \geq W$	2	$2.0 \geq L$	$0.05 \geq W$	$1.0 \geq L$	$0.1 > W$	1	---	$0.05 < W$	Applied as point defect
Line		Acceptable Qty.																				
L	W																					
---	$0.015 \geq W$	Disregard																				
$3.0 \geq L$	$0.03 \geq W$	2																				
$2.0 \geq L$	$0.05 \geq W$																					
$1.0 \geq L$	$0.1 > W$	1																				
---	$0.05 < W$	Applied as point defect																				
5	Rainbow	Not more than two color changes across the viewing area.																				

No	Item	Criterion																																	
6	Chip	<div><div><div>Remark: X: Length direction Y: Short direction Z: Thickness direction t: Glass thickness W: Terminal Width</div><div><table><caption>Acceptable criterion</caption><thead><tr><th>X</th><th>Y</th><th>Z</th></tr></thead><tbody><tr><td>≤2</td><td>0.5mm</td><td>≤t/2</td></tr></tbody></table></div></div><div><div><table><caption>Acceptable criterion</caption><thead><tr><th>X</th><th>Y</th><th>Z</th></tr></thead><tbody><tr><td>≤2</td><td>0.5mm</td><td>≤t</td></tr></tbody></table></div></div><div><div><table><caption>Acceptable criterion</caption><thead><tr><th>X</th><th>Y</th><th>Z</th></tr></thead><tbody><tr><td>≤3</td><td>≤2</td><td>≤t</td></tr><tr><td colspan="2">shall not reach to ITO</td><td></td></tr></tbody></table></div></div><div><div><table><caption>Acceptable criterion</caption><thead><tr><th>X</th><th>Y</th><th>Z</th></tr></thead><tbody><tr><td>Disregard</td><td>≤0.2</td><td>≤t</td></tr></tbody></table></div></div><div><div><table><caption>Acceptable criterion</caption><thead><tr><th>X</th><th>Y</th><th>Z</th></tr></thead><tbody><tr><td>≤5</td><td>≤2</td><td>≤t/3</td></tr></tbody></table></div></div></div>	X	Y	Z	≤2	0.5mm	≤t/2	X	Y	Z	≤2	0.5mm	≤t	X	Y	Z	≤3	≤2	≤t	shall not reach to ITO			X	Y	Z	Disregard	≤0.2	≤t	X	Y	Z	≤5	≤2	≤t/3
X	Y	Z																																	
≤2	0.5mm	≤t/2																																	
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X	Y	Z																																	
Disregard	≤0.2	≤t																																	
X	Y	Z																																	
≤5	≤2	≤t/3																																	

No.	Item	Criterion								
7	Segment pattern W = Segment width $\phi = (X+Y)/2$	<div><div><div>(1) Pin hole</div><div>$\phi < 0.10\text{mm}$ is acceptable.</div><div></div></div><div><table><tr><th>Point Size</th><th>Acceptable Qty</th></tr><tr><td>$\phi \leq 1/4W$</td><td>Disregard</td></tr><tr><td>$1/4W < \phi \leq 1/2W$</td><td>1</td></tr><tr><td>$\phi > 1/2W$</td><td>0</td></tr></table><div>Unit: mm</div></div></div>	Point Size	Acceptable Qty	$\phi \leq 1/4W$	Disregard	$1/4W < \phi \leq 1/2W$	1	$\phi > 1/2W$	0
Point Size	Acceptable Qty									
$\phi \leq 1/4W$	Disregard									
$1/4W < \phi \leq 1/2W$	1									
$\phi > 1/2W$	0									
8	Back-light	<div><div>(1) The color of backlight should correspond its specification.</div><div>(2) Not allow flickering</div></div>								
9	Soldering	<div><div><div>(1) Not allow heavy dirty and solder ball on PCB. (The size of dirty refer to point and dust defect)</div><div>(2) Over 50% of lead should be solderedon Land.</div></div><div></div></div>								
10	Wire	<div><div><div>(1) Copper wire should not be rusted</div><div>(2) Not allow crack on copper wire connection.</div><div>(3) Not allow reversing the position of the flat cable.</div><div>(4) Not allow exposed copper wire inside the flat cable.</div></div></div>								
11*	PCB	<div><div><div>(1) Not allow screw rust or damage.</div><div>(2) Not allow missing or wrong putting of component.</div></div></div>								

No	Item	Criterion
12	Protruded W: Terminal Width	 <p>Acceptable criteria: $Y \leq 0.4$</p>
13	TAB	<p>1. Position</p>  <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto;"> $W1 \leq 1/3W$ $H1 \leq 1/3H$ </div> <p>2 TAB bonding strength test</p>  <p>$P (=F/TAB \text{ bonding width}) \geq 650\text{gf/cm}$,(speed rate: 1mm/min) 5pcs per SOA (shipment)</p>
14	Total no. of acceptable Defect	<p>A. Zone</p> <p>Maximum 2 minor non-conformities per one unit. Defect distance: each point to be separated over 10mm</p> <p>B. Zone</p> <p>It is acceptable when it is no trouble for quality and assembly in customer's end product.</p>

10.3 Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	48	No abnormalities in functions and appearance
High temp. Operating	70°C	48	
Low temp. Storage	-30°C	48	
Low temp. Operating	-20°C	48	
Humidity	40°C/ 90%RH	48	
Temp. Cycle	0°C ← 25°C → 50°C (30 min ← 5 min → 30min)	10cycles	

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (20±8°C), normal humidity (below 65% RH), and in the area not exposed to direct sun light.

10.4 Precaution for using LCD/LCM

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isopropyl alcohol, ethyl alcohol or trichlorotrifluoroethane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not make any modification on the PCB without consulting NEWHAVEN
5. When mounting a LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.

4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$
4. Soldering time: 3 to 4 second.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

1. The viewing angle can be adjusted by varying the LCD driving voltage V_o .
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.
6. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7. For long-term storage over 40°C is required, the relative humidity should be kept below 60%, and avoid direct sunlight.

Limited Warranty

NEWHAVEN LCDs and modules are not consumer products, but may be incorporated by NEWHAVEN's customers into consumer products or components thereof, NEWHAVEN does not warrant that its LCDs and components are fit for any such particular purpose.

1. The liability of NEWHAVEN is limited to repair or replacement on the terms set forth below. NEWHAVEN will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between NEWHAVEN and the customer, NEWHAVEN will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with NEWHAVEN general LCD inspection standard . (Copies available on request)
2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.
3. In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the failures or defect.