DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 240064A SYH-LY

Product specification   *Version: 4*

09/August/2004

GENERAL SPECIFICATION

MODULE NO. :

DEM 240064A SYH-LY

CUSTOMER P/N

VERSION NO.	CHANGE DESCRIPTION	DATE
0	ORIGINAL VERSION	21/01/2003
1	CHANGED LCD TYPE	05/03/2003
2	ADD PCB DRAWING	12/07/2003
3	CHANGE MODULE AND PCB DRAWING	13/10/2003
4	CHANGED BLOCK DIAGRAM AND DESCIPTION	05/06/2004

PREPARED BY: CHJ   DATE: 05/06/2004
APPROVED BY: MH   DATE: 09/08/2004

CONTENTS

1. FUNCTIONS &FEATURES

- LCD TYPE:

MODULE MODEL	LCD MODEL	LCD TYPE
DEM 240064A SYH-LY	STN Yellow-Green	Transflective Positive Mode

- Viewing Direction   : 6 O'clock

- Driving Scheme   : 1/64 Duty, 1/9 Bias

- Backlight   : Yellow Green (lightbox)

- Display Content   : 240 x 64 Dots

- V_{LCD} : 12.6 Volt (typ.)

- Weight   : 200g (max.)

- Operating Temperature   : -20°C ~ 70°C

- Storage Temperature   : -25°C ~ 75°C

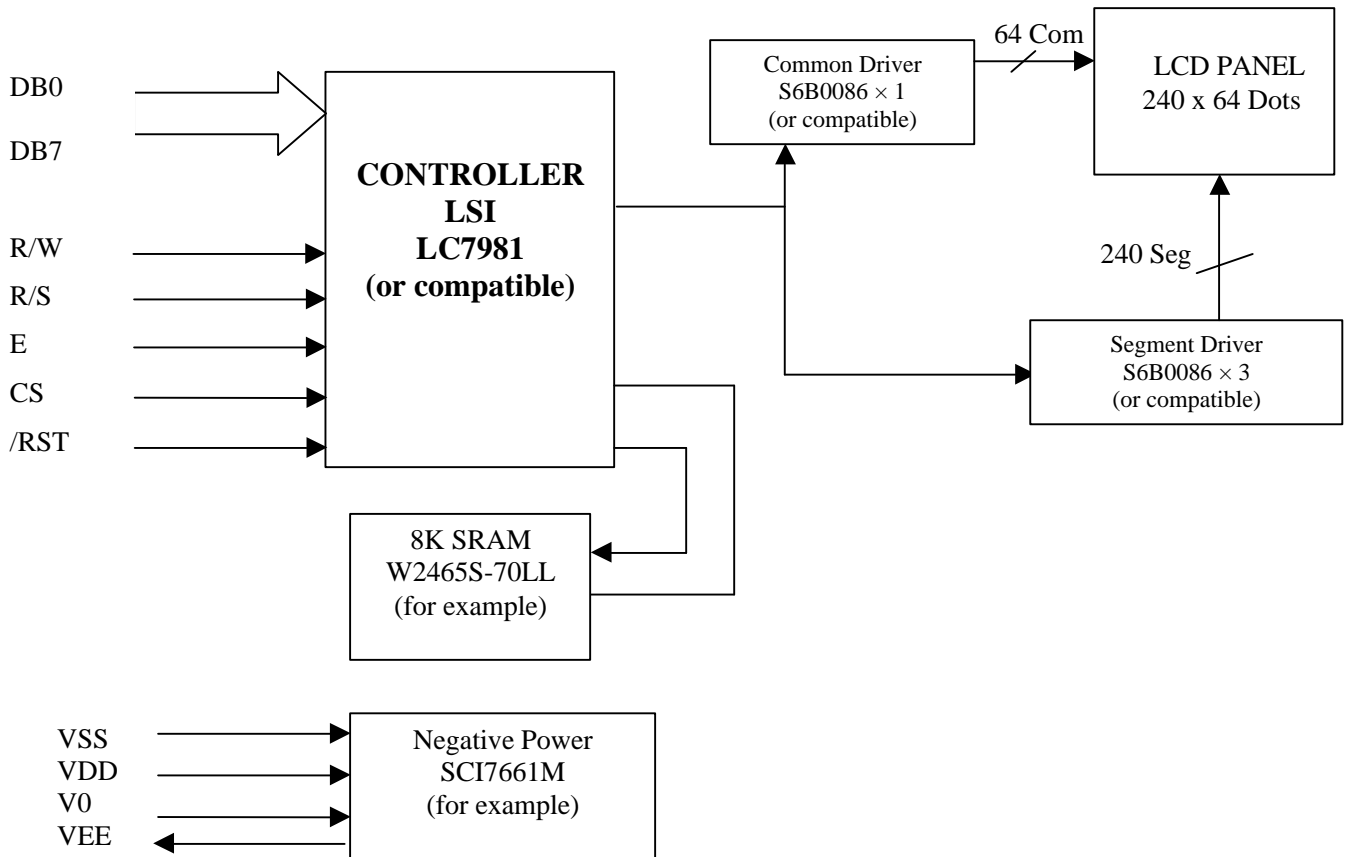# 2. MODULE ARTWORK

- Module Size   : 180mm x 65mm x 16mm (max.)

- Dot Size   : 0.49mm x 0.49mm

- Dot Gap   : 0.04 mm

3. EXTERNAL DIMENSIONS
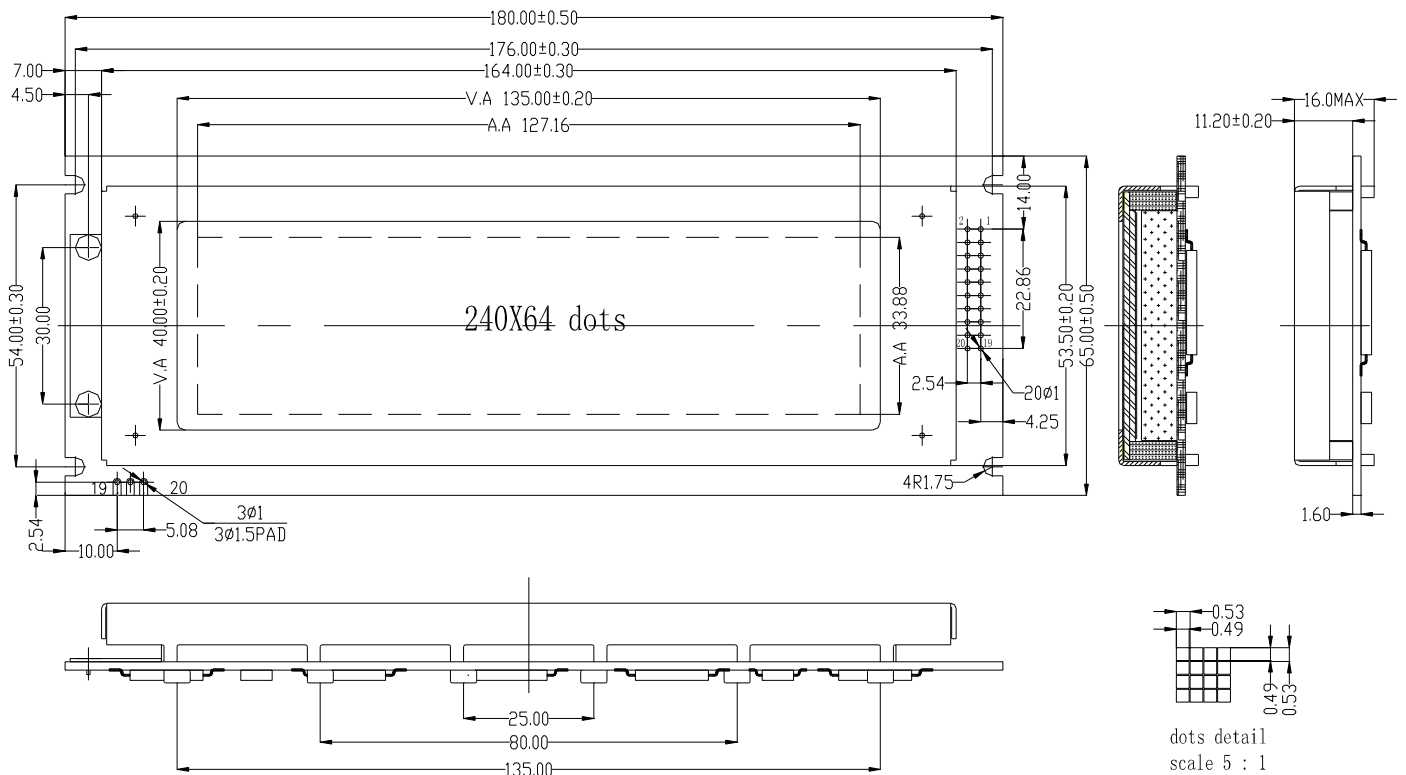
4. BLOCK DIAGRAM

5. PIN ASSIGNMENT

PIN NUMBER	SYMBOL	FUNCTION
1	VSS	Ground (0V)
2	VDD	Power Supply (+5V)
3	V0	Power Supply for LCD Drive
4	R/S	L: Instruction H: Data
5	R/W	L: Data Write H: Data Read
6	E	Enable Signal
7~14	DB0~DB7	Data Bus Line
15	CS	Chip select Active "L"
16	/RST	Reset Active "L"
17	VEE	Negative Voltage Output (-10V)
18	N.C	No Connection
19	LED- (K)	You will find these pins on the 20-hole interface and separated 3-hole
20	LED+ (A)	interface. Please also refer to 7.1 PCB drawing and description.

6. POWER SUPPLY
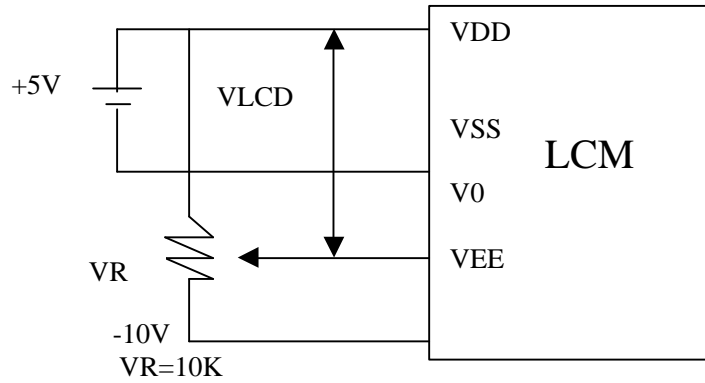
7. PCB DRAWING & DESCRIPTION
7.1 PCD DRAWING
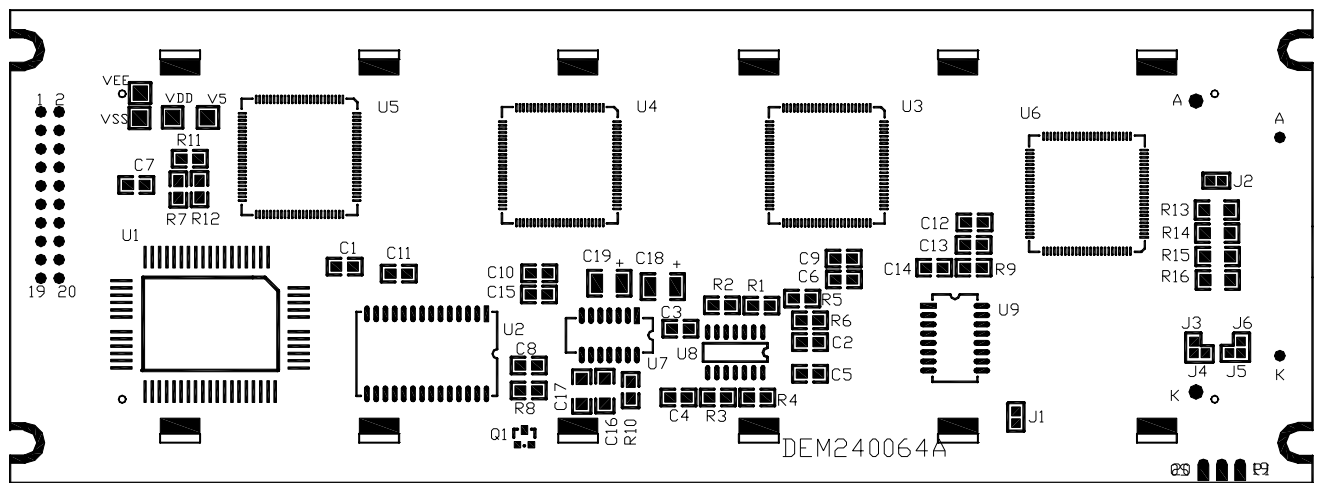
7.2 DESCRIPTION:

7-2-1. The polarity of the pin 19 and the pin 20:

symbol \ state		J3, J5	J4, J6	LED Polarity	
symbol	state			19 Pin	20 Pin
J4, J6	Each solder-bridge	Each open	Each closed	Anode	Cathode
J3, J5	Each solder-bridge	Each closed	Each open	Cathode	Anode

Note: In application module, J3=J5=closed, J2=J4=open.

7-2-2. The metal-bezel should be on ground when the J1 is closed.

Note: In application module, J1=closed

7-2-3. The LED resistor should be bridged when the J2 is closed.

Note: In application module, J2=open

7-2-4. The R13, R14, R15 and the R16 are the LED resistor.

Note: R13 = R14 = R15 =R16= 6.2Ω.

7.3 Example application

7-3-1. The 19 pin is the anode and the 20 pin is the cathode as following.

J3   J5

J4   **J6**
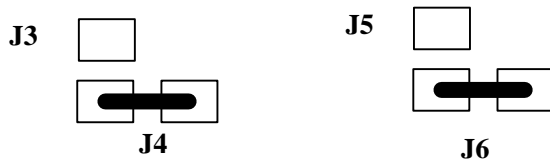
7-3-2.The 19 pin is the cathode and the 20 pin is the anode as following.

J3   J5

J4   **J6**

7-3-3. The metal-bezel is on ground as following.

J1
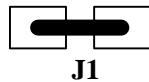
7-3-4. The Module NO. DEM240064A is printed on the PCB.
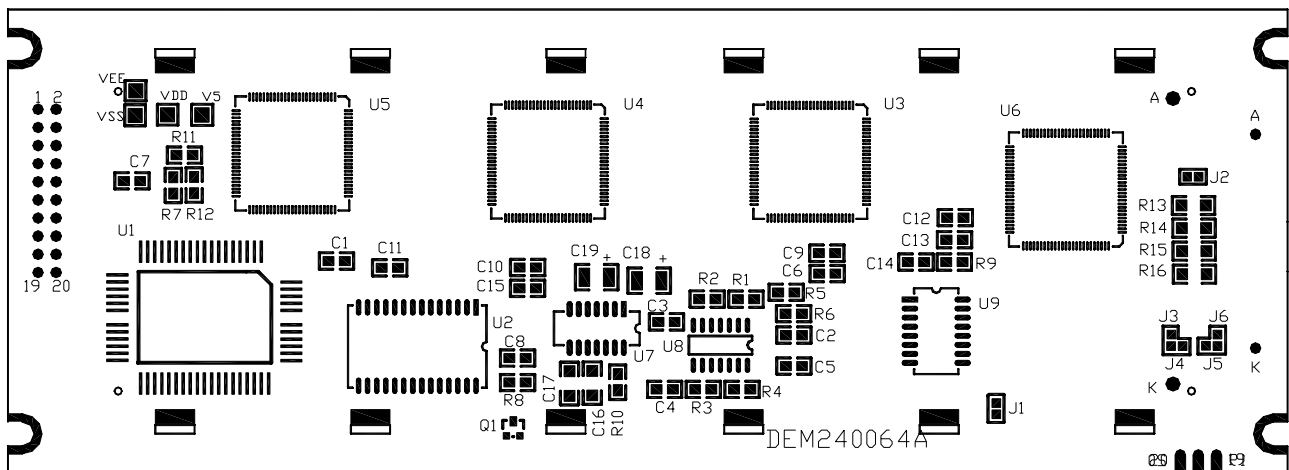
8. ABSOLUTE MAXIMUM RATINGS

8.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS (Vss=0V, Ta=25°C)

PARAMETER	SYMBOL	Min.	Max.	UNIT
Supply Voltage (Logic)	$V_{DD}-V_{SS}$	0	7	V
Supply Voltage (LCD Driver)	$V_{DD}-V_{EE}$	0	19	V
Input voltage range	V_I	V_{SS}	V_{DD}	V
Operating temperature range	T_{OPR}	-20	70	°C
Storage temperature range	T_{STR}	-25	75	°C

8.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

Item	Operating		Storage		Comment
	(Min.)	(Max.)	(Min.)	(Max.)	
Ambient Temp	-20	70	-25	75	Note(1)
Humidity	Note(2)		Note(2)		Without Condensation
Vibration	--	$4.9M/S^2$	--	$19.6M/S^2$	XYZ Direction
Shock	--	$29.4M/S^2$	--	$490M/S^2$	XYZ Direction

Note (1) Ta=0°C: 50Hr Max.

Note (2) Ta ≤ 40°C: 90% RH Max.

Ta ≥ 40°C: Absolute humidity must be lower than the humidity of 90% RH at 40°C.

9. ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage (Logic)	VDD-VSS		4.5	5.0	5.5	V
Supply voltage (LCD)		25°C	12	12.6	13.2	V
Input voltage	VIH	--	0.7xVDD	--	VDD	V
	VIL		0	--	0.3xVDD	
Logic Supply Current	IDD	VDD-VSS=5V	--	15	--	mA
	IEE	VDD-V0=12.6V	--	5	--	mA

10. ELECTRO-OPTICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REF.
Rise Time	Tr	0°C	---	450	560	ms	Note(1)
		25°C		140	210		
Fall Time	Tf	0°C	-----	680	800	ms	
		25°C		220	330		
Contrast	CR	25°C	---	2.7	---		Note(3)
View Angle	θ1 ≥ θ2	25°C &	--	--	80		Note(2)
	Φ1 ≥ Φ2	CR≥1.5	-35	--	35		
Frame Frequency	Ff	25°C	--	64	--	Hz	

Note (1) Response time is measured as the shortest period of time possible
Between the change is state of an LCD segment as demonstrated below:
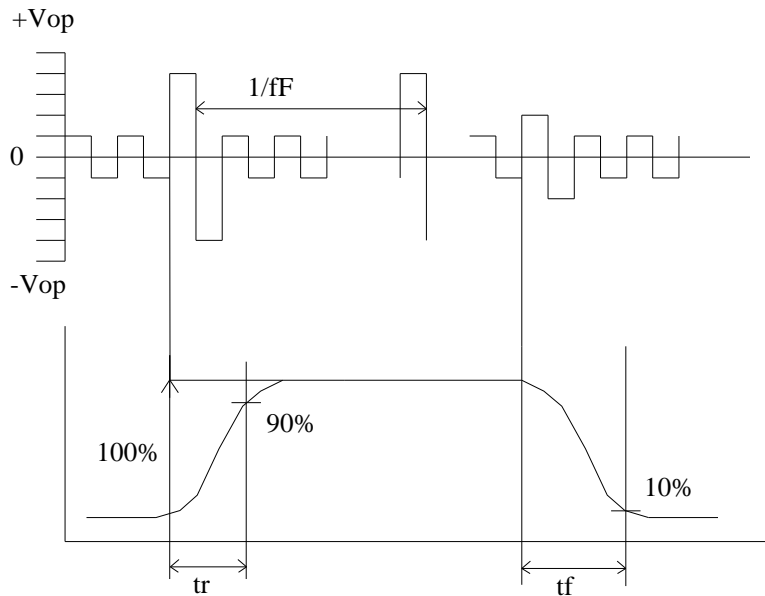
Condition:
(a) .Temperature--------------------25 °C
(b).Frame frequency-----------------64Hz
(c). View Angle---------------------θ = 0°, φ = 0°
(d). Operating voltage---------------12V

Note(2) definition of View Angle

Top --bottom direction
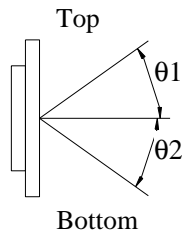
Right --left direction
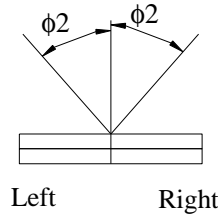
Note(3) : Contrast ratio is defined under the following condition: $CR = \dfrac{\text{Brightness of no-selected condition}}{\text{Brightness of selected condition}}$

(a). Temperature: 25°C
(b). Frame frequency: 64Hz
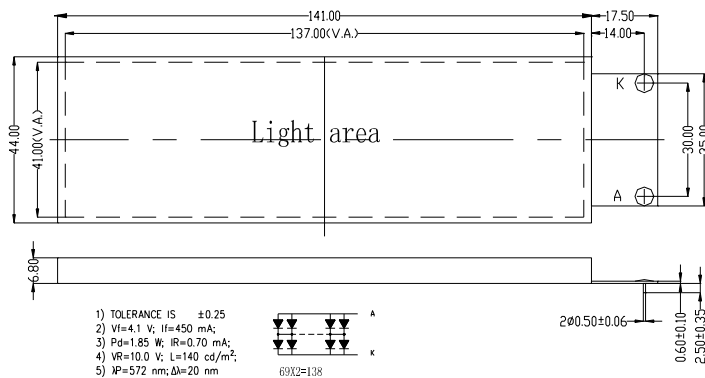(c). Viewing angle: θ = 0°, Φ = 0°
(d). Operating voltage: 12Volt

10.1 LED ELECTRO-OPTICAL CHARACTERISTIC   (Ta=25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V_F	IF=450mA Yellow Green	--	4.1	4.5	V
Luminous intensity	I_V	IF=450mA Yellow Green	90	140	--	cd/m^2
Peak Emission	λp	IF=10mA Yellow Green	--	572	--	nm
Spectrum Radiation	Δλ	IF=10mA Yellow Green	--	20	--	nm
Reverse Current	IR	VR=10V Yellow Green	--	--	0.7	mA

10.2 LED MAXIMUM OPERATING RANGE

ITEM	SYMBOL	YELLOW GREEN	UNIT
Power Dissipation	P_{AD}	1.85	W
Forward Current	I_{AF}	450	mA
Reverse Voltage	VR	10	V

10.2.1 LED ARRAY BLOCK DIAGRAM

1) TOLERANCE IS   ±0.25
2) Vf=4.1 V; If=450 mA;
3) Pd=1.85 W; IR=0.70 mA;
4) VR=10.0 V; L=140 cd/m^2;
5) λP=572 nm; Δλ=20 nm

11. TIMING CHARACTERISTICS

- Bus read/write operations 1
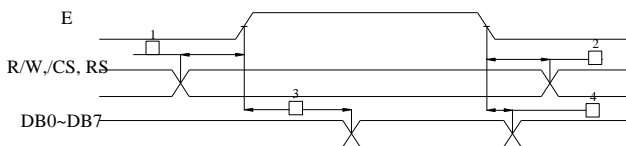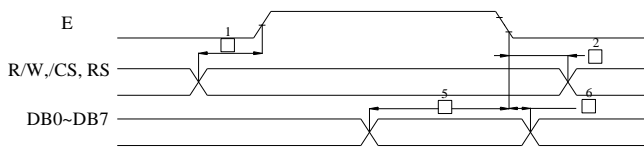
Ta=-20 to +75; VDD=5V ± 5%, GND=0V

No.	Item	Symbol	Min	Typ	Max	Unit	Conditions
1	Address set-up time	tAS	90	--	--	ns	
2	Address hold time	tAH	10	--	--	ns	
3	Data delay time (read)	tDDR	--	--	140	ns	CL=50pF
4	Data hold time (read)	tDHR	10	--	--	ns	
5	Data set-up time (write)	tDSW	220	--	--	ns	
6	Data hold time (write)	tDHW	20	--	--	ns	

Note : Definition of the test waveform
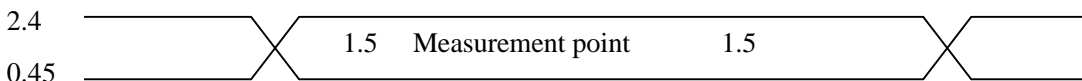
The input terminals are driven at 2.4V and 0.45V. Timing is measured at 1.5V.

12. DESCRIPTION OF EACH INSTRUCTIONS

Display is controlled by writing data into the instruction register and 13 data registers. The instruction register and the data register are distinguished by the RS signal. First, write 4-bit data in the instruction register when RS=1, then specify the code of the data register. Next, with RS=0, write 8-bit data in the data register, which executes the specified instruction.

A new instruction cannot be accepted while and old instruction is being executed. As the Busy flag is set under this condition, write and instruction only after reading the Busy flag and making sure that it is 0.

However, the next instruction can be executed without checking the Busy flag when the maximum read cycle time or the write cycle time has been exceeded after execution of the previous data read instruction or the data write instruction. The Busy flag does not change when data is written into the instruction register (RS=1). Therefore, the Busy flag need not be checked immediately after writing data into the instruction register.

1) Mode control

Write code "00H" (in hexadecimal notation) in the instruction register and specify the mode control register.

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction Reg	0	1	0	0	0	0	0	0	0	0
Mode control Reg	0	0	0	0	Mode Data					

DB5	DB4	DB3	DB2	DB1	DB0	Cursor/blink	CG	Graphic/character display
1/0	1/0	0	0	0	0	Cursor OFF	Built-in CG	Character display
		0	1			Cursor ON		
		1	0			Cursor OFF character blink		
		1	1			Cursor blink		
		0	0		1	Cursor OFF	External CG	
		0	1			Cursor ON		
		1	0			Cursor OFF character blink		
		1	1			Cursor blink		
		0	0	1	0			Graphic mode
Display ON/OFF	Master/slave	Blink	Cursor	Mode	External/builtin CG			

1: master mode
2: slave mode
1: display ON
2: display OFF
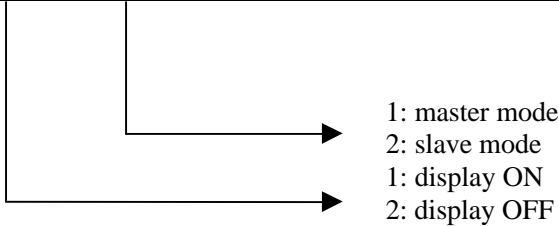
2) Setting the character pitch

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction Reg	0	1	0	0	0	0	0	0	0	1
Character pitch Reg	0	0	(Vp-1) Binary				0	(Hp-1) Binary		

Vp is number of vertical dots per character. Determine Vp with the pitch between two vertically placed character taken into consideration. This value is meaningful only in the character display mode: it is invalid in the graphic mode.

In character mode, Hp indicates the number of horizontal dots per character, from the leftmost part of one character to the leftmost part of the next. In the graphic mode, Hp indicates how many bits (or dots) from RAM appear in a 1-byte display.

Hp must take one of the following three values.

Hp	DB2	DB1	DB0	
6	1	0	1	Horizontal character pitch 6
7	1	1	0	· · 7
8	1	1	1	· · 8

3) Setting the number of characters

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction Reg	0	1	0	0	0	0	0	0	1	0
Character number Reg	0	0				(H_N-1) Binary				

In the character display mode, H_N indicates the number of characters in the horizontal direction. In the graphic mode, it indicates the number of bytes in the horizontal direction. The total number of dots positioned horizontally on the screen n is given by the formula

n=Hp x H_N

Even numbers in the range 2 to 256 (decimal) can be set as H_N.

4) Setting the time division number (display duty)

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction Reg	0	1	0	0	0	0	0	0	1	1
Time division Reg	0	0				(N_X-1) Binary				

Consequently, $1/N_X$ is the display duty.

Decimal numbers within the range 1 to 256 can be set as N_X.

5) Setting the cursor position

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction Reg	0	1	0	0	0	0	0	1	0	0
Cursor Position Reg	0	0	0	0	0	0		(C_P-1) Binary		

 In the character display mode, C_P indicates the line at which the cursor is displayed. For example, when C_P=8 (decimal) is specified, the cursor is displayed beneath the character of the 5 x 7 dot-font. The horizontal length of the cursor equals Hp (the horizontal character pitch). Decimal values in the range 1 to 16 can be assigned to Cp.

 When the value is less than the vertical character pitch Vp (Cp· Vp), display priority is given to the cursor (provided the cursor display is ON). The cursor is not displayed when CP>Vp. The horizontal length of the cursor equals Hp.

6) Setting the display start lower address

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction Reg	0	1	0	0	0	0	1	0	0	0
Display start address Reg (lower byte)	0	0				(start address lower byte) Binary				

7) Setting the display start upper address

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction Reg	0	1	0	0	0	0	1	0	0	1
Display start address Reg (upper byte)	0	0				(start address upper byte) Binary				

This instruction writes the display start address value in the display start address register. The display start address is the RAM address at which data to be displayed at the leftmost position of the top lime of the screen is stored. The start address consists of 16 bits (upper and lower)

8) Setting the cursor (lower) address (RAM read/write lower address)

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction Reg	0	1	0	0	0	0	1	0	1	0
Cursor address Reg (lower byte)	0	0				(cursor address lower byte) Binary				

9) Setting the cursor (upper) address (RAM read/write upper address)

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction Reg	0	1	0	0	0	0	1	0	1	1
Cursor address counter (upper byte)	0	0	(cursor address upper byte) Binary							

This instruction writes the cursor address value in the cursor address counter. The cursor address indicates the address for exchanging display data and character codes with RAM. In other words, data at the address specified by the cursor address is read from or written into RAM. In character display, the cursor is displayed at the position specified by the cursor address.

 The cursor address is divided into a lower address (8 bits) and an upper address (8 bits). It should be set in accordance with the following rules.

1	To rewrite (set) both lower and upper addresses:	First set the lower address, then the upper.
2	To rewrite the lower address:	Always reset the upper address after setting the lower address
3	To rewrite the upper address only:	Set the upper address. It is necessary to reset the lower address.

The cursor address counter is a 16-bit up-counter with set/reset functions: when the Nth bit goes from 1 to 0, the count of the (N+1)th bit increments by one. Accordingly, when the lower address is set so that the lower MSB (8 bit) changes from 1 to 0, the LSB (1st bit) of the upper counter must increment by one. When setting the cursor address, set the lower and upper addresses as a 2-byte continuous instruction.

10) Writing display data

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction Reg	0	1	0	0	0	0	1	1	0	0
RAM	0	0	MSB	(pattern data, character code)			LSB			

Write code "0D" in the instruction register. Then, write 8-bit data with RS=0, and the data is written into RAM as display data or character codes at the address specified by the cursor address counter. After writing, the cursor address Counter increments by 1.

11) Reading display data

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction Reg	0	1	0	0	0	0	1	1	0	1
RAM	0	0		MSB	(pattern data, character code)			LSB		

   Write "0CH" in the instruction register. Then, establish the read status with RS=0, and data in the RAM can be read. The procedure for reading data is as follows:

  This instruction outputs the contents of the data output register to DB0 to DB7, then transfers the RAM data indicated by the cursor address to the data output register. It then increments the cursor address by 1, which means that correct data cannot be read in the first read operation. The specified value is output in the second read operation. Accordingly, a dummy read operation must be performed once when reading data after setting the cursor address.

12) Bit clear

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction Reg	0	1	0	0	0	0	1	1	1	0
Bit clear	0	0	0	0	0	0	0	(N$_B$-1) Binary		

13) Bit set

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction Reg	0	1	0	0	0	0	1	1	1	1
Bit clear	0	0	0	0	0	0	0	(N$_B$-1) Binary		

As the bit-clear or bit-set instruction, 1 bit of a 1 byte of data in display RAM is set to 0 or 1. The bit specified by NB is set to 0 for the bit-clear instruction and 1 for the bit-set instruction. The RAM address is specified by the cursor address, which is indicated by $N_B=1$, and the MSB by $N_B=8$.

14) Reading the BUSY flag]

Register	R/W	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Busy flag	1	1	1/0				*			

The Busy flag is output to DB7 when read mode is established with RS=1. the Busy flay is set to 1 while any of the instructions 1) through 13) is being executed. It is set to 0 at the completion of the execution, allowing the next instruction to be accepted. No other instruction can be accepted when the Busy flag is 1. Accordingly, before writing an instruction and data, it is necessary to ensure that the Busy flag is 0. However, the next instruction can be executed without checking the Busy flag when the maximum read cycle time or the write cycle time has been exceeded after execution of the previous data read instruction or the data write instruction.

The Busy flag does not change when data is written into the instruction register (RS=1). Therefore, the Busy flag need not be checked immediately after writing data into the instruction register.

Specification of the instruction register is unnecessary ;to read the Busy flag.

The relation between the LCD panel display and H_P, H_N, V_P, and N_X.
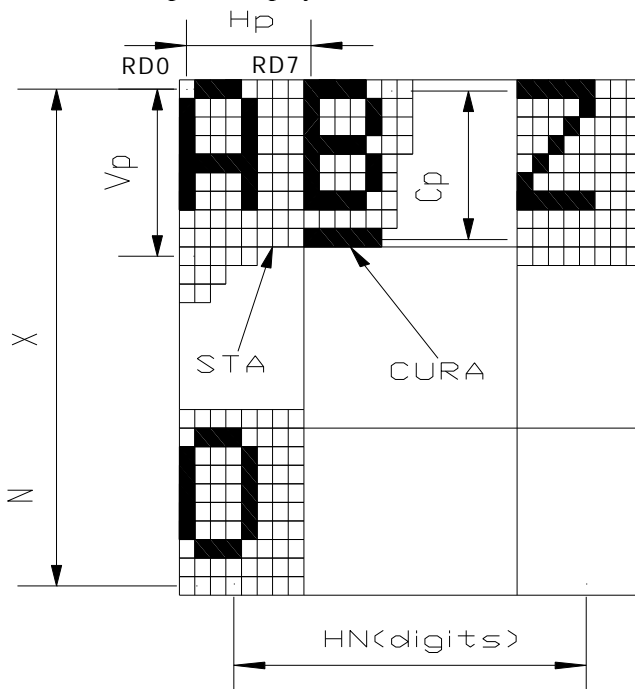
Symbol	Description	Contents	Value
H_P	Horizontal character pitch	Character pitch is the horizontal direction	6 to 8 dots
N_N	Number of characters in the horizontal direction	Number of characters (digits) per horizontal line or the number of words per line (graphic)	Even digits in the Range 2 to 256
V_P	Vertical character pitch	Character pitch in the vertical direction	1 to 16 dots
C_P	Cursor position	The line number at which the cursor is to be displayed	1 to 16 lines
N_X	Number of lines in the vertical direction	Display duty	1 to 256 lines

Note)

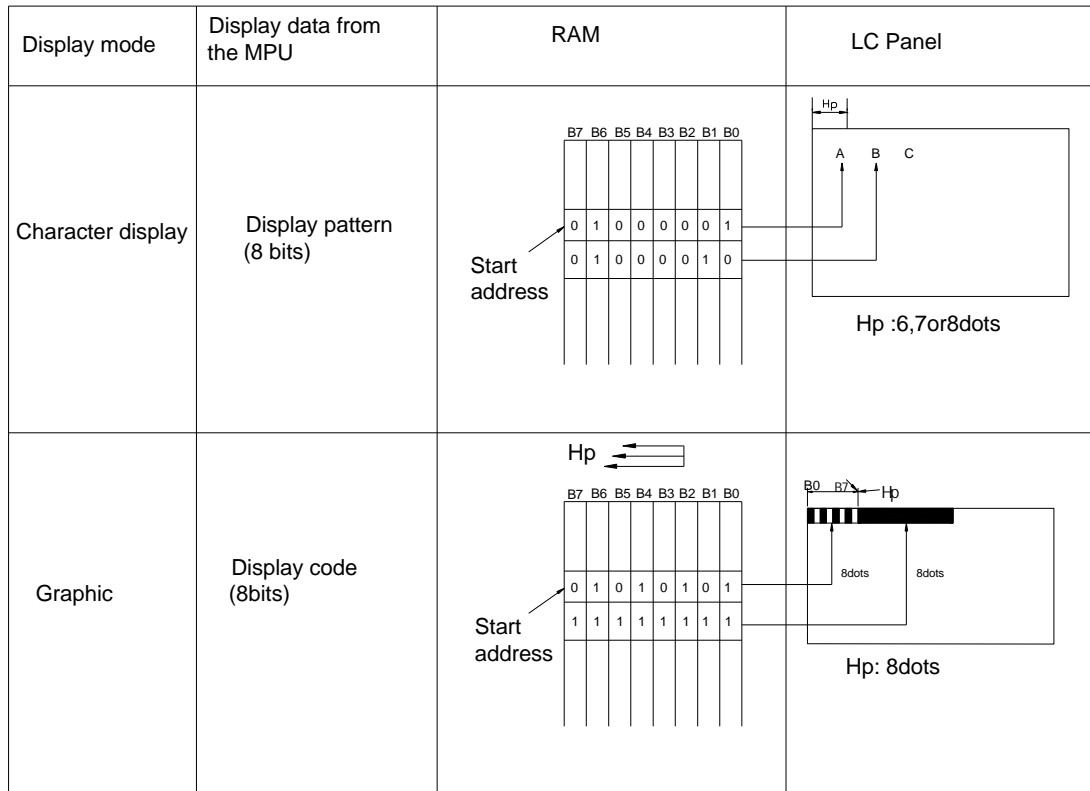When the number of vertical dots on the screen is m and that of horizontal dots is n,

$1/m = 1/N_X = $ Display duty

$n = H_P \times H_N$

$m/V_P = $ number of display lines

$C_P \cdot V_P$

Display mode

Display mode	Display data from the MPU	RAM	LC Panel
Character display	Display pattern (8 bits)		 Hp :6,7or8dots
Graphic	Display code (8bits)		 Hp: 8dots

13. QUALITY ASSURANCE

13.1 Test Condition

13.1.1 Temperature and Humidity (Ambient Temperature)

       Temperature : $20 \pm 5°C$

       Humidity   : $65 \pm 5\%$

13.1.2 Operation

       Unless specified otherwise, test will be conducted with LCM in operation.

13.1.3 Container

       Unless specified otherwise, vibration test will be conducted on module only.

13.1.4 Test Frequency

       Single cycle.

13.1.5 Test Method

No.	Parameter	Conditions	Regulations
1	High Temperature Operating	$70 \pm 2°C$	Note 3
2	Low Temperature Operating	$-20 \pm 2°C$	Note 3
3	High Temperature Storage	$75 \pm 2°C$	Note 3
4	Low Temperature Storage	$-25 \pm 2°C$	Note 3
5	Vibration Test (non-operation state)	Total fixed amplitude: 1.5mm Vibration Frequency: 10 ~ 55Hz One cycle 60 seconds to 3 directions of X.Y.Z. for each 15 minutes	Note 3
6	Damp Proof Test (non-operations state)	$40°C \pm 2°C$, 90 ~ 95% RH, 96 hours	Note1.2
7	Shock Test (non-operation state)	To be measured after dropping from 60cm High once concreter surface I packing state	Note3

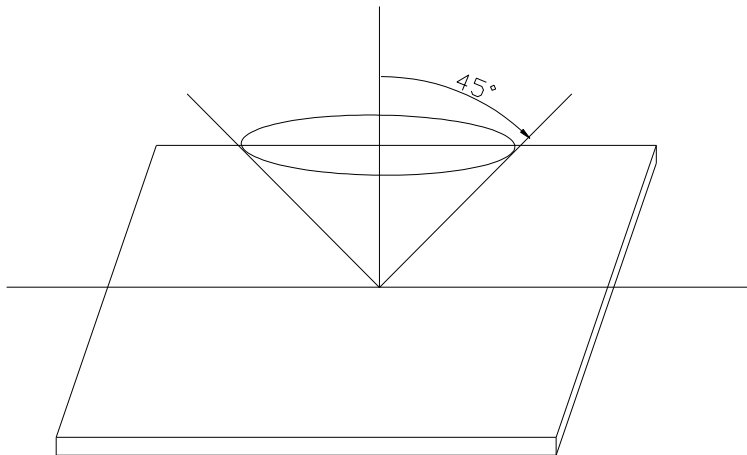Note 1: Returned under normal temperature and humidity for 4 hours.

Note 2: No dew condensation to be observed.

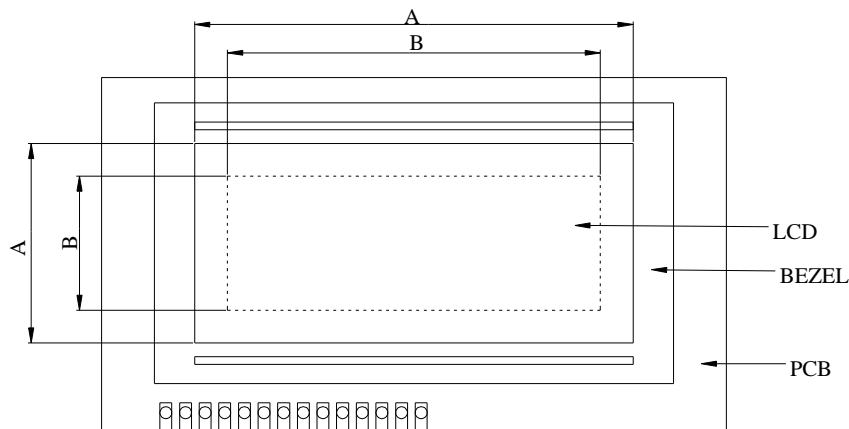Note 3: No change on display and in operation under the test condition

13.2 Inspection condition
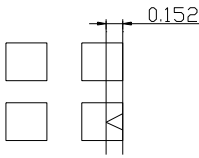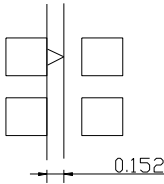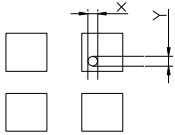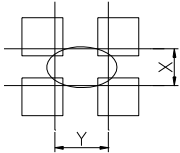
13.2.1 Inspection conditions

The LCD shall be inspected under 40 W white fluorescent light.

45°

13.2.2 Definition of applicable Zones

A

B

A

B

LCD

BEZEL

PCB

TYPICAL LCM   A: VIEWING AREA
                B: ACTIVE AREA

13.2.3 Inspection Parameters

No.	Parameter	Criteria
1	Foreign Substances (Spots)	(1) Round Shape
2	Air Bubbles (between glass & polarizer)	

Foreign Substances (Spots) — (1) Round Shape

Zone / Dimension	Acceptable number			Class Of defects	Acceptable level
	A	B	C		
D≤0.2	*	*	*	Minor	2.5
0.2≤D≤0.3	3	4	*		
0.3≤D≤0.4	2	3	*		
D<0.3	0	1	*		

D= (Long+Short)/2   *: Disregard

X (mm)	Zone	Acceptable number			Class Of Defects	Acceptable level
		A	B	C		
*	0.03≥W	*	*	*	Minor	2.5
3.0≥L	0.05≥W	3	4			
1.0≥L	0.1≥W	3	3			
-	0.1<W					

Y(mm)

X: Length Y: Width   *: Disregard

Total defects should not exceed 4/module

Air Bubbles (between glass & polarizer)

Zone / Dimension	Acceptable number			Class of defects	Acceptable Level
	A	B	C		
D≤0.3	*	*	*	Minor	2.5
0.3<D≤0.4	3	*	*		
0.4<D≤0.6	2	3	*		
0.6<D	0	0	*		

*: Disregard

Total defects shall not excess 3/module

3	Uniformity of Pixel	(1) Pixel shape (with Dent) 0.152 (2) Pixel shape (with Projection) Should not be connected to next pixel 0.152 (3) Pin hole $(X+Y)/2 \pounds 0.02mm$ (Less than 0.1 mm is no counted) (4) Deformation $(X+Y)/2 \pounds 0.3mm$ Total accceptable number : 1/ pixel , 5 / cell

14. PRECAUTION FOR USING LCM

1. LIQUID CRYSTAL DISPLAY (LCD)
LCD is made up of glass, organic sealant, organic fluid, and polymer based polarizers. The following precautions should be taken when handling,

(1). Keep the temperature within range of use and storage. Excessive temperature and humidity could cause polarization degredation, polarizer peel off or bubble.

(2). Do not contact the exposed polarizers with anything harder than an HB pencil lead. To clean dust off the display surface, wipe gently with cotton, chamois or other soft material soaked in petroleum benzin.

(3). Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or color fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.

(4). Glass can be easily chipped or cracked from rough handling, especially at corners and edges.

(5). Do not drive LCD with DC voltage.

2. Liquid Crystal Display modules

2.1 Mechanical considerations
LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modifications. The following should be noted.
(1). Do not tamper in any way with the tabs on the metal frame
(2). Do not modify the PCB by drilling extra holes, changing its outline, moving its components or modifying its pattern.
(3). Do not touch the elastomer connector, especially insert an backlight panel (for example, EL).
(4). 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.
(5). Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels.

2.2. Static Electricity
LCM contains CMOS LSI's and the same precaution for such devices should apply, namely
(1). The operator should be grounded whenever he/she comes into contact with the module. Never 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.
(2). The modules should be kept in antistatic bags or other containers resistant to static for storage.
(3). Only properly grounded soldering irons should be used.
(4). If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.
(5). The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended.
(6). Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

2.3. Soldering
(1). Solder only to the I/O terminals.
(2). use only soldering irons with proper grounding and no leakage.
(3). Soldering temperature: 280°C ± 10°C
(4). Soldering time: 3 to sec.
(5). Use eutectic solder with resin flux fill.
(6). If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed after wards.

2.4 Operation
(1). The viewing angle can be adjusted by varying the LCD driving voltage V0.
(2). Driving voltage should be kept within specified range; excess voltage shortens display life.
(3). Response time increases with decrease in temperature.
(4). Display may turn black or dark blue at temperatures above its operational range; this is (however not pressing on the viewing area) may cause the segments to appear "fractured".
(5). Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear "fractured".

2.5 Storage
If any fluid leaks out of a damaged glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.

2.6 Limited Warranty
Unless otherwise agreed between DISPLAY and customer, DISPLAY will replace or repair any of its LCD and LCM which is found to be defective electrically and visually when inspected in accordance with DISPLAY acceptance standards, for a period on one year from date of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of DISPLAY is limited to repair and/or replacement on the terms set forth above. DISPLAY will not responsible for any subsequent or consequential events.