

SPECIFICATIONS

TITLE : 6,4" TFT COLOR MODULE

NUMBER : HLD 0604-010000 REV.A PAGE 1

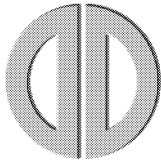
DATA DISPLAY AG

HLD 0604 - 010000

6.4 INCH

**ACTIVE MATRIX COLOR
TFT DISPLAY**

640 x 480 DOTS



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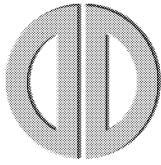
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1. OUTLINE

1-1 Scope

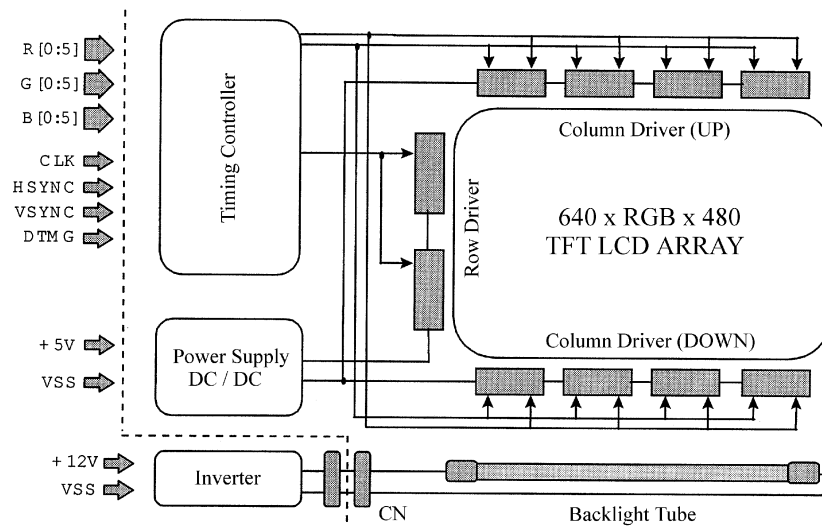
This specification shall be applied to Data Displays Color Active Dot Matrix Liquid Crystal Display (ALCD) with CCFL backlight

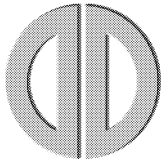
1-2 Features

Display Mode	Transmissive type normally white mode
Display Format	640 (x3) x 480 Dots
Screen Area	130,56 x 97,92 mm (163,2 mm diagonal)
Display Outline	168,0 x 123,0 x 9,0 mm (typ.)
Contrast Ratio	150:1 (typ.)
Brightness	140 cd/m ² (typ) / If = 5 mA
Response Time	Tr = 20ms (typ) / Tf = 35 ms (typ)
Color Pixel Arrangement	RGB vertical stripes
Display Surface	Low reflection type, antiglare with hard coating (2H)
Number of Colors	262.144 colors (6 bits for each RGB subpixel)
Contrast Setting	Maximum setting
Viewing Direction	6:00 o' clock (Maximum contrast direction)
Interface	5V CMOS logic
Backlight	CCFL top edgelight system

1-3 Block Diagram

1-3-1 Display



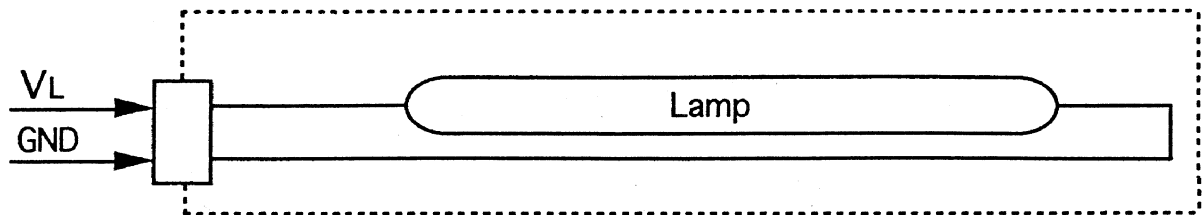


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1-3-2 Backlight Unit



2. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Specification	Unit	Remark
Storage Temperature	T _{st}	-25 ... 70	°C	
Humidity *	RH	95 max	%	≤ 40°C
Operating Temperature	T _{op}	0 ... 60**	°C	
Humidity *	RH	95 max	%	≤ 40°C
Supply Voltage	V _{DD}	+4.5 ... +5.5		T _a =25°C
Input Voltage	V _I	0V ... V _{DD}	V	

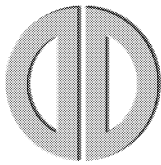
* Notes :

The relative humidity must not exceed 80% non-condensing at temperatures of 50°C or less
At temperatures higher than 40°C the wet bulb temperature must not exceed 49°C

The unit should not be exposed to corrosive chemicals

See section "5 Reliability" for other conditions

** Optical values (contrast, response time, brightness, viewing angle) maybe influenced in lower and upper Top



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3. DISPLAY CHARACTERISTICS

3-1 Physical Dimensions

Item	Standard Value	Unit
Display Pixels	640 (x3RGB) x 480	dots
Pixel Pitch	0,204 x 0,204	mm
Screen Area	134,6 x 102,0	mm
Active Area	130,56 x 97,92 (6,4" diagonal)	mm
Display Outline	168,0 x 123,0 x 9,0	mm
Weight	230 (typ.)	grams

3-2 Electro-Optical Characteristics

Item	Condition	Symbol	Min	Typ	Max	Unit	
Contrast Ratio	$\theta=0^\circ, \phi=0^\circ$	CR	100	150	-	-	
Viewing Angle	X axis right	CR > 5	-	50	-	degree	
	X axis left	CR > 5	-	50	-	degree	
	Y axis up	CR > 5	-	15	-	degree	
	Y axis down	CR > 5	-	35	-	degree	
Response Time	Rise	$25^\circ\text{C} \pm 2,5^\circ\text{C}$	T_r	-	20	50	ms
	Fall	$\theta=0^\circ, \phi=0^\circ$	T_f	-	35	50	ms
Brightness (5 point average)	see 3-3-2 (typ)		100	140		cd/m^2	
Brightness Variation	see note d)		-		1.4		
Chromaticity (CIE 1931)	White x	x	0.292	0.322	0.352		
	White y	y	0.289	0.319	0.349		
	Red x	y	0.557	0.587	0.617		
	Red y	x	0.322	0.352	0.382		
	Green x	y	0.254	0.284	0.314		
	Green y	x	0.522	0.552	0.582		
	Blue x	y	0.114	0.144	0.174		
	Blue y	x	0.092	0.122	0.152		

Note : Measurements made after 30 min in a dark environment at RT

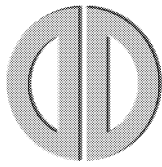
RT means Room Temperature ($25^\circ\text{C} \pm 5^\circ\text{C}$)

a) If not specially mentioned, CCFL supply current (If) shall be referred to section 3-3-2

b) Refer to section 4 for definitions and other information

c) If not specially mentioned, condition of temperature is RT ($20^\circ\text{C} \dots 30^\circ\text{C}$)

d) The variation in surface brightness is determined by measuring B_{ON} at each test position 0...9 and then dividing the maximum B_{ON} of 9 points luminance by the minimum B_{ON} of 9 points luminance.



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3-3 Electrical Characteristics

3-3-1 Display

Item	Symbol	Min	Typ	Max	Unit	Remark
Supply Voltage	V _{DD}	4,5	5,0	5,5	V	V _{DD} ± 10%
Supply Power	P _{DD}	-	0,56	0,75	W	DCLK=25MHz
"High" Input Voltage	V _{Ih}	0,7V _{DD}	-	V _{DD}	V	INPUT SIGNALS : DE,VS,HS,DCCLK R0...R5 / G0...G5 B0...B5
"Low" Input Voltage	V _{Il}	V _{SS}	-	0.3V _{DD}	V	
Input Leakage Current	I _{CL,I} CH	-20	-	20	µA	
Input Capacitance	C _i			120	pF	
Supply Current Note : *1	I _{DD}	-	180	280	mA	V _{DD} =5V,T _{OP} =25°C DCLK=25 MHz

Note :

*1 The supply current is measured with an 8 gray scale bar check pattern

3-3-2 CCFL Backlight

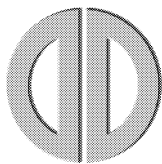
Item	Symbol	Min	Typ	Max	Unit	Remark
Lamp Current	I _f	3.0	5.0	9.0	mA	
Lamp Voltage	V _L	-	355	385	V _{rms}	*3
Power Consumption	P _L	-	1.75	2.9	W _{rms}	
Starting Voltage				680 860	V _{rms}	25°C ± 2°C 0°C ± 2°C
Driving Frequency		35	55	80	kHz	*2
Life (half brightness time)		20.000	25.000		h	

Note :

*2 : Lamp frequency may produce interference with horizontal sync frequency and may cause beat on the display. Therefore lamp frequency shall be detached from the HSYNC and from the harmonics of HSYNC to avoid interference.

Recommended Inverters :

ZU 01 002	CXA-L10A (5V)
ZU 01 003	CXA-L10L (12V)
ZU 01 004	CCFL Inverter 8m (5V)
ZU 01 005	CCFL Inverter 8m (12V)



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3-3-3 Interface Description Display

Connector (CN1) for display

Manufacturer : HIROSE ELECTRIC CO., LTD

Part Number : DF9B-31P-1V

Matching Connector : DF9B-31S-1V

Pin No.	Signal Name	Function
1	GND	Ground
2	DCLK	Dot Clock
3	HS	Horizontal Sync
4	VS	Vertical Sync
5	GND	Ground
6	R0 (LSB)	Red Data 0
7	R1	Red Data 1
8	R2	Red Data 2
9	R3	Red Data 3
10	R4	Red Data 4
11	R5 (MSB)	Red Data 5
12	GND	Ground
13	G0 (LSB)	Green Data 0
14	G1	Green Data 1
15	G2	Green Data 2
16	G3	Green Data 3
17	G4	Green Data 4
18	G5 (MSB)	Green Data 5
19	GND	Ground
20	B0 (LSB)	Blue Data 0
21	B1	Blue Data 1
22	B2	Blue Data 2
23	B3	Blue Data 3
24	B4	Blue Data 4
25	B5 (MSB)	Blue Data 5
26	GND	Ground
27	DTMG	Data Timing Signal
28	V _{DD}	Power Supply
29	V _{DD}	Power Supply
30	OAS	Connected to V _{DD}
31	NC	No Connection (leave open)

Connect all Ground pins together and to metal frame. Connect all V_{DD} pins together
The signals DTMG, HS and VS should be supplied simultaneously.

Available Interfaces : ZU 02 007

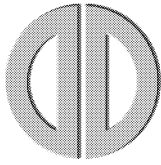
IF 107

31 pin HIROSE to 30 pin FFC

ZU 02 040

IF 151

LVDS interface (15 pin HIROSE connector)



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3-3-4 Interface Description Backlight

Connector (CN2) for backlight

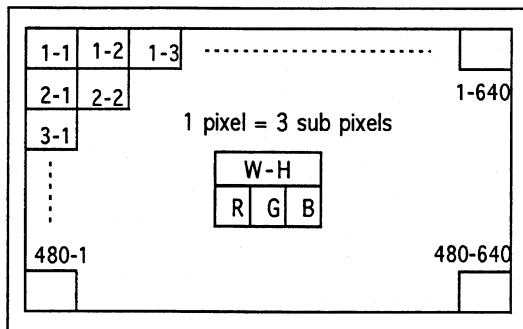
Manufacturer : JAPAN SOLDERLESS TERMINAL MFG. CO. LTD (JST)

Part Number : BHR-03VS-1 Matching Part : SM02(8.0)B-BHS-1

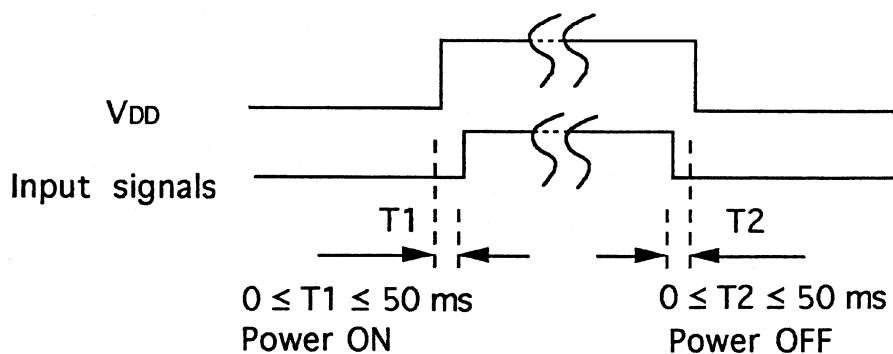
Pin No.	Signal Name	Function
1	HV	Power Supply (pink wire)
2	NC	No Connection
3	LV	Ground

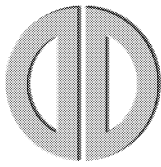
3-3-5 Data Input Format

Display Position of Input Data (W-H)



3-3-6 Power ON/OFF Sequential Timing





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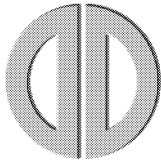
3-3-7 Data Signal, Basic Color and Gray Scale of Each Color

Basic Color	Data Signal																	
	R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Gray Scale of Red / Green / Blue	Data Signal						Gray Level (decimal)
	RGB	RGB	RGB	RGB	RGB	RGB	
Black	5	4	3	2	1	0	= 0
Darker	0	0	0	0	0	1	= 1
↑	0	0	0	0	1	0	= 2
:	0	0	0	0	1	1	= 3
:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:
↓	1	1	1	1	0	1	= 61
Brighter	1	1	1	1	1	0	= 62
Red / Green / Blue	1	1	1	1	1	1	= 63

0 = Low Level Voltage

1 = High Level Voltage



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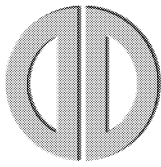
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3-3-8 Interface Timing Specification

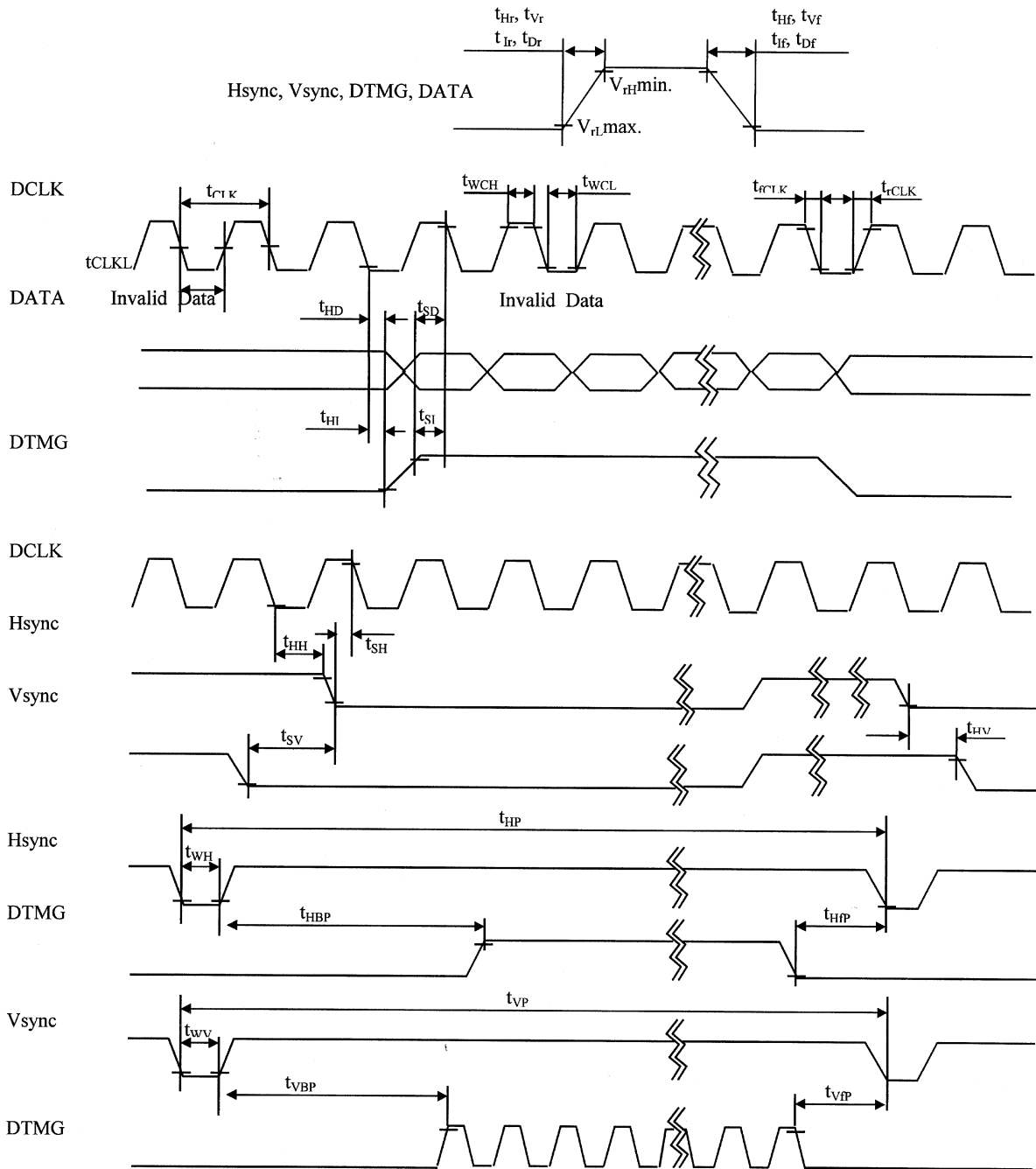
	Parameter	Symbol	Min	Typ	Max	Unit
DCLK	Frequency	fCLK	-	25	28	MHz
	Width Low	twCL	7	-	-	ns
	Width High	twCH	7	-	-	
	Rise Time	t _r CLK	7	-	-	
	Fall Time	t _f CLK	7	-	-	
	Duty (D=t _{CLKL} /t _{CLK})	D	0.45	0.50	0.55	
HS	Set up time	t _{SH}	3	-	-	ns
	Hold time	t _{HH}	8	-	-	t _{CLK}
	Period	t _{HP76}	7	800	880	
	Width Active	t _{WH}	12	96	200	
	Rise / Fall time	t _{Hr} / t _{Hf}	-	-	30	ns
VS	Setup time	t _{SV}	0	-	-	t _{CLK}
	Hold time	t _{HV}	2	-	-	
	Period	t _{VP}	515	525	560	t _{HP}
	Width Active	t _{WV}	1	2	34	t _{HP}
	Rise / Fall time	t _{Vr} / t _{Vf}	-	-	50	line
DTMG	Set up time (for DCLK)	t _{SI}	3	-	-	ns
	Hold time (for DCLK)	t _{HI}	8	-	-	t _{CLK}
	Horizontal Backporch	t _{HBP}	-	48	-	
	Horizontal Frontporch	t _{HFP}	-	16	-	
	Vertical Backporch	t _{HBP}	-	32	-	t _{HP}
	Vertical Frontporch	t _{HFP}	-	11	-	ns
	Rise / Fall time	t _r / t _f	-	-	30	
DATA	Set up time (for DCLK)	t _{SD}	7	-	-	ns
	Hold time (for DCLK)	t _{HD}	14	-	-	
	Rise / Fall time	t _{Dr} / t _{Df}	-	-	25	

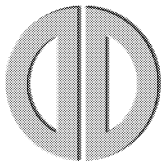
Note : Setup, Hold, Rise and Fall times are preliminary values (TBD finally)



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3-3-9 Signal Timing Waveform (Data latched at falling edge of DCLK)





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4. DEFINITION AND MEASURING METHOD

- Note 1) Viewing Angle, Contrast Ratio, Response Time, Reflectance and Chromaticity are measured in a dark room at panel center.
- 2) Brightness and Brightness Uniformity are measured at 5 points as described in Fig. 4
- 3) Backlight is warmed up for more than 15 minutes to make its condition stable.

4-1 Viewing Angle

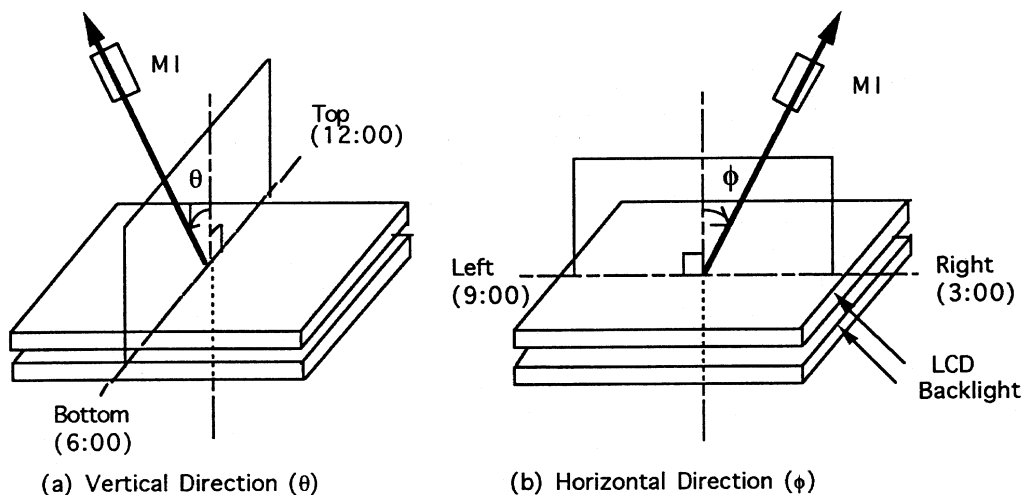


Figure 1

4-2 Optical Measurement

4-2-1 Measurement Instrument (MI)

Luminance & Chromaticity : PHOTORESEARCH / PRITCHARD 1980B/SS or
TOPCON / Color Luminance Meter BM5(A)

Response Time : PRITCHARD 1980/SS or photomultiplier

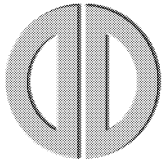
Measurement Diameter : 5 ... 10 mm

4-2-2 Module Driving Conditions

Frame Frequency : 60 Hz

Supply Voltage : Refer to Section 3-3-1

Backlight Supply Current : Refer to Section 3-3-2



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4-3 Contrast Ratio (CR)

Definition Contrast Ratio = $\frac{\text{Luminance in White Level (Gray Level 63)}}{\text{Luminance in Black Level (Gray Level 0)}}$

4-4 Definition of Response Time (T_r , T_f)

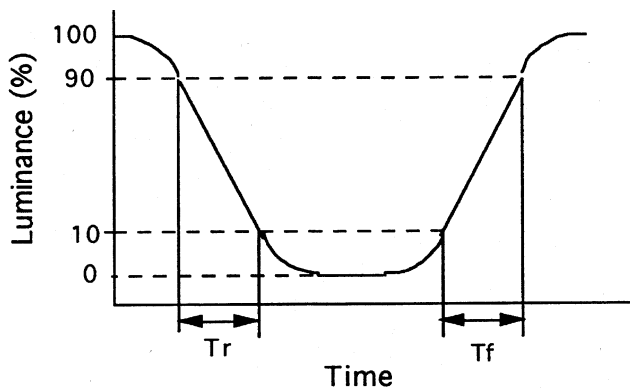


Figure 2

4-5 Definition of Reflectance

Reflectance : $R = R_s / R_{ref} \times 100\%$
Rs : Brightness of LCD reflectance
Rref : Brightness of calibrated front surface mirror reflectance

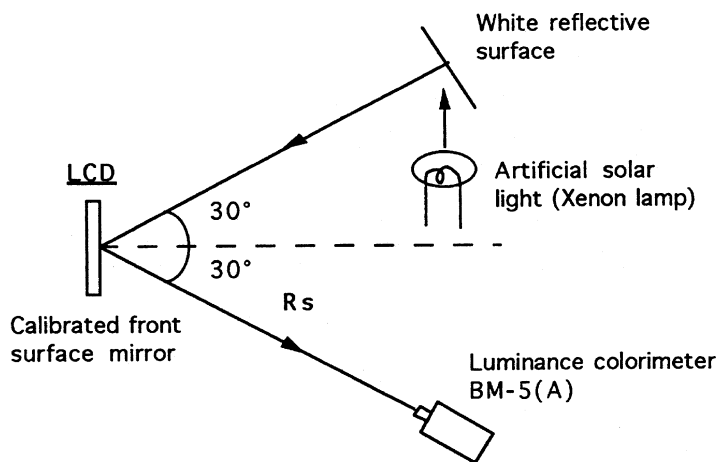
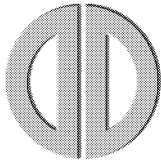


Figure 3



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4-6 Definition of Brightness and Brightness Uniformity

Brightness : Average value of 5 points shown in Figure 4

Brightness Uniformity :
$$\frac{\text{Max (Min) - Average}}{\text{Average}} \times 100 \%$$

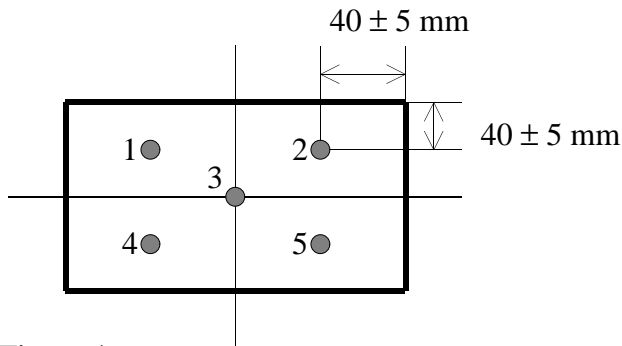


Figure 4

Condition : Display Pattern : Gray Level 63 (white)

4-7 Supply Current (Display without Backlight)

Maximum Current Display Pattern : Line by line vertical stripes with Gray level 0 and 63

Typical Current Display Pattern : 64 vertical gray shades

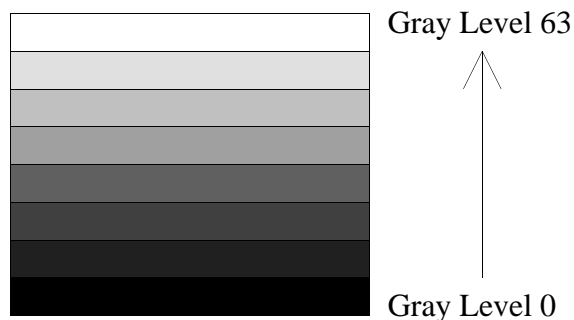
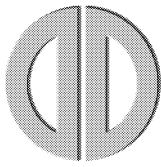


Figure 5



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5. ENVIRONMENTAL AND RELIABILITY DATA

5-1 Environmental

Altitude : Operating 0 ... 10000 feet (3048 m)
 Storage / Shipping 0 ... 40000 feet (12192 m)

5-2 Reliability Test Item and Condition

Test Item		Condition	
1	Low Temperature Storage	- 20°C x 240 h	Non-operating
2	High Temperature Storage	+ 60°C x 240 h	Non-operating
3	Low Temperature Operating	0°C x 240 h (CCFL current 5mA)	Operating
4	High Temperature Operating	50°C x 240 h (CCFL current 5mA)	Operating
5	High Temp. & High Humidity	40°C , 95% RH x 240h (no condensation)	Operating
6	Vibration	Frequency: 10...57Hz ,Vibration width (one side) 0,075mm Frequency: 58...500 Hz, Gravity : 9.8m/s ² Sweep time : 11 minutes, Test period : 1hour per each axis	Non-operating
7	Shock	Max. Gravity: 490 m/s ² Pulse width: 11ms, half sine wave Direction : X,Y,Z / One shock each direction	Non-operating

Result :

There should be no change which might affect the practical display function when the display quality test is conducted under normal operating conditions.

5-3 Standards

SAFETY

UL1950 "Safety of Information Technology Equipment Including Electrical Business Equipment Third Edition" Underwriters Laboratories, Inc 1995

CAS C22.2 "Safety of Information Technology Equipment Including Electrical Business Equipment Third Edition" Canadian Standards Association, 1995

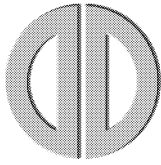
EN 60950 "Safety of Information Technology Equipment Including Electrical Business Equipment" European Committee for Electrotechnical Standardization, 1995

EMC

ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low Voltage Electr. and Electronic Equipment in the Range of 9 kHz to 40 GHz" ANSI, 1992

C.I.S.P.R. "Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment" Int. Special Committee on Radio Interference

EN 55022 "Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment" CENELEC 1988



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6. APPLICABLE OTHER DOCUMENTS

Outline Drawing : Attached
Shipping Container : 10 pcs per packaging unit

7. CAUTION AND HANDLING PRECAUTION

7-1 Handling

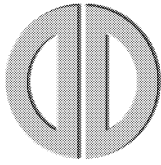
1. Do not disassemble the module
2. Since the LCD cell is made of glass, do not apply strong mechanical impact or static load onto it. Handle with care, and do not twist or bend the LCD module.
3. In case the LCD cell is broken, do not sip or drink leaked liquid crystal material. If the liquid crystal material touched your skin, wash it out with soap immediately.
4. Do not drop water or any chemicals onto the display surface.
5. Handle the polarizers with care as it may be easily scratched. Do not press or rub them with any hard object.
6. Do not apply high electrostatic voltage to the LCD module. It may damage CMOS / LSI circuit in the LCD module. Ground yourself when you touch the LCD module directly.
7. When you handle the LCD module for incoming inspection or assembly, use soft fingerstalls or gloves in order to keep the display quality.
8. Do not pull or fold the CCFL cable

7-2 Storage

1. Store the LCD module within the ratings in order to keep the performance and prevent from any damages. Never store the LCD module under abnormal conditions of high temperature and high humidity. It is recommended that the LCD module shall be stored under the condition of temperature between 0°C and 35°C and humidity less than 60%.
2. Never store LCD module with exposure to direct sunlight

7-3 Operation

1. Do not connect or disconnect the LCD module to or from the system when power is on.
2. Use the LCD module within the ratings in order to keep the performance and prevent from any damages. Never use the LCD module under abnormal conditions of high temperature and high humidity.
3. Long term operation with same image pattern may cause remanent image. (May be avoided with screen saver). Remanent image will disappear after certain time.



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7-4 Others

Avoid any condensation of water during storage or operation as it may cause misoperation or disconnection of electrodes.

8. WARRANTY

8-1 Incoming Inspection

Incoming inspection by the customer shall be performed within thirty (30) days from the shipping date.

8-2 Warranty Period

The warranty period for the LCD modules is 6 months from the shipping date when stored or used under normal conditions.

9. OTHERS

Any and all questions or disputes arising out of or related to this specification shall be settled by a consultation between the customer and Data Display GmbH & Co. KG or its representatives.

10. DRAWING

See following page.

If a more detailed drawing is necessary please contact Data Display GmbH & Co. KG or its representatives.

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