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TFT | OLED | CHARACTER | GRAPHIC | UWVD | SEGMENT | CUSTOM

## TFT Display Module

Part Number

*E70RA-I-HS650-N*

### Overview:

- 7.0-inch TFT (165.00x100mm)
- 1024x600 Pixels
- HDMI Interface
- Special Temperature Range
- All Viewing Angles
- IPS, Transmissive
- No Touch Panel
- 650 NITS
- TFT IC: EK73215 & EK79001
- RoHS Compliant

## Description

This is a color active matrix TFT (Thin Film Transistor) LCD (Liquid Crystal Display) that uses amorphous silicon TFT as a switching device. This model is composed of a transmissive type TFT- LCD Panel, driver circuit, and backlight unit. The resolution of the 7.0" TFT- LCD contains 1024x600 pixels and can display up to 262K/16.7M colors.

## Features

Input Voltage: 12V

TFT Interface: HDMI

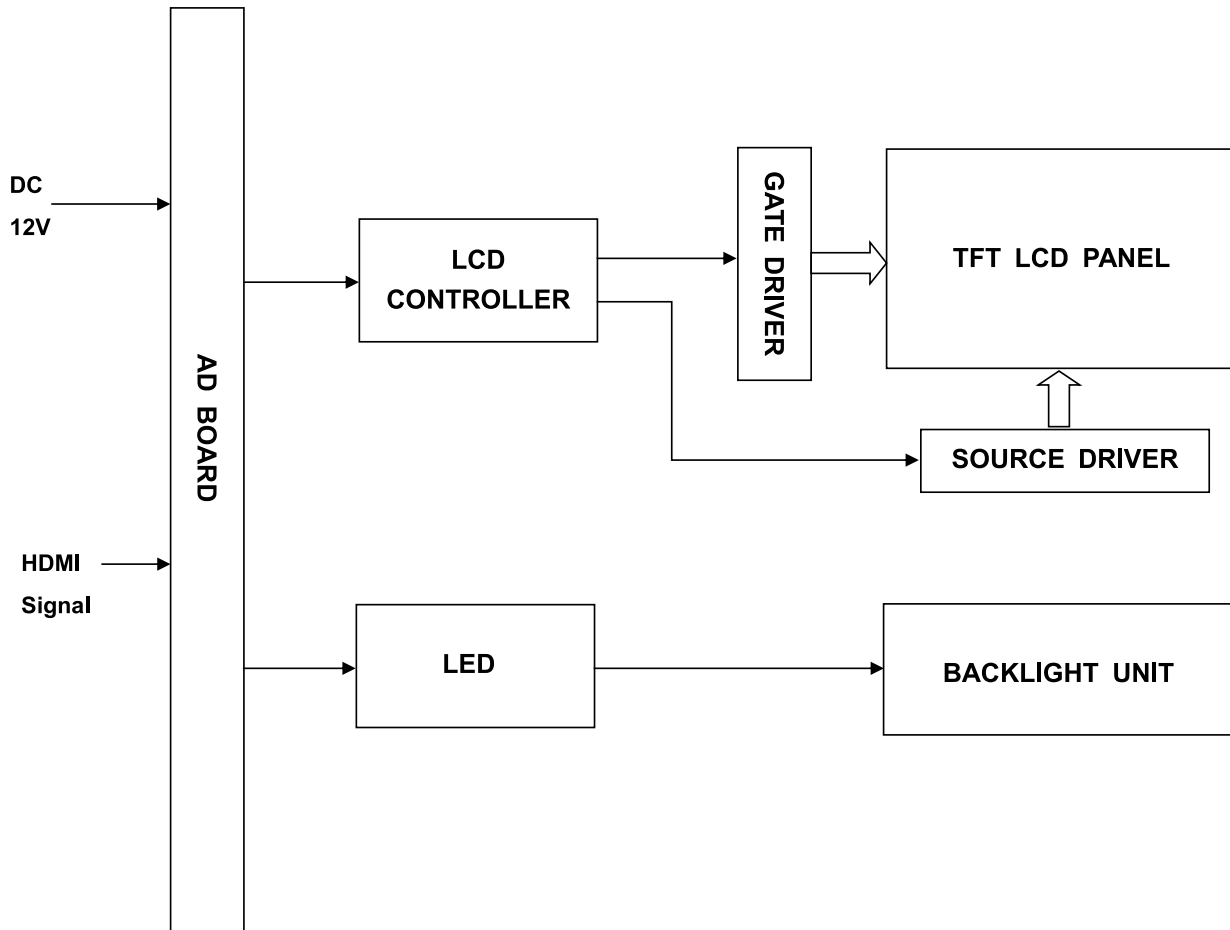
| General Information Items | Specification                   | Unit    | Note |
|---------------------------|---------------------------------|---------|------|
|                           | Main Panel                      |         |      |
| TFT Display Area (AA)     | 154.21(H) x 85.92(V) (7.0 inch) | mm      | --   |
| Driver Element            | TFT active matrix               | --      | --   |
| Display Colors            | 262K/16.7M                      | colors  | --   |
| Number of Pixels          | 1024(RGB)x600                   | dots    | --   |
| TFT Pixel Arrangement     | RGB vertical stripe             | --      | --   |
| Pixel Pitch               | 0.1506 (H) x 0.1432 (V)         | mm      | --   |
| Viewing Angle             | ALL                             | o'clock | --   |
| TFT Controller IC         | EK73215 & EK79001               | --      | --   |
| Display Mode              | Transmissive/Normally Black     | --      | --   |
| Operating Temperature     | -10 to +60                      | °C      | --   |
| Storage Temperature       | -20 to +70                      | °C      | --   |

## Mechanical Information

| Item        |                | Min. | Typ.   | Max.  | Unit | Note        |
|-------------|----------------|------|--------|-------|------|-------------|
| Module Size | Horizontal (H) | --   | 165.00 | --    | mm   | --          |
|             | Vertical (V)   | --   | 100.00 | --    | mm   | --          |
|             | Depth (D)      | --   | --     | 20.74 | mm   | --          |
| Weight      |                | --   | 180    | --    | g    | Approximate |



## 2. Block Diagram



### 3. Terminal Pin Assignment

#### 3.1 Power Input Pin Assignment

CON1 (DC-044 Socket)

| NO. | Symbol | Description            | I/O |
|-----|--------|------------------------|-----|
| 1   | DC_IN  | Power supply (DC 12V). | P   |
| 2   | GND    | Ground.                | P   |
| 3   | GND    | Ground.                | P   |

Extension CON3 (JST:S2B-PH-SM4-TB)

| NO. | Symbol | Description            | I/O |
|-----|--------|------------------------|-----|
| 1   | +12V   | Power supply (DC 12V). | P   |
| 2   | GND    | Ground.                | P   |

#### 3.2 Touch Input Pin Assignment (Dummy)

USB1 (Micro USB)

| NO. | Symbol  | Description          | I/O |
|-----|---------|----------------------|-----|
| 1   | VBUS_5V | Supply voltage (5V). | P   |
| 2   | USB_DN  | USB- signal.         | I/O |
| 3   | USB_DP  | USB+ signal.         | I/O |
| 4   | NC      | No connection.       | --  |
| 5   | GND     | Ground.              | P   |

Extension CON6 (Molex:53261-0471)

| NO. | Symbol  | Description          | I/O |
|-----|---------|----------------------|-----|
| 1   | VBUS_5V | Supply voltage (5V). | P   |
| 2   | USB_DN  | USB- signal.         | I/O |
| 3   | USB_DP  | USB+ signal.         | I/O |
| 4   | GND     | Ground.              | P   |

### 3.3 HDMI Pin Assignment

CON4: The type of HDMI connector is a type A.

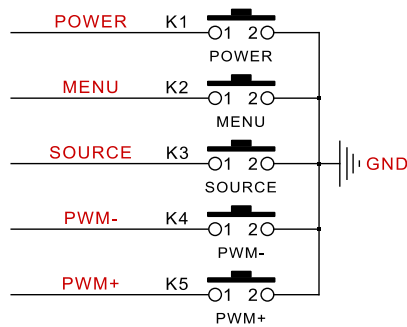
| NO. | Symbol   | Description                                    | I/O |
|-----|----------|------------------------------------------------|-----|
| 1   | RX_D2+   | HDMI receiver channel 2 positive analog input. | I/O |
| 2   | GND      | Ground.                                        | P   |
| 3   | RX_D2-   | HDMI receiver channel 2 negative analog input. | I/O |
| 4   | RX_D1+   | HDMI receiver channel 1 positive analog input. | I/O |
| 5   | GND      | Ground.                                        | P   |
| 6   | RX_D1-   | HDMI receiver channel 1 negative analog input. | I/O |
| 7   | RX_D0+   | HDMI receiver channel 0 positive analog input. | I/O |
| 8   | GND      | Ground.                                        | P   |
| 9   | RX_D0-   | HDMI receiver channel 0 negative analog input. | I/O |
| 10  | RX_CLK+  | HDMI receiver clock positive analog input.     | I   |
| 11  | GND      | Ground.                                        | P   |
| 12  | RX_CLK-  | HDMI receiver clock negative analog input.     | I   |
| 13  | CEC      | No connection.                                 | --  |
| 14  | RESERVED | No connection.                                 | --  |
| 15  | HDMI_SCL | HDMI receiver DDC data channel.                | I   |
| 16  | HDMI_SDA | HDMI receiver DDC clock channel.               | I/O |
| 17  | GND      | Ground.                                        | P   |
| 18  | HDMI_VCC | HDMI supply voltage (5.0V).                    | P   |
| 19  | HPD      | HDMI receiver hot plug detect output.          | O   |

*I: Input, O: Output, P: Power*

### 3.4 Backlight Key Output Pin Assignment

CON7 (Molex-53261-0671)

| NO. | Symbol | Description                                                                                             | I/O |
|-----|--------|---------------------------------------------------------------------------------------------------------|-----|
| 1   | POWER  | Power supply control.                                                                                   | I   |
| 2   | MENU   | Switch to the menu control.<br>Note: It will be dummy if the resolution is lower than 640x480.          | I   |
| 3   | SOURCE | Switch the input signal control, there is only HDMI signal, with return function in the menu interface. | I   |
| 4   | PWM-   | Reduce brightness of backlight.                                                                         | I   |
| 5   | PWM+   | Increase brightness of backlight.<br>Note: The brightness is configured for maximum after power on.     | I   |
| 6   | GND    | Ground.                                                                                                 | P   |



OSD key circuit diagram

### 3.5 Extension Backlight Output Pin Assignment

CON2 (Molex-53261-0671)

| NO. | Symbol | Description        | I/O |
|-----|--------|--------------------|-----|
| 1   | GND    | Ground.            | P   |
| 2   | GND    | Ground.            | P   |
| 3   | BL_PWM | PWM signal output. | O   |
| 4   | BL_EN  | Enable signal.     | O   |
| 5   | 12V    | Power supply.      | P   |
| 6   | 12V    | Power supply.      | P   |

## 4. LCD Optical Characteristics

### 4.1 Optical Specifications

| Item                      |         | Symbol | Condition                      | Min    | Typ.   | Max    | Unit   | Note   |
|---------------------------|---------|--------|--------------------------------|--------|--------|--------|--------|--------|
| Color Gamut               |         | S(%)   |                                | 45     | 49     | --     | %      | (5)    |
| Contrast Ratio            |         | CR     | θ=0<br>Normal<br>viewing angle | 600    | 900    | --     | %      | (2)    |
| Response Time             | Rising  | TR     |                                | --     | 25     | 40     | ms     | (4)    |
|                           | Falling | TF     |                                |        |        |        |        |        |
| Color Filter Chromaticity | White   | WX     |                                | 0.2646 | 0.2846 | 0.3046 |        | (5)(6) |
|                           |         | WY     |                                | 0.2891 | 0.3091 | 0.3291 |        |        |
|                           | Red     | RX     |                                | 0.5436 | 0.5836 | 0.6236 |        |        |
|                           |         | RY     |                                | 0.3084 | 0.3484 | 0.3884 |        |        |
|                           | Green   | GX     |                                | 0.2648 | 0.3048 | 0.3448 |        |        |
|                           |         | GY     |                                | 0.5053 | 0.5453 | 0.5853 |        |        |
|                           | Blue    | BX     |                                | 0.1115 | 0.1515 | 0.1915 |        |        |
|                           |         | BY     | 0.0537                         | 0.0937 | 0.1337 |        |        |        |
| Viewing Angle             | Hor.    | θL     | CR>10                          | --     | 85     | --     | degree | (1)(6) |
|                           |         | θR     |                                | --     | 85     | --     |        |        |
|                           | Ver.    | θT     |                                | --     | 85     | --     |        |        |
|                           |         | θB     |                                | --     | 85     | --     |        |        |
| Option View Direction     |         | ALL    |                                |        |        |        |        | (1)    |

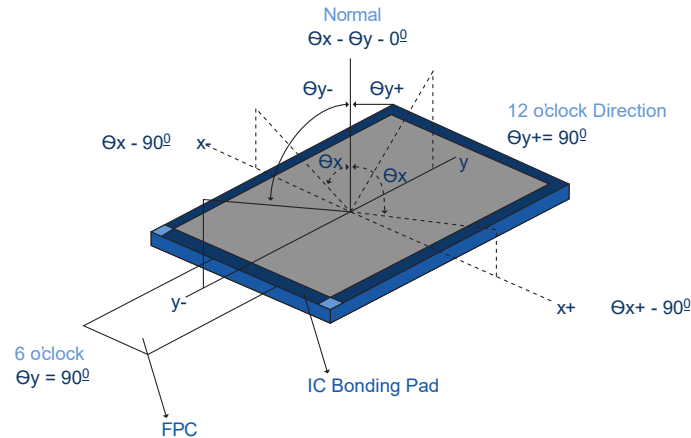
#### Measuring Conditions:

1. Dark Room
2. Ambient Temperature of  $25\pm 2^\circ\text{C}$
3. 15 Minute Warm up

## Optical Specification Reference Notes:

### (1) Definition of Viewing Angle:

The viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3,9 o'clock direction and the vertical or 6,12 o'clock direction with respect to the optical axis which is normal to the LCD surface.



### (2) Definition of Contrast Ratio:

Measured at the center point of panel. The contrast ratio (Cr) measured on a module, is the ratio between the luminance (Lw) in a full white area (R=G=B=1) and the luminance (Ld) in a dark area (R=G=B=0).

$$Cr = \frac{Lw}{Ld}$$

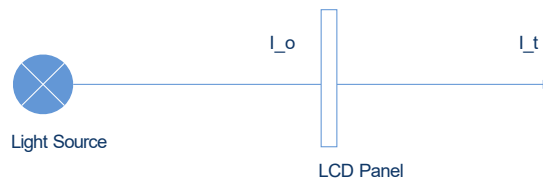
### (3) Definition of Transmittance (T%):

The transmittance of the panel including the polarizers is measured with electrical driving. The equation for transmittance Tr is:

$$Tr = \frac{I_t}{I_o} \times 100\%$$

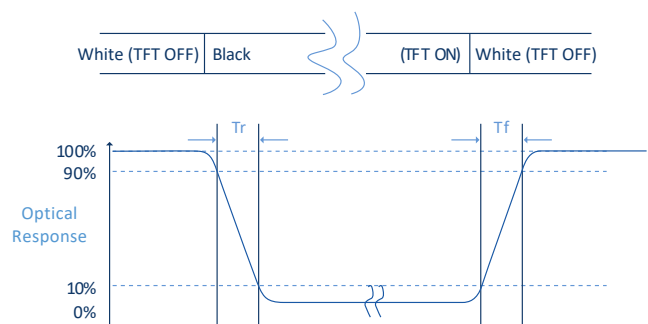
$I_o$  = the brightness of the light source.

$I_t$  = the brightness after panel transmission



### (4) Definition of Response Time (T<sub>R</sub>, T<sub>F</sub>):

The rise time 'Tr' is defined as the time for luminance to change from 90% to 10% as a result of a change of the electrical condition. The fall time 'Tf' is defined as the time for luminance to change from 10% to 90% as a result of a change of the electrical condition.



##### (5) Definition of Color Gamut:

Measuring machine CFT-01. NTSC's Primaries: R(x,y,Y), G(x,y,Y), B(x,y,Y). FPM520 of Westar Display Technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics. The color chromaticity shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

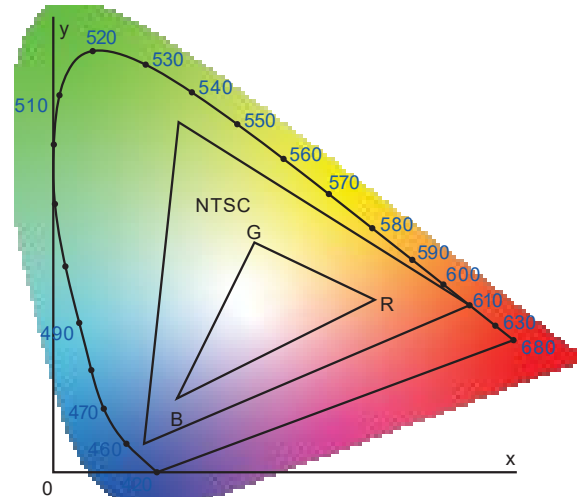
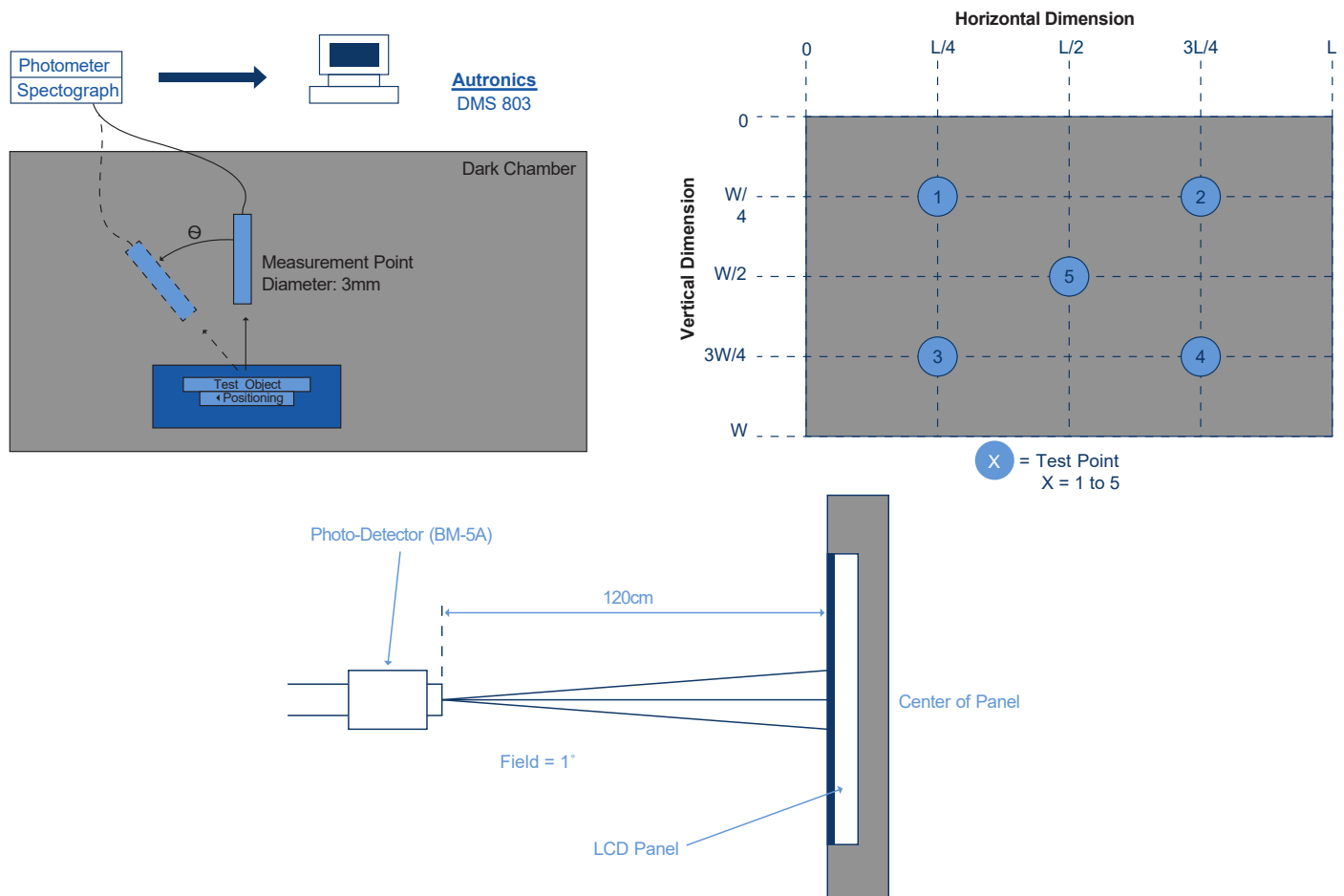


Fig. 1931 CIE Chromaticity Diagram

$$\text{Color Gamut: } S = \frac{\text{Area of RGB Triangle}}{\text{Area of NTSC Triangle}} \times 100\%$$

##### (6) Definition of Optical Measurement Setup:

The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 20 minutes.



## 5. TFT Electrical Characteristics

### 5.1 Absolute Maximum rating (Ta=25°C, VSS=0V)

| Characteristics        | Symbol | Min  | Max | Unit |
|------------------------|--------|------|-----|------|
| Digital Supply Voltage | DC_IN  | -0.5 | 16  | V    |
| Operating Temperature  | TOP    | -10  | +60 | °C   |
| Storage Temperature    | TST    | -20  | +70 | °C   |

*NOTE: If the absolute maximum rating of the above parameters is exceeded, even momentarily, the quality of the product may be degraded. Absolute maximum ratings specify the values which the product may be physically damaged if exceeded. Be sure to use the product within the range of the absolute maximum ratings.*

### 5.2 DC Electrical Characteristics

| Characteristics                 | Symbol | Min | Typ. | Max | Unit | Note      |
|---------------------------------|--------|-----|------|-----|------|-----------|
| Power Supply Voltage            | DC_IN  | 9   | 12   | 16  | V    | --        |
| Normal Mode Current Consumption | IDC_IN | --  | 330  | --  | mA   | DC_IN=12V |

## 6. TFT AC Characteristics

For more information on EK73215 & EK79001, please see the following links:

EK73215: <https://focuslcds.com/wp-content/uploads/Drivers/EK73215.pdf>

EK79001: <https://focuslcds.com/wp-content/uploads/Drivers/EK79001.pdf>

## 7. Quality Inspection Standards

For TFT quality inspection standards, please see the following link: <https://focuslcds.com/lcd-resources/tft-quality-inspection-standards/>

## 8. Cautions and Handling Precautions

### 8.1 Handling and Operating the Module

1. When the module is assembled, it should be attached to the system firmly. Do not warp or twist the module during assembly work.
2. Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
3. Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
4. Do not allow drops of water or chemicals to remain on the display surface. If you have the droplets for a long time, staining and discoloration may occur.
5. If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
6. The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
7. If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.
8. Protect the module from static; it may cause damage to the CMOS ICs.
9. Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
10. Do not disassemble the module.
11. Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
12. Pins of I/F connector shall not be touched directly with bare hands.
13. Do not connect, disconnect the module in the "Power ON" condition.
14. Power supply should always be turned on/off by the item Power On Sequence & Power Off Sequence.

### 8.2 Storage and Transportation

1. Do not leave the panel in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%.
2. Do not store the TFT-LCD module in direct sunlight.
3. The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
4. It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module. In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.
5. This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.