Front Light Panel and LCD Panel Handling Guide

Revision Table

Version	Revision	Description	ECN	Date
01	T1	Original	2518	4/14/23
01	T2	Updated LCD Display Panel Handling Guide to incorporate additional precautions from AUO 3.4". Updated "Final product integration" to include mounting of "OB" Display Assemblies.	2698	3/20/24

Azumo LCD 2.0 Product Overview

The Azumo LCD 2.0 product is composed of a reflective LCD panel (rLCD) and a front light panel (FLP) as shown in Fig. 1 below. The Azumo FLP is a highly engineered thin film light guide that requires knowledgeable handling to avoid unintended damage. The FLP is permanently bonded to the LCD panel through: 1) an optical bonding procedure of the FLP to the active area of the rLCD; 2) a separate roll procedure to bond the light bar to the LCD. Azumo uses different roll configurations to bond the lightbar to the rLCD as shown in Fig. 2. The final Azumo LCD 2.0 display panel is a complete assembly of the FLP to the rLCD as shown in Fig. 3 with the light bar laminated to the back of the LCD display panel. The following handling guide will address the proper handling of both the FLP and the LCD panel.

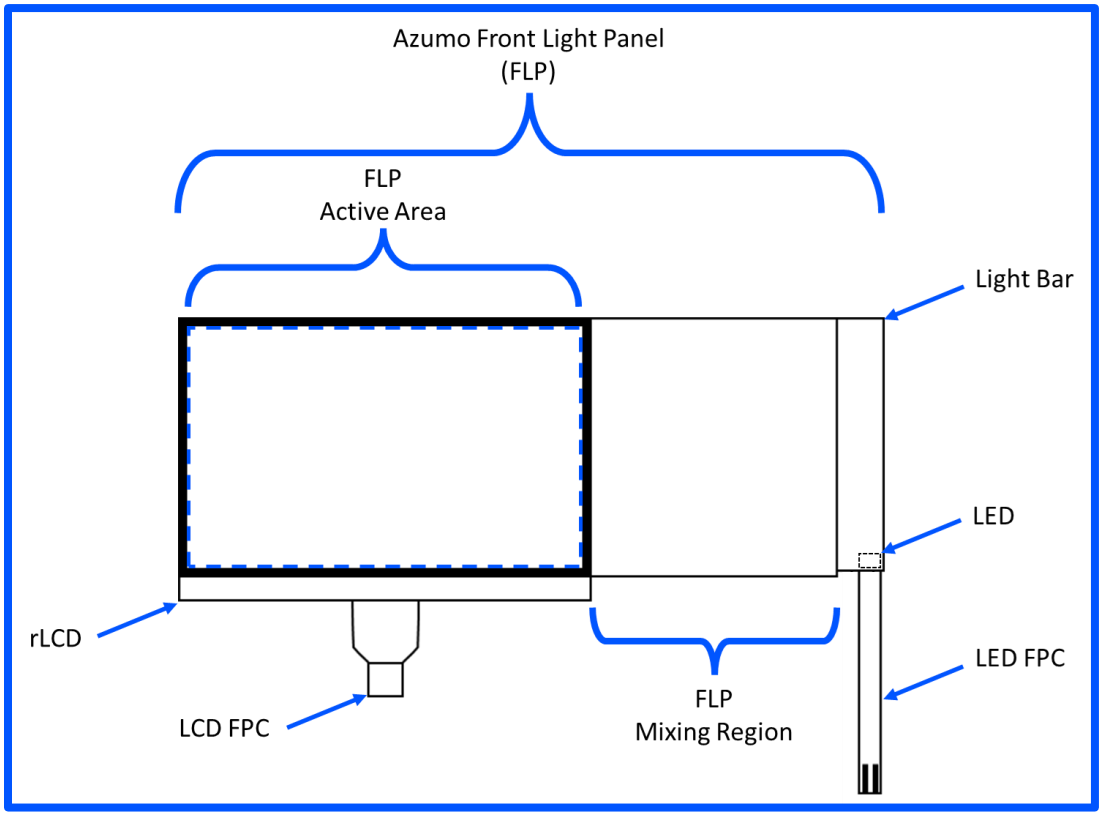

Figure 1. Diagram of Azumo LCD 2.0 FLP in unrolled state.

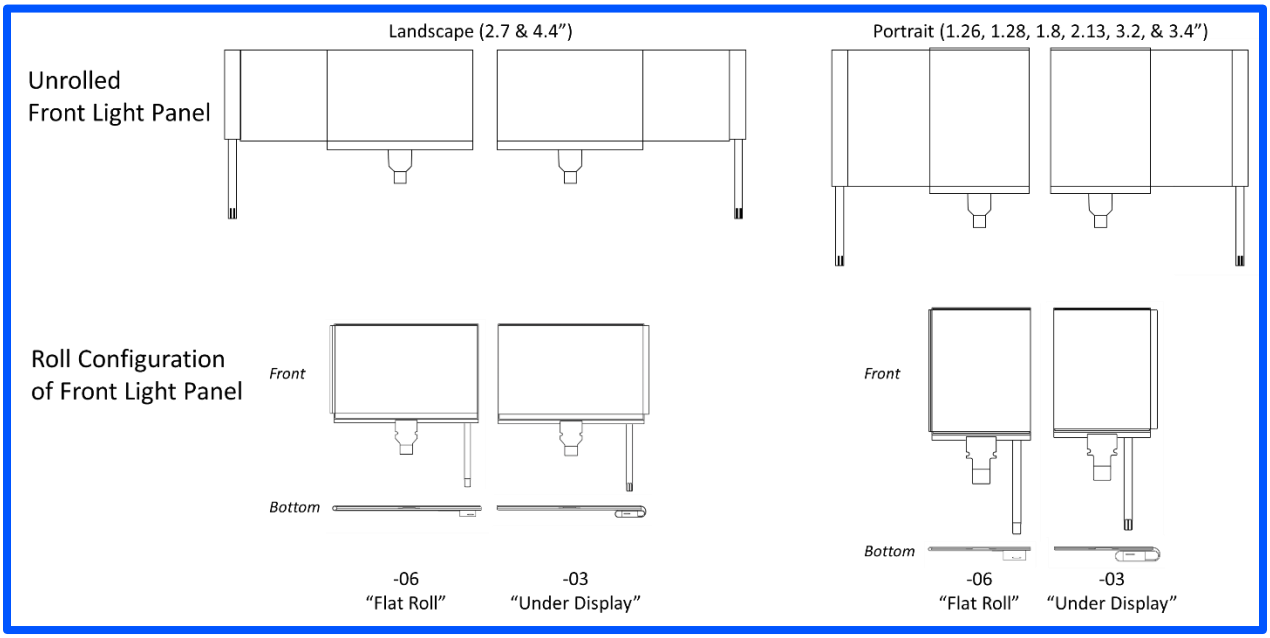

Figure 2. -06 and -03 roll configurations of the Azumo LCD 2.0 FLP

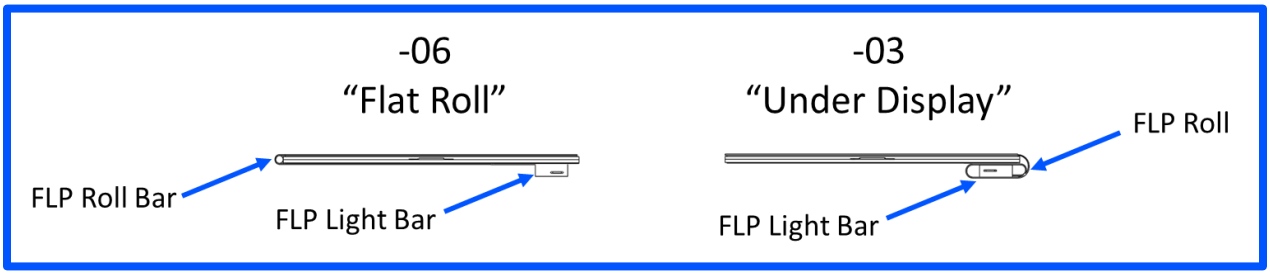

Figure 3. Bottom view of Azumo LCD 2.0 showing different roll configurations.

General Precautions

1. The application examples in this spec are provided to explain the application and are not intended to guarantee any industrial property right or other rights or license you to use them.
2. Azumo reserves the right to make changes in the specifications, characteristics, data, materials, structures, and other contents described herein at any time without notice to improve design or reliability of the Azumo product.
3. Azumo takes no responsibility for damage caused by improper use of the device.
4. The appropriate design measures should be taken to ensure reliability and safety when Azumo's devices are used.
5. Azumo assumes no responsibility for any damage resulting from the use of the device which does not comply with the instructions and the precautions specified in these specs sheets.

Front Light Panel Handling Guide

Failure to follow the guidelines outlined below may result in diminished brightness, non-uniform brightness, unintended effects to optical performance, increased power consumption, or a fully inoperable unit.

General Guidelines

1. When removing the Azumo LCD 2.0 product from the packaging tray be careful to:
    a. Lift Azumo LCD 2.0 product at finger slot (refer to Figure 4).
    b. Avoid applying excessive pressure to the FLP roll and roll bar
    c. Avoid direct contact with the FLP active area.
    d. Avoid bending the LED FPC.
    e. Avoid bending the LCD FPC.

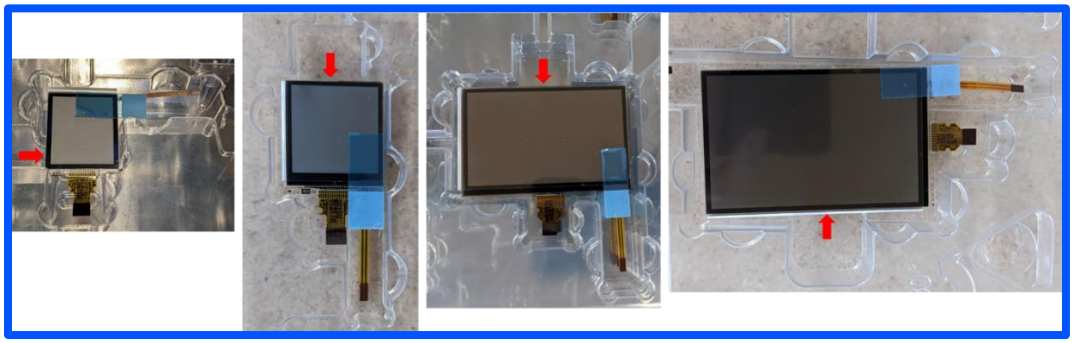

Figure 4. Image of typical packaging tray (1.26”, 1.8”, 2.7”, 3.2”) showing finger slot location.

2. The protective liner should remain on the front lit display until its removal is necessary for final installation (refer to Figure 5).

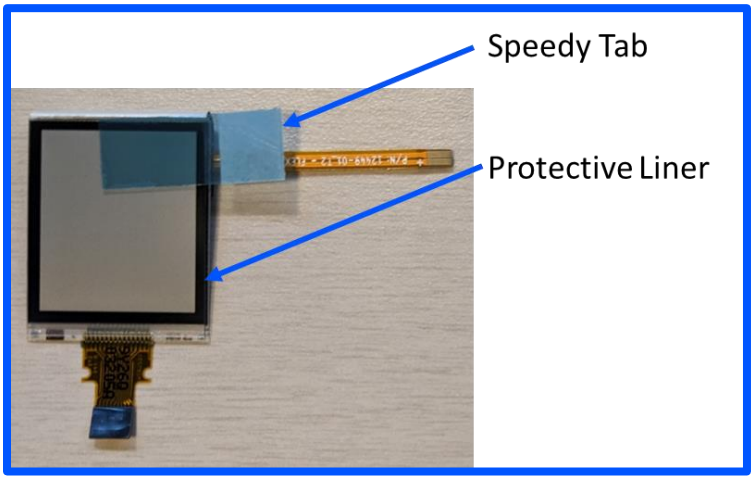

Figure 5. Identification of protective line and speedy tab.

3. Do not reapply or reuse the protective liner once removed from the product
4. Once the protective liner is removed, do not touch the exposed top layer of the front light film.
5. Remove the protective film slowly, using the speedy tab, pulling at a ~30° angle from display surface. Remove under an ESD control device, like an ion blower, in a >50% RH environment to reduce the risk of static charge. Refer to Figure 6.

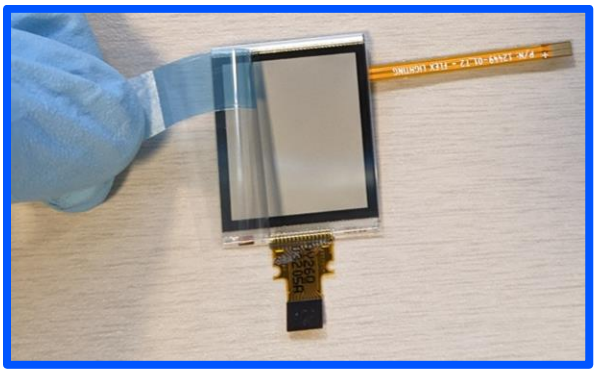

Figure 6. Removal of protective liner using speedy tab.

6. Transfer of particulate matter or liquids, particularly oils, to the top layer of the front light film can result in uneven lighting performance.

7. Clean room grade gloves are recommended when handling units.
8. When handling the product, grasp onto the LCD edges that are not covered by the FLP (see Fig. 7).
9. The Azumo LCD 2.0 product should never be held/carried/handled by either the LED or LCD FPC.
10. Avoid resting the Azumo LCD 2.0 product on the top layer of the FLP (active area).

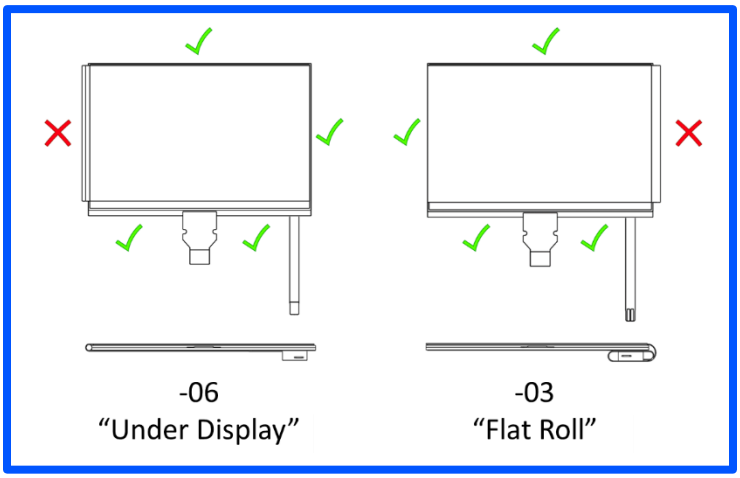

Figure 7. Identification of edges to be used for handling and mounting Azumo LCD 2.0 in final product.

ESD Precautions

1. Standard ESD precautions should be followed when handling Azumo front lit displays.
2. Both the front light LED and the LCD are susceptible to ESD damage if handled improperly.

Handling Precautions for thin film light panel

1. Ensure there is adequate clearance within the intended device for the rolled portion of the front light film. The film is flexible and can be rolled or curved to fit into custom applications, but hard creases or physical damage can reduce optical performance.
2. Avoid creating deep scratches or gouges in the FLP, which can negatively impact brightness and uniformity.

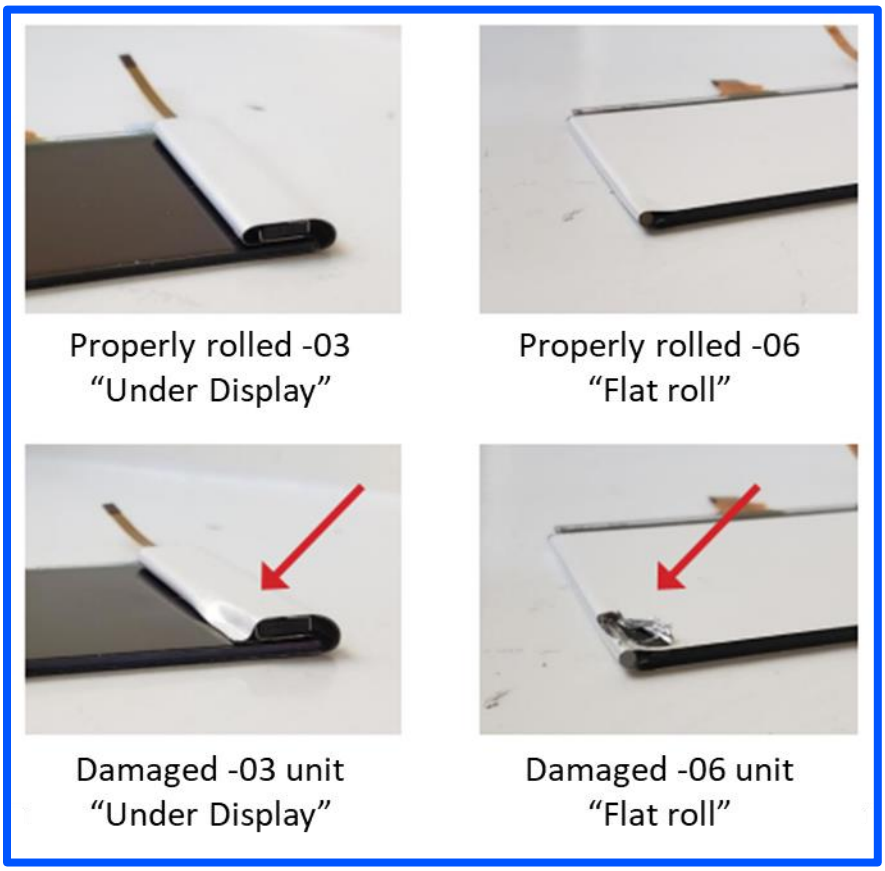

Figure 8. Examples of damage to FLP roll.

Handling Precautions for LED FPC

1. The LED flexible printed circuit (FPC) is a simple flexible circuit with a single LED soldered to its end as shown in Fig. 9. Extreme care should be employed when handling the LED FPC as excessive pulling, bending, or twisting can cause the FPC to become detached from the lightbar.

Figure 9. Azumo LCD 2.0 FLP LED FPC

2. Refer to the Azumo data sheet for LED FPC polarity, max current ratings, and connector options.

3. Avoid twisting the LED FPC in such a way that would strain the LED FPC connection to the lightbar
4. Avoid pulling on the LED FPC in such a way that would strain the LED FPC connection to the lightbar.
5. When designing a connector layout for the LED FPC, avoid routing the LED FPC in such a way that produces strain at the lightbar connection. It is recommended to provide the LED FPC ample strain relief as close to the light bar connection as possible. Refer to Fig. 10.
6. At the insertion or removal of the LED FPC from its connector in the final assembly, do not excessively rotate, twist, tilt, or bend the LED FPC. The attachment of the LED FPC at the FLP light bar is very sensitive and improper handling may cause FLP failure.

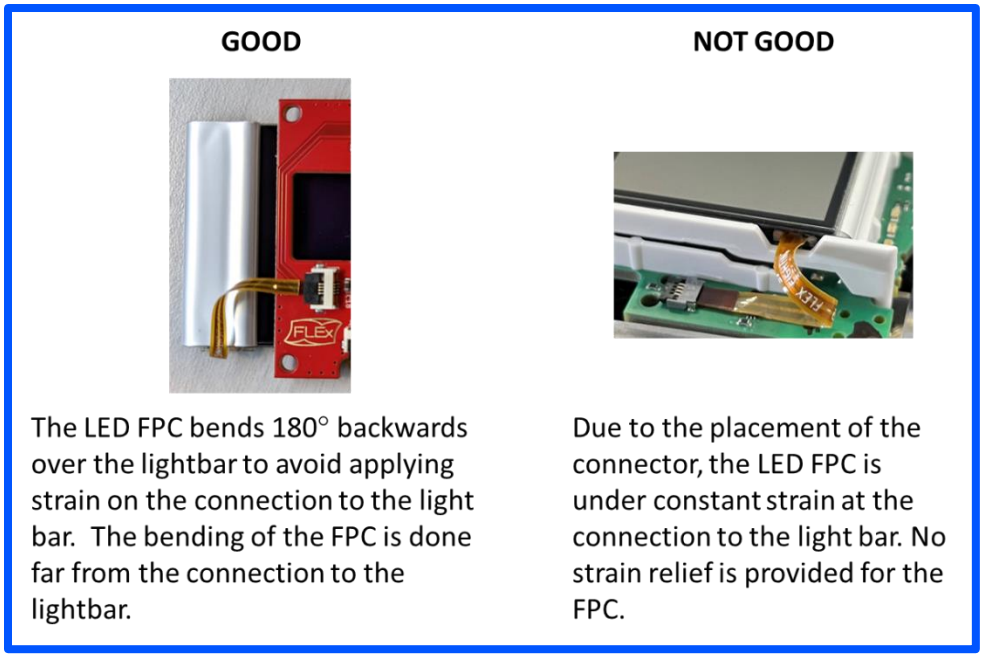

Figure 10. Recommended connector layout and routing for LED FPC.

Other Notes

1. Operation outside specified environmental conditions cannot be guaranteed.
2. Operating outside specified environmental conditions may affect optical performance of Azumo LCD 2.0.
3. LED thermal derating curves should be employed when operating outside specified environmental conditions.
4. Do not operate the LCD panel outside of electrical specification, otherwise, the LCD panel may be damaged.

5. To avoid unintended damage to the front light film, only use blunt tipped tools around LCD panel.
6. To ensure product performance within stated specifications, use product within warranty period.
7. Avoid extended exposure to direct sunlight.
8. Avoid close proximity of the FLP to any polyvinyl chloride (PVC) material.
9. Do not expose FLP to oils, water, fluids, epoxies, etc.
10. Do not expose FLP to VOCs.
11. Do not expose the FLP to solvent vapors, like gasoline or mineral spirits.
12. Do not delaminate the FLP from the LCD display panel.
13. Do not adjust the position of the lightbar or any components of the FLP.
14. Do not pull on any part of FLP roll or reorient the FLP film in any way.
15. Disassembling the LCD module will cause permanent damage to the module. Do not disassemble the module. Do not pry components apart.
16. Avoid contact with the active area of the product.
17. Do not rest the product on its face or allow any contact of the face with other objects.
18. To avoid build up of static electricity, the protective liner should be removed slowly.

Final product integration

1. Avoid close proximity of Azumo LCD 2.0 assembly to concentrated heat sources while always adhering to the environmental requirements.
2. Do not bond to lightbar.
3. Do not apply epoxy or any other adhesive to the Azumo LCD 2.0 assembly.
4. Follow the specifications outlined in the LCD display panel manufacturer's data sheet for proper handling of the LCD FPC.
5. Mounting of the Azumo LCD 2.0 product:
    a. Non "OB" Display Assemblies: Mount the Azumo LCD 2.0 product within its final assembly by providing support along the back of the LCD panel and/or along the hard edges of the LCD panel glass not covered by the FLP, as shown in Fig. 13. Avoid mechanical contact with FLP.
    b. "OB" Display Assemblies: For "OB" Display Assemblies, mounting can be provided in the same way as for non-"OB" displays. However, since an "OB" display assembly can be optically bonded, the typical mounting method will be through bonding to a cover lens. When bonded to a cover lens, no additional mechanical support would be required.
6. The product should be integrated behind a transparent protective plate (cover glass) to protect the FLP and LCD in the final product. "OB" products can be optically bonded to the protective plate. Non "OB" products should have an air gap that separates the product from the protective plate.
7. Mechanical support of the LCD panel in the final product should be carefully designed to avoid stresses that exceed specifications on glass surface.

8. The Azumo LCD 2.0 product should be installed flat, without twisting or bending.
9. Do not allow the LCD display panel to be contacted with excessive pressure in any direction.

Handling Precautions for Storage

1. Do not stack more than 2 boxes high.
2. Boxes should always be oriented properly as indicated on the outside of the box.
3. Packaging trays should always be oriented 180° from the trays above and below.
4. Do not leave LCD panels in the packaging trays longer than the warranty period.
5. After opening the package, do not leave the LCD panel in direct sun or under strong ultraviolet light. Store in dark place and protect the LCD from direct sunlight or fluorescent light.
6. Store in normal room temperature and humidity as much as possible.
7. Storage in the environment of oxidation or deoxidation gas and the use of such materials as reagent, solvent, adhesive, resin, etc. may cause corrosion and discoloration of Azumo LCD 2.0 products.
8. Always store the Azumo LCD 2.0 products so that it is free from external pressure.
9. The polarizer surface should not come in contact with any other objects. It is advised to store the Azumo LCD 2.0 products in the trays in which they were shipped.
10. Store the display in a clean environment, free from dust, PVC, organic solvents, and corrosive gases.
11. Avoid storing the Azumo LCD 2.0 product on its face (active area).
12. Do not crash, shake or jolt the Azumo LCD 2.0 assembly.

LCD Display Panel Handling Guide

General Guidelines

1. Handle with care. Dropping or contact against hard objects may cause cracks or chips in the glass. Avoid strong vibration and shock.
2. Special care should be employed when handling the sharp edges of the LCD display panel.
3. Do not scratch the surface of the polarizer. Prevent touching it with any hard material, and from being pushed or rubbed.
4. When handling the LCD display panel use fingerstalls or protective gloves to maintain optimal quality of LCD display panel.
5. Water droplets on the polarizer must be wiped off immediately. Clean condensation or moisture from any source immediately. Sudden temperature changes can cause condensation on the LCD.
6. Do not leave the LCD display panel in direct sun or under ultraviolet light.
7. To clean LCD panel surface, wipe clean with absorbent cotton or soft cloth. If further cleaning is needed, use IPA and wipe clean lightly on surface only.
8. Do not use organic solvents on the LCD panel. Do not directly touch the LCD panel with finger. When the terminals need cleaning, they should be wiped by a soft cloth or cotton swab without directly touching by hand.
9. Avoid contact with oil or any greasy substances.
10. Do not put or attach anything to the LCD panel active area to avoid leaving marks.
11. Do not touch the display with bare hands.
12. Avoid exposure of LCD FPC to light. When mounting the LCD module in the final product, the enclosure should shield the LCD FPC from direct light.
13. Exercise care to minimize corrosion of the LCD FPC. Do not touch LCD FPC with bare hands.
14. Do not put a seal or an adhesive material on the panel surface.
15. Do not use chloroprene rubber in close proximity to the LCD panel. Acetic acid or chlorine compounds should be avoided.
16. The LCD panel is susceptible to mechanical stress. Place the panel on a flat surface to avoid stress caused by twist, bend, etc. When transporting the LCD panels, secure them on a flat tray to avoid mechanical stress.
17. Avoid pressing LCD panel in any direction.
18. Avoid displaying a fixed pattern on the LCD for a long period of time.
19. Follow the correct power sequence while operating. Do not apply an invalid signal. Be sure to turn off the power when connecting or disconnecting the circuit. Avoid excess EMI when operating the LCD.
20. As this LCD panel is composed of electronic circuits, it is sensitive to electrostatic discharge. Handle with care using caution for the following:
    a. Protect the LCD panel from static electricity.
    b. Since this module uses CMOS LSI, give the same careful attention to the ESD as you would for an ordinary CMOS IC.

c. Any unused input terminal should be connected to Vdd or Vss. Do not input any signals before power is turned on, and ground your body, work/assembly area, and assembly equipment to protect against static electricity.
d. Operators must wear anti-static clothing to prevent electrostatic charge up to and discharge from human body. Operators should wear ground straps.
e. Process equipment such as conveyors, soldering iron, working bench, and containers may generate electrostatic charge up and discharge. Equipment must be grounded through 100Mohms resistance. Use ion blower.
    i. When soldering the terminal of the LCD module, make sure the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach the LCD module, the screwdriver should be of ground potentiality.
f. To reduce the generation of static electricity, be careful that the air in the working environment is not too dry. (A relative humidity of 50-60% is recommended).

Handling Precautions for LCD FPC

1. Refer to LCD display panel manufacturer's data sheet for LCD FPC minimum bend radius as well as bending direction and cycle restrictions.
2. At the insertion or removal of the LCD FPC from its connector in the final assembly, be sure not to excessively rotate, tilt, or bend the LCD FPC. The traces on the LCD FPC are very sensitive and improper handling may cause LCD failure.