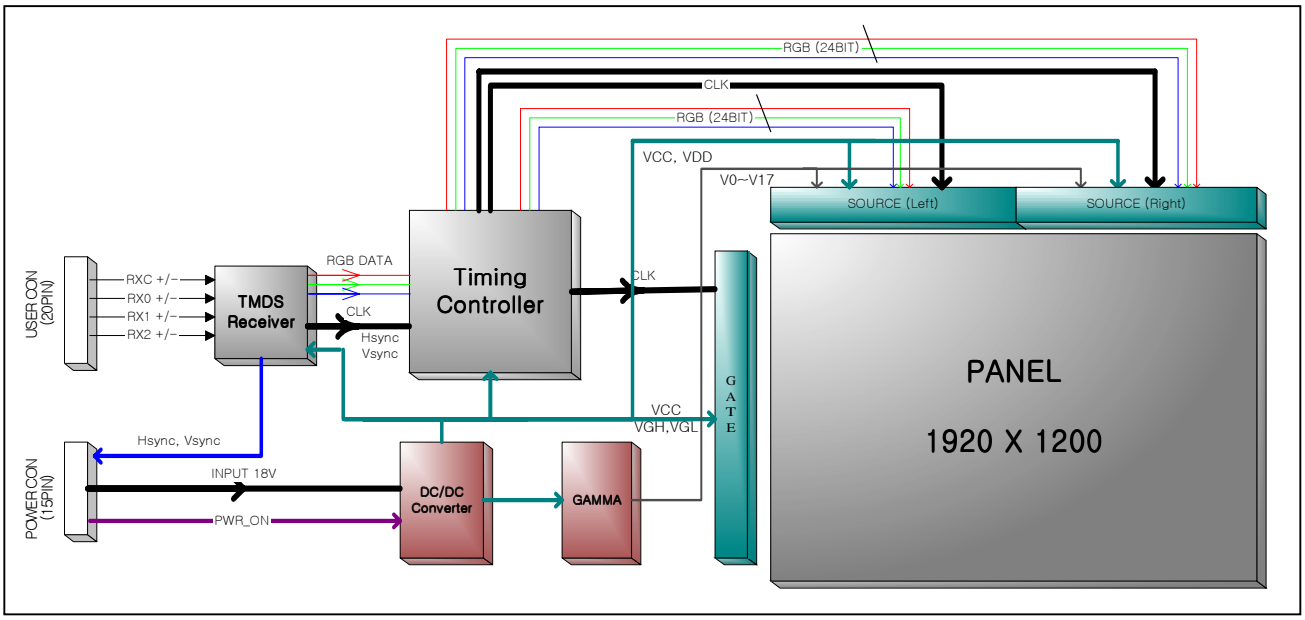
Product Specification

1. General Description

The LM230W01 LCD is a Color Active Matrix Liquid Crystal Display with an integral Cold Cathode Fluorescent Lamp(CCFL) back light system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive type display operating in the normally black mode. This TFT-LCD has a 23.0 inch diagonally measured active display area with WUXGA resolution(1920 vertical by 1200 horizontal pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the luminance of the sub-pixel color is determined with a 8-bit gray scale signal for each dot, thus, presenting a palette of more than 16,777,216 colors.
The LM230W01 has been designed to apply the TMDS™(Transition Minimized differential Signaling) as the interface method to enables a simple and low-cost implementation in both the host and monitor.



General Features

Active Screen Size	23.0 inches(58.4cm) diagonal
Outline Dimension	550.0(H) x 360.5(V) x 25.0(D) mm(Typ.)
Active Area	495.36[mm] × 309.6[mm]
Pixel Pitch	0.258 mm x 0.258mm
Pixel Format	1920 horiz. By 1200 vert. Pixels RGB stripes arrangement
Color Depth	8-bit, 16,777,216 colors
Luminance, White	200 cd/m^2(Typ.)
Power Consumption	Total 47 Watt(Typ.)
Weight	4,500 g (typ.)
Display Operating Mode	Transmissive mode, normally black
Surface Treatment	Hard coating(3H) Anti-glare treatment of the front polarizer,
Interface	TMDS (Hsync/DE)
LAMP	6 CCFL's(Cold Cathode Fluorescent Lamp)

2. Electrical Specifications

The LM230W01 requires two power inputs. One input is employed to power the LCD electronics and to drive the voltages to drive the TFT array and liquid crystal. And the second input which powers the CCFL, is typically generated by an inverter. The inverter is an external unit to the LCD.

Table 2. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
MODULE :						
Power Supply Input Voltage	Vcc	17.0	18.0	19.0	Vdc	
Power Supply Input Current	Icc	-	0.4	0.6	A	1
Power Consumption	Pc	-	7.2	10.2	Watt	1
Inrush Current	I_{Rush}	-	-	3	A	2
LAMP :						
Operating Voltage	V_{BL}	830(9mA)	875(7.5mA)	1090(2.5mA)	V_{RMS}	3
Operating Current	I_{BL}	2.5	7.5	9.0	mA	
Established Starting Voltage	Vs					4
at 25 °C		-	-	1400	V_{RMS}	
at 0 °C		-	-	1960	V_{RMS}	
Operating Frequency	F_{BL}	40	50	60	kHz	5
Power Consumption	P_{BL}	-	41.0	45.1	Watt	6
Discharge Stabilization Time	Ts	-	-	3	min	7
Life Time		30,000			Hrs	8

Notes : 1. The input current shall be measured at V_{CC} of 18.0Vdc at 25℃, refresh rate of 60Hz, and pixel clock frequency of 156MHz under mosaic pattern(8x6) (typ).
2. The measuring condition
The duration of rush current is about 20ms, and rising time of Power input is 1ms.
3. The variance of the voltage is ±10%.
4. Operating voltage is measured at 25°C. The variance of the voltage is ±10%.
5. The output voltage at the transformer in the inverter must be high considering to the loss of the ballast capacitor in the inverter. The voltage above V_S should be applied to the lamps for more than 1 second for start-up. Otherwise, the lamps may not be turned on.
6. Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.
7. The lamp power consumption shown above does not include loss of external inverter at 25°C. The used lamp current is the lamp typical current.

8. Let's define the brightness of the lamp after being lighted for 5 minutes as 100%.
   T_S is the time required for the brightness of the center of the lamp to be not less than 95%.
   The used lamp current is the lamp typical current.

9. The life time is defined as the time at which brightness of lamp is 50% compare to that of initial value at the typical lamp current on condition of continuous operating at 25±2°C.

Note. Do not attach a conducting tape to connecting wire.
If the lamp wire attach to a conducting tape, TFT-LCD Module has a low luminance and the inverter has abnormal action. Because leakage current is occurred between lamp wire and conducting tape.

The design of the inverter must have specifications for the lamp in LCD Assembly**.**
The performance of the Lamp in LCM, for example life time or brightness, is extremely influenced by the characteristics of the DC-AC inverter. So all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter.
When you design or order the inverter, please make sure unwanted lighting caused by the mismatch of the lamp and the inverter(no lighting, flicker, etc) never occurs. When you confirm it, the LCD – Assembly should be operated in the same condition as installed in you instrument.
Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp.
It shall help increase the lamp lifetime and reduce its leakage current.

a. The asymmetry rate of the inverter current and voltage waveform should be 10% below;
b. The distortion rate of the current and voltage waveform should be within $\sqrt{2} \pm 10\%$;
c. The ideal sine current and voltage waveform shall be symmetric in positive and negative polarities.

* Asymmetry rate = $| I_p - I_{-p} | / I_{rms} * 100\%$

* Distortion rate = I_p (or I_{-p}) / I_{rms}

3. Interface Connections

This LCD employs three kinds of interface connections. A 20 pin connector is used for TMDS signals from the host computer. A 15-pin connector is used for LCD module power and LCM controls signal from external monitor control circuits. And six connectors, two pin connector, are used for the integral backlight system.

3-1. Signal Interface

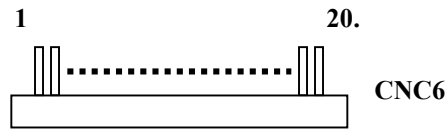
The TMDS signal interface connector is FI-XL20S-HF by JAE.
The pin configuration for the 20 pin connector is shown in the table below.

Table 3 20PIN CONNECTOR (CNC6) PIN CONFIGURATION

Pin	Symbol	Description	Pin	Symbol	Description
1	GND	Ground	11	SHLD0	Shield for TMDS channel 0
2	GND	Ground	12	TX0+	TMDS positive differential output (Channel 0)
3	GND	Ground	13	TX0-	TMDS negative differential output (Channel 0)
4	GND	Ground	14	SHLDC	Shield for TMDS channel C
5	SHLD2	Shield for TMDS channel 2	15	TXC+	TMDS positive differential output (Channel C)
6	TX2+	TMDS positive differential output (Channel 2)	16	TXC-	TMDS negative differential output (Channel C)
7	TX2-	TMDS negative differential output (Channel 2)	17	GND	Ground
8	SHLD1	Shield for TMDS channel 1	18	GND	Ground
9	TX1+	TMDS positive differential output (Channel 1)	19	GND	Ground
10	TX1-	TMDS negative differential output (Channel 1)	20	GND	Ground

1. Interface chips
   1.1 LCD : PTFP 403 PZP (TI)

2. Connector
   2.1 LCD : FI-XL20S-HF
   2.2 Mating : FI-XL20H or compatible
   2.3 Connector pin arrangement



Notes: 1. All shield pins and GND(ground) pin should be connected together and should also be connected to the LCD's metal frame.

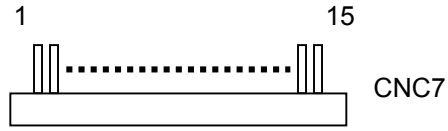
3-2. Power Interface

A 15 pin connector (CNC7) for external monitor control circuits, is a model 53261 manufactured by Molex. The mating connector part number is 51021 or its equivalent. The pin configuration for this connector is shown in the table below.

Table 4 15 PIN CONNECTOR (CNC7) PIN CONFIGURATION

Pin	Symbol	Description	Notes
1	GND	Ground	
2	GND	Ground	
3	PWR_ON	Power ON control signal input 5V(H:90%,L:10%)	
4	GND	Ground	
5	Vcc	LCM power supply, +18V ±5%	
6	Vcc	LCM power supply, +18V ±5%	
7	Vcc	LCM power supply, +18V ±5%	
8	Vcc	LCM power supply, +18V ±5%	
9	GND	Ground	
10	DDC_CLK	DDC clock line out	
11	DDC_DAT	DDC data line out	
12	GND	Ground	
13	HS_OUT	Hsync Output	
14	VS_OUT	Vsync Output	
15	GND	Ground	

Connector pin arrangement



Notes: 1. All GND(ground) pins should be connected together and should also be connected to the LCD's metal frame.

3-3. Backlight Interface

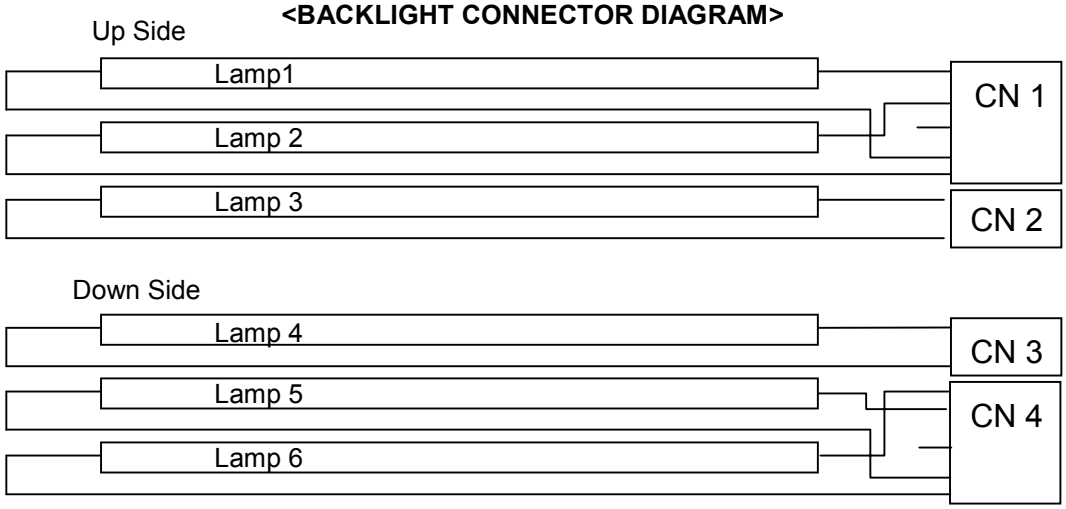
The backlight interface connector is a model BHSR-02VS-1(CN2/CN3) and BHSR-05VS-1 (CN1/CN4) manufactured by JST. The mating connector part number are SM02B-BHSS-1-TB(2pin), SM04(9-E2)B-BHS-1-TB or equivalent. The pin configuration for the connector is shown in the table below.

Table 5 BACKLIGHT CONNECTOR PIN CONFIGURATION

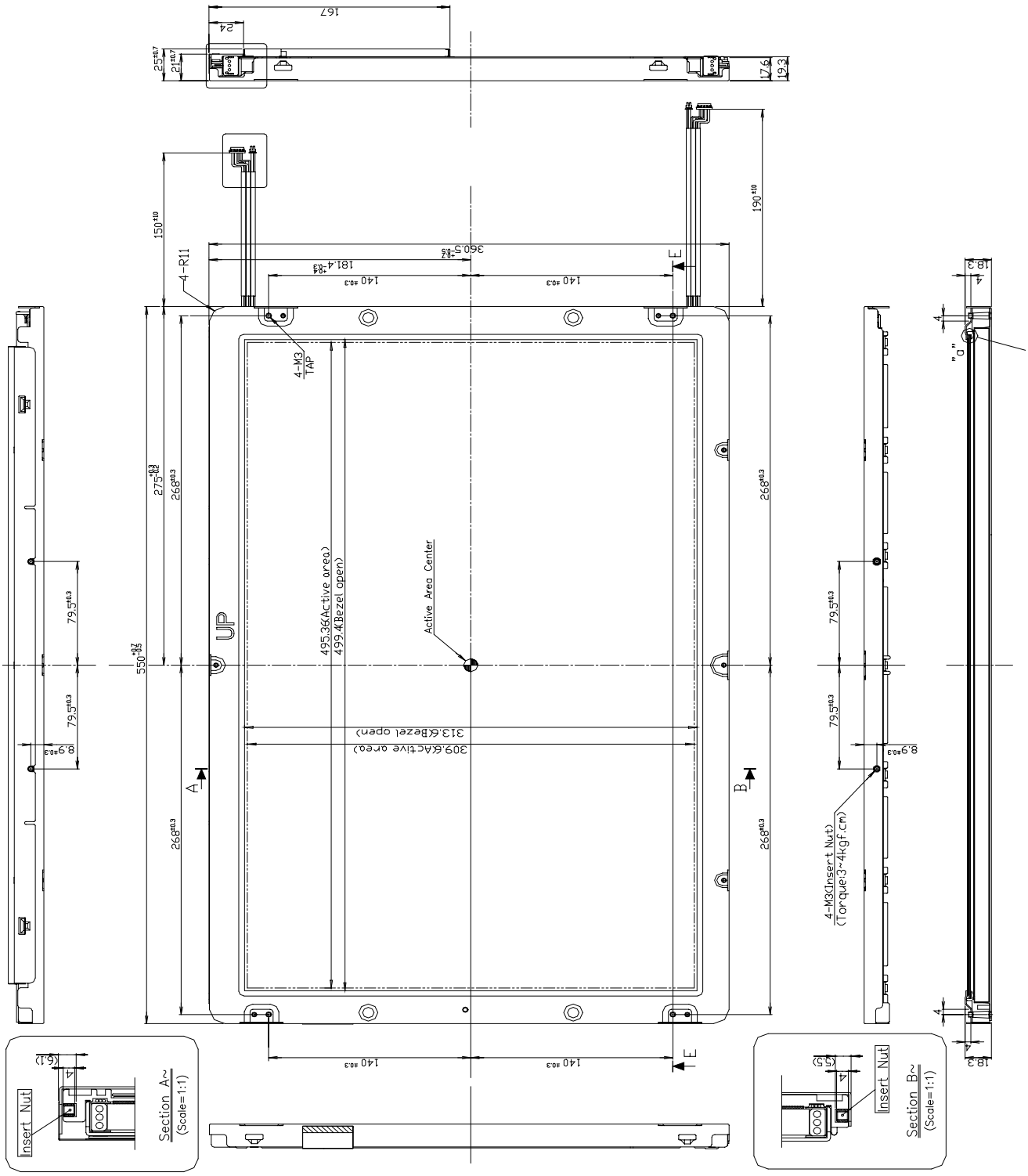
No	Pin	Symbol	Description	Notes
CN1	1	HV	Power supply for lamp 1(High voltage side) - Pink	1
	2	HV	Power supply for lamp 2(High voltage side) - Blue	1
	3	NC	NC	
	4	LV	Power supply for lamp 1(Low voltage side) - White	
	5	LV	Power supply for lamp 2(Low voltage side) - White	
CN2	1	HV	Power supply for lamp 3(High voltage side) - Gray	1
	2	LV	Power supply for lamp 3(Low voltage side) - White	
CN3	1	HV	Power supply for lamp 4(High voltage side) - Gray	1
	2	LV	Power supply for lamp 4(Low voltage side) - White	
CN4	1	HV	Power supply for lamp 6(High voltage side) - Pink	1
	2	HV	Power supply for lamp 5(High voltage side) - Blue	1
	3	NC	NC	
	4	LV	Power supply for lamp 5(Low voltage side) - White	
	5	LV	Power supply for lamp 6(Low voltage side) - White	

Notes: 1. The high voltage power terminal is colored pink,blue,gray. Ground pin color is white.

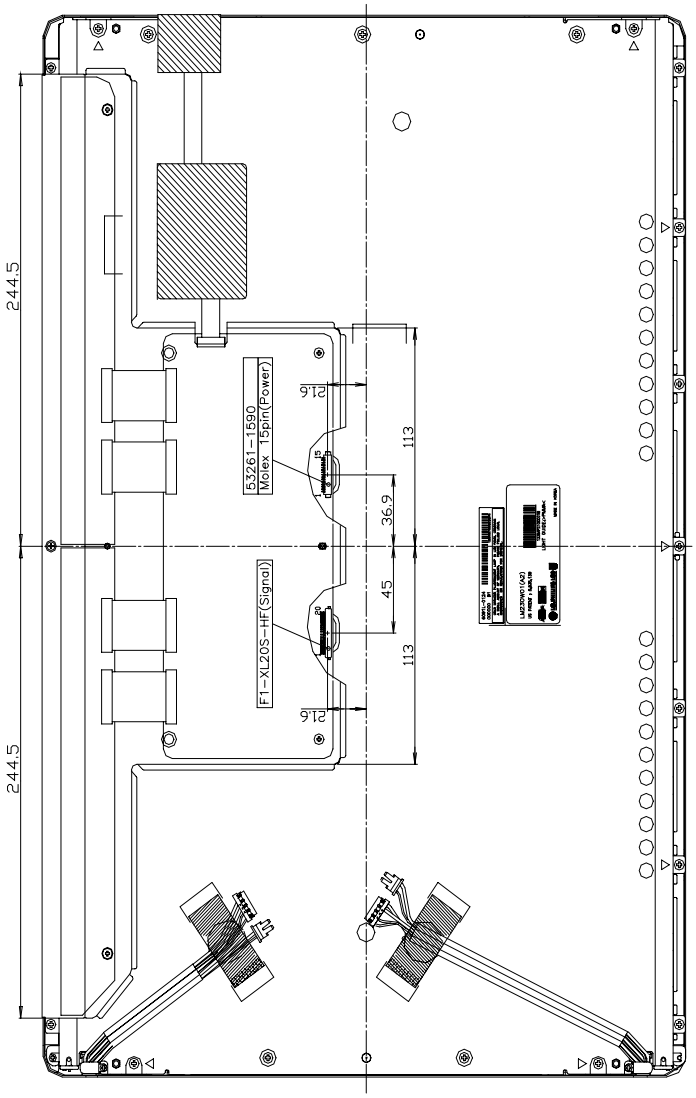
<BACKLIGHT CONNECTOR DIAGRAM>

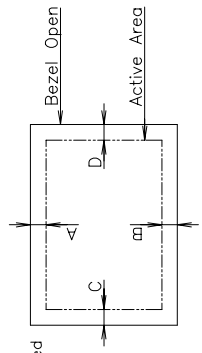


<FRONT VIEW>


4-R11
4-M3 TAP
UP
Active Area Center
495.36(Active area)
499.4(Bezel open)
309.6(Active area)
313.6(Bezel open)
4-M3(Insert Nut)
(Torque:3~4kgf.cm)
Insert Nut
Section A~
(Scale=1:1)
Insert Nut
Section B~
(Scale=1:1)

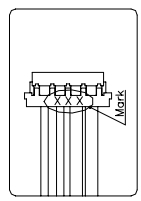
<REAR VIEW>





NOTES

1. Unspecified tolerances are to be ±0.5mm
2. Both backlight wires and contraction tubes are excluded from outline dimensions.
3. Tilt and partial disposition tolerance of display area are as following.
   (1) Y-Direction : |A-B| ≤ 1.4mm
   (2) X-Direction : |C-D| ≤ 1.4mm
4. Lamp(CCFL) lot No. is marked at backlight connector.



5. Do not wrap conductive tapes around the backlight wires.

4. PRECAUTIONS

The LCD Products listed on this documents are not suitable for use of Military, Industry, Medical etc. System
If customers intend to use these LCD products for above application, Please contact sales people In advance.