

10.4 INCH NVIS DISPLAY

P/N: DDO-2410-S000



TABLE OF CONTENT

1. OVERVIEW	5
2 GENERAL CHARACTERISTICS	5
3 ELECTRICAL SPECIFICATIONS	6
3-1 General.....	6
3-2 Block Diagram.....	7
3-3 Interface Connections.....	7
3-4 Signal Timing Specification.....	8
3-5 Power on/off Sequences	9
3-6 Input Data Format	10
3-7 Heater Power.....	11
3-8 Conformal Coating	11
4 OPTICAL CHARACTERISTICS	12
4-1 General.....	12
4-2 Color Data Assignment	14
5 MECHANICAL CHARACTERISTICS	15
5-1 General.....	15
5-2 I/O Connectors.....	15
5-3 In Front Control	15
5-4 Modularized Construction.....	16
5-5 Drawing w / Mounting Bracket.....	17



1. OVERVIEW

This NVIS monitor is a Monitor with VGA (1024 x 768) resolution, and LED backlit for both daylight and night use. This LCD of the monitor is laminated with heater and 4 wire resistive touch. The front of the touch has an A/R coating and EMI Mesh. The monitor is equipped with backlight controller membrane which can switch daylight and night mode.

Specifications are subject to change without prior notice.

Features:

1. Sunlight readable
2. High Quality 10.4" XGA Panel, 1024x768 resolution
3. NVIS LCD include daylight and night mode
4. Display backlight dimmable
5. Full IP65 Dust/Water Proof Enclosures (Except I/O parts)
6. Aluminum Housing with Anti-Corrosion Treatments
7. 4 Wire Resistive Touch screen / heater / EMI Shielding

2 GENERAL CHARACTERISTICS

LCD Module Size	225.5(H)×176.3(V)×10.17(D)mm (typ.)
LCD Effective Display Area	210.4(H)×157.8(V)mm
LCD Driver Element	a-si Active Matrix
LCD Pixel Number	1024×RGB×768
LCD Pixel Pitch	0.0685(H)×0.2055(V)
LCD Interface Connector	JAE FI-XB-XB30SRL-HF11
LCD Pixel Arrangement	RGB vertical stripe
LCD Display Colors	16.2M
LCD Operating Temp	-40 °C ~ 55 °C
LCD Storage Temp	-40 °C ~85°C
Display operating mode	Transmissive / normal black
Backlight Unit	White LED
NVIS Compatibility	TYPE1 , Class B
Brightness	800 cd/m ² typ.
Power Consumption	LCD: 3.63 W type at 3.3 VDC Day BLU: 12.6 W, typ. Night mode: 0.504 W, typ. Heater: < 50W Max at 28VDC)
Touch Surface Quality	High effective AR coating.(80-50 surface quality)



3 ELECTRICAL SPECIFICATIONS

3-1 General

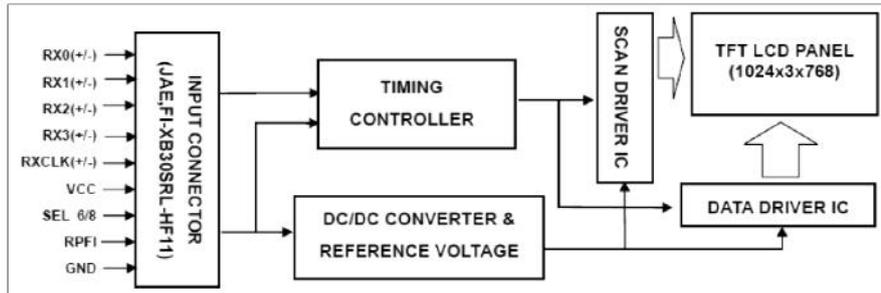
Parameter	Symbol	Condition	Value			Unit	note
			Min	Typ	Max		
LCD Module:							
Power Supply Input Voltage	V_{cc}		3	3.3		V_{DC}	
Power Supply Input Current	I_{cc}	White		1.1		A	1
		Black		0.8		A	
Power consumption	P_c		-		-	W	
BLU/ Day Mode:							
Operating Voltage	$V_{BL,D}$			18		V_{DC}	
Operating Current				0.7		A	(3)
Power consumption				12.6		W	(3)
Life Time	-		20,000	30,000		Hrs.	2
BLU/ Night Mode:							
Operating Voltage	$V_{BL,N}$			18		V_{DC}	
Operating Current	I_N			0.028		A	
Power consumption	P_N			0.504		W	
Heater:							
Resistance					16	Ω	
Thermal Sensor							
Power consumption	P_H	$V=28 V_{DC}\pm 5\%$	-	-	50	W	
		$I=1.78A$					

Notes:

1. The current draw is under the conditions at $VCC = 3.3 @ 25^{\circ}C @ 60Hz$
2. Life time is determined as the time at which the brightness of the lamp is 50% compared to that of initial value at the typical LED current and at ambient temperature of $25^{\circ}C$.



3-2 Block Diagram



3-3 Interface Connections

JAE FI-XB-XB30SRL-HF11

Pin	Symbol	Description
1	NC	No Connection
2	GND	Ground
3	RX3+	Positive transmission data of pixel 3
4	RX3-	Negative transmission data of pixel 3
5	GND	Ground
6	RXCLK+	Positive of clock
7	RXCLK-	Negative of clock
8	GND	Ground
9	RX2+	Positive transmission data of pixel 2
10	RX2-	Negative transmission data of pixel 2
11	GND	Ground
12	RX1+	Positive transmission data of pixel 1
13	RX1-	Negative transmission data of pixel 1
14	GND	Ground
15	RX0+	Positive transmission data of pixel 0
16	RX0-	Negative transmission data of pixel 0
17	GND	Ground
18	STV	Vertical Start Pulse Output
19	GND	Ground
20~23	N.C.	No Connection
24	RPF	Display Rotation
25~27	GND	Ground
28~30	VCC	Power supply: +3.3V



3-4 Signal Timing Specification

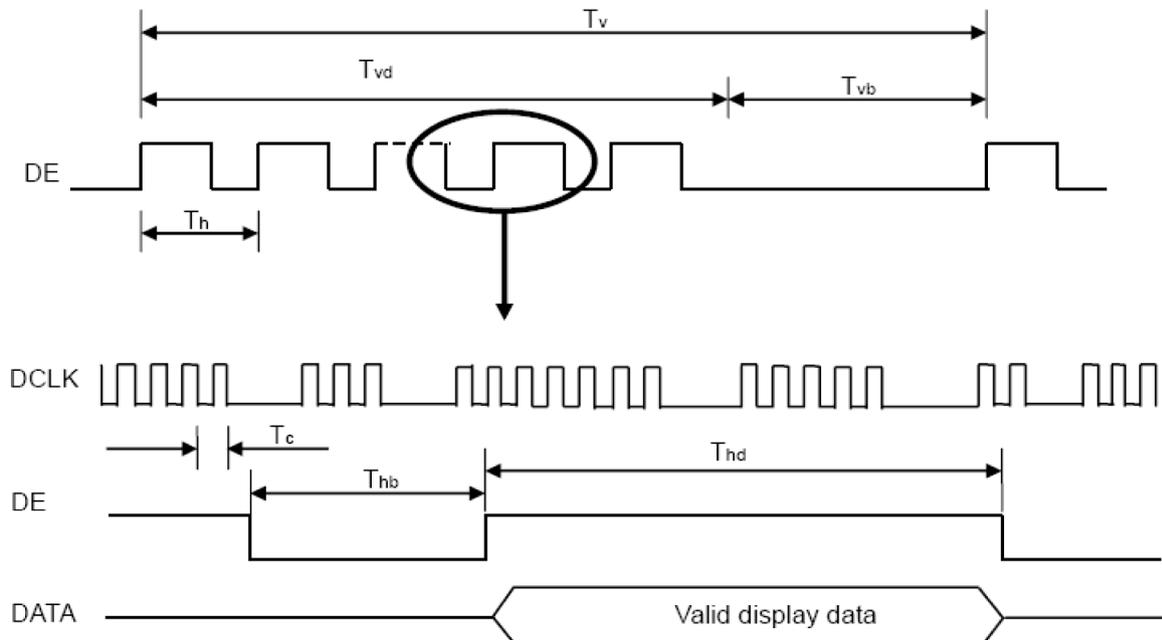
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	Fc	55	65	75	MHZ	
Vertical Active Display Term	Total	Tv	770	806	950	Th	Tv=Tvd+Tvb
	Display	Tvd	768	768	768	Th	-
	Blank	Tvb	2	38	182	Th	-
Horizontal Active Display Term	Total	Th	1104	1344	1800	Tc	Th=Thd+Thb
	Display	Thd	1024	1024	1024	Tc	-
	Blank	Thb	76	320	776	Tc	-

Notes:

1. Operated in DE mode only.
2. Hsync and Vsync signals should be set to low logic level.
3. Frame rate is 60Hz

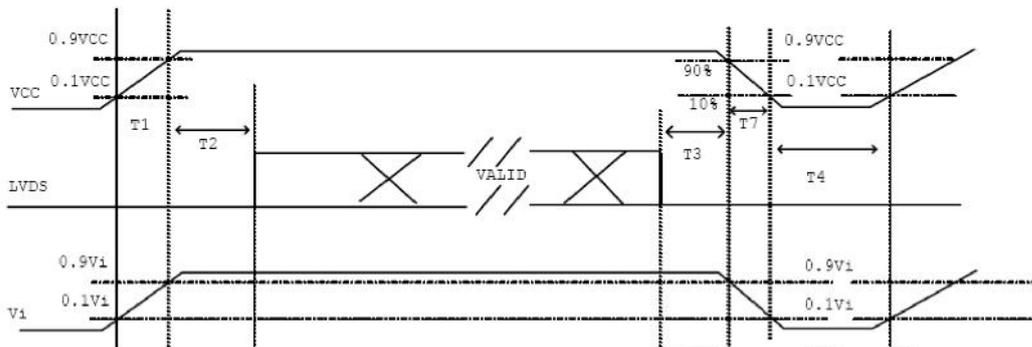
INPUT SIGNAL TIMING DIAGRAM





3-5 Power on/off Sequences

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as shown below.



Parameter	Value			Units
	Min.	Type.	Max.	
T1	0.5	-	10	Ms
T2	0	-	50	Ms
T3	0	-	50	Ms
T4	500	-	-	Ms
T7	5	-	300	Ms

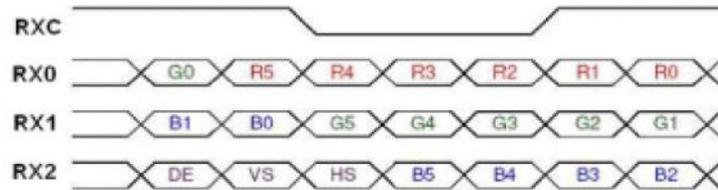
Notes:

Avoid a floating state of the interface signal at an invalid period. When the interface signal is invalid, be sure to pull down the power supply for LCD Vcc to 0.

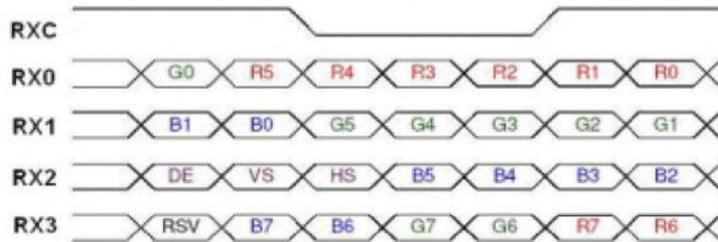


3-6 Input Data Format

SEL 6/8 = "High" for 6 bits LVDS Input



SEL 6/8 = "Low" or "NC" for 8 bits LVDS Input



Signal Name	Description	Remark
R7	Red Data 7 (MSB)	Red-pixel Data Each red pixel's brightness data consists of these 8bits pixel data.
R6	Red Data 6	
R5	Red Data 5	
R4	Red Data 4	
R3	Red Data 3	
R2	Red Data 2	
R1	Red Data 1	
R0	Red Data 0 (LSB)	
G7	Green Data 7 (MSB)	Green-pixel Data Each red pixel's brightness data consists of these 8bits pixel data.
G6	Green Data 6	
G5	Green Data 5	
G4	Green Data 4	
G3	Green Data 3	
G2	Green Data 2	
G1	Green Data 1	
G0	Green Data 0 (LSB)	
B7	Blue Data 7 (MSB)	Blue-pixel Data Each red pixel's brightness data consists of these 8bits pixel data.
B6	Blue Data 6	
B5	Blue Data 5	
B4	Blue Data 4	
B3	Blue Data 3	
B2	Blue Data 2	
B1	Blue Data 1	



B0	Blue Data 0 (LSB)	
RXCLKIN+	LVDS Clock Input	
RXCLKIN-		
DE	Display Sync	
VS	Vertical Sync	
HS	Horizontal Sync	

3-7 Heater Power

The heater shall operate from 28VDC +/-5% and consume no more than 50W. The heater shall be controlled by one thermistor, Epcos P/N B57321V2103J60). The heater shall provide the following warm up conditions for the LCD:

Table 1. LCD Warm Up Parameters

Performance	Time
Display a legible image at least 25% brightness, 1Hz at -40°C	TBD
Full performance at -40°C	TBD
Full performance at 0°C	TBD

3-8 Conformal Coating

The PWAs shall be conformal coated with Humiseal 1B31. Detail information: TBD



4 OPTICAL CHARACTERISTICS

4-1 General

Optical characteristics are determined after the unit has been "ON" and stable in a dark environment at 25°C. The Values specified are at approximate distance of 50cm from the LCD surface at a viewing angle of Φ and Θ equal to 0° . Appendix A presents additional information concerning the measurement equipment and method.

Parameter	Symbol	Values			Unit	Note
		Min	Typ	Max		
Contrast Ratio	CR		1000			1
Surface Luminance, white	L _{WH}		800		cd/m ²	2
Luminance Uniformity	δ_{WHITE}	-	70	90	%	3
Response Time(Rise)	T _r	-	15		ms	4
(Fall)	T _f	-	10		ms	
CIE Color Coordinates						
Red	R _X	-	0.629	-		
	R _Y	-	0.348	-		
Green	G _X	-	0.306	-		
	G _Y	-	0.560	-		
Blue	B _X	-	0.150	-		
	B _Y	-	0.102	-		
White	W _X	-	0.329	-		
	W _Y	-	0.346	-		
Viewing Angle						
X Axis, Right ($\Theta = 0^\circ$)	x+		88		deg.	5
X Axis, Left ($\Theta = 180^\circ$)	x-		88			
Y Axis, Up ($\Theta = 90^\circ$)	y+		88			
Y Axis, Down ($\Theta = 270^\circ$)	y-		88			
NV mode	(Dual mode)					
Surface Luminance, white	L _{WH}			50	cd/m ²	
Luminance Uniformity	δ_{WHITE}	-			%	
CIE Color Coordinates	U' _w					
	V' _w					


Day Mode Sunlight Readable Performance

Outdoor Readability	Ambient light (Equivalent brightness under sunlight) cd/m2				Note
	Measuring angle	10,000	20,000	30,000	
Brightness gain (min)	35°	900	1000	1100	6
Brightness gain (max)	35°	1200	1400	1600	
Reflectance (%)	35°	1 %~2 %			

Notes:

1. Contrast Ratio (CR) is defined as:

$$\text{Contrast Ratio} = \frac{\text{Surface luminance with all white pixels}}{\text{Surface luminance with all black pixels}}$$

2. Surface luminance is the center point of the LCD surface at a distance 50cm from the surface with all pixels displaying white.
3. The uniformity in surface luminance, δ_{WHITE} , is determined by measuring L_{ON} at each test position 1 through 9, and then dividing the minimum L_{ON} of 9 points luminance by maximum L_{ON} of 9 points luminance and multiply by 100 for percentage value.

$$\delta W = \frac{\text{Maximum [L (1), L (2), L (3), L (4), L (5)]}}{\text{Minimum [L (1), L (2), L (3), L (4), L (5)]}}$$

4. Response time is the time required for the display to transition from white to black (Rise Time, TR) and from black to white (Fall Time, TF).
5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x-axis and the vertical or y-axis with respect to the z-axis: the normal to the LCD surface.
6. According to Sunlight readable LCD reflectance of ambient light is 1%~2% · we infer the brightness of LCD under different ambient light from the reflectance.

The minimum of the brightness = LCD standard brightness + (ambient light)× 1 %

The maximum of the brightness = LCD standard brightness + (ambient light)× 2 %



4-2 Color Data Assignment

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

Color	Data Signal																							
	Red								Green								Blue							
	R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red(1)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Green	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
	Green(253)	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	
	Green(254)	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
Green(255)	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0		
Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	
Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1		

Note (1) 0: Low Level Voltage, 1: High Level Voltage



5 MECHANICAL CHARACTERISTICS

5-1 General

Dimensions (W x L x H)	315 mm x 250 mm x 67mm
Power Input	12V DC w/ lockable connector
Power Consumption	TBD
Operating Temperature	-40°C ~50°C
Operating Humidity	10% to 95% (non condensing)
Mounting	VESA mount, Vehicle mount
Shock	TBD
Vibration	TBD

5-2 I/O Connectors

Back Panel I/O Port:	1 x VGA(DB-15) 1 x DC-in Jack(Lockable) 1x RS232 for Touch Screen(Optional w/ touch)
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5-3 In Fornt Control

Control Button:	Menu / Enter Button Auto-adjust / Esc Button Brightness Up / Increase Button Brightness Down / Decrease Button Display Power Button
LED indicator	Power On/ Off Display Sleep



Modularized Construction

