Noritake itron

VACUUM FLUORESCENT DISPLAY MODULE SPECIFICATION

MODEL: GU256X64-900A

SPECIFICATION NO.	:	DS-834-0000-00
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This specification is subject to change without prior notice.

1.General Description

1.1 Scope

This specification covers the requirements of vacuum fluorescent graphic display module, Model·GU256X64-900A.

1.2 Construction

The module consists of a graphic BD-VFD which does have the dot configuration of 64X256, a refresh RAM, a character generator, a DC/DC converter, a display controller and all necessary control logics

The module can display graphic patterns and /or characters in a screen of the VFD.

2.Warranty

Warranty on the "itron "VFD module expires 12months after shipment from factory.

3. Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power Supply Voltage	Vcc	0	-	5.5	VDC
Logic Supply Voltage	VIN	0	-	Vcc+0.5	VDC

4. Electronical ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power Supply Voltage	Vcc	4.75	5.0	5.25	VDC

All driving voltage for the VFD is converted from the DC/DC converter on board.

5. Electrical Characteristics

Measuring Conditions : TA (Ambient temperature) = 25degrees, Vcc =5.0VDC

Parameter		Symbol	Min.	Typ.	Max.	Unit	Condition	Note
Logic Input Voltage	"H"	VIH	3.5	-	Vcc	VDC	-	-
	"L"	VIL	-	-	1.5	VDC	-	-
Logic Output Voltage	"H"	VOH	4.0	-	-	VDC	IOH=-2mA	-
	"L"	VOL	-	-	0.4	VDC	IOL=4mA	-
Power Supply Current 1		ICC1	-	1.4	1 9	A		(1)
Power Supply Current 2		ICC2	-	1.1	1 5	A		(2)

Note(1),(2) ICC1 shows the cuurent at all dots in the screen are lighted and ICC2 at all dots off. At power on rush, more than 2times current of above table should be expected. Provide the power supply which has current capacity of approximate 5 Amps and also quick rise type(<100msec.).

6. Optical Specifications

Number of dots	:	16384(256x64)
PCB Size	:	230.0 mm X 78.0 mm (X × Y)
Display area	:	166.25 mm X 41.45 mm (X × Y)
Dot size	:	0.5 mm X 0.5 mm (X × Y)
Dot pitch	:	0.65 mm X 0.65 mm (X × Y)
Luminance	:	350cd/m^2 Min (500cd/m^2 Typ.)
Color of illumination	:	Green(Blue Green)
Weight	:	340(g)

7. Environmental Specifications

Operating temperature	:	-40 to +85degrees
Storage temperature	:	-40 to +85degrees
Storage humidity	:	20 to 80 % R.H(Non Condensation)
Vibration	:	10-55-10Hz, all amplitude 1mm, 30Min., X-Y-Z(Non operating)
Shock	:	539m/s^2 (55G) 10mS(Non operating)

8. Functions Of Data Lines

Data Line	Function
D0~D7	Data Bus(Input / Output)
$\overline{WR}$	Write Signal(Input)
$\overline{RD}$	Read Signal (Input)
$\overline{CS}$	Chip Select Signal(Input)
C/$\overline{D}$	Command / Data Select Signal(Input) C/$\overline{D}$ = "1" ··· Command C/$\overline{D}$ = "0" ··· Data
FRP	Frame Signal(Output) (1 output pulse per 1 display frame)
$\overline{BL}$	Display Blanking Signal(Input)
Vcc	Input Voltage
GND	Ground

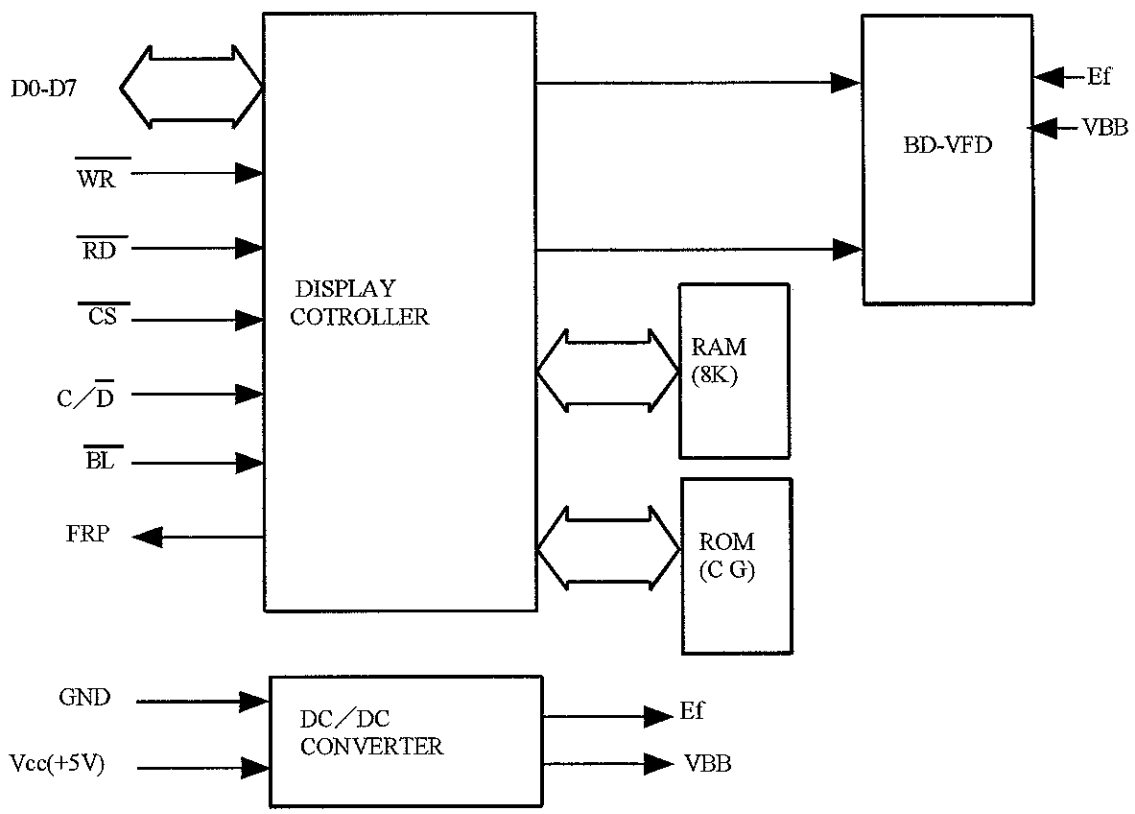
9. Construction and Major Functions

The module consists of 1 PC boards, control logics and DC/DC converter.
The display memory (RAM) has the capacity of 8k bytes and it can be memorized 4 screen pages at graphic mode and 8 screen pages at character mode(see para.12).
The module can display graphic patterns and /or characters in a screen of the VFD.
The display screens can be alternative as the screen #1 for graphic only and the screen #2 for character and graphic Therefore,4 different display combinations are available as follows.

- Graphic display only (use the screen #1 or #2)
- Character display only (use the screen #2)
- Merge 2 graphic displays such as OR/EX-OR/AND (use the screen #1 and #2)
- Graphic(use the screen #1)and Character(use the screen#2)displays such as OR/EX-OR/AND

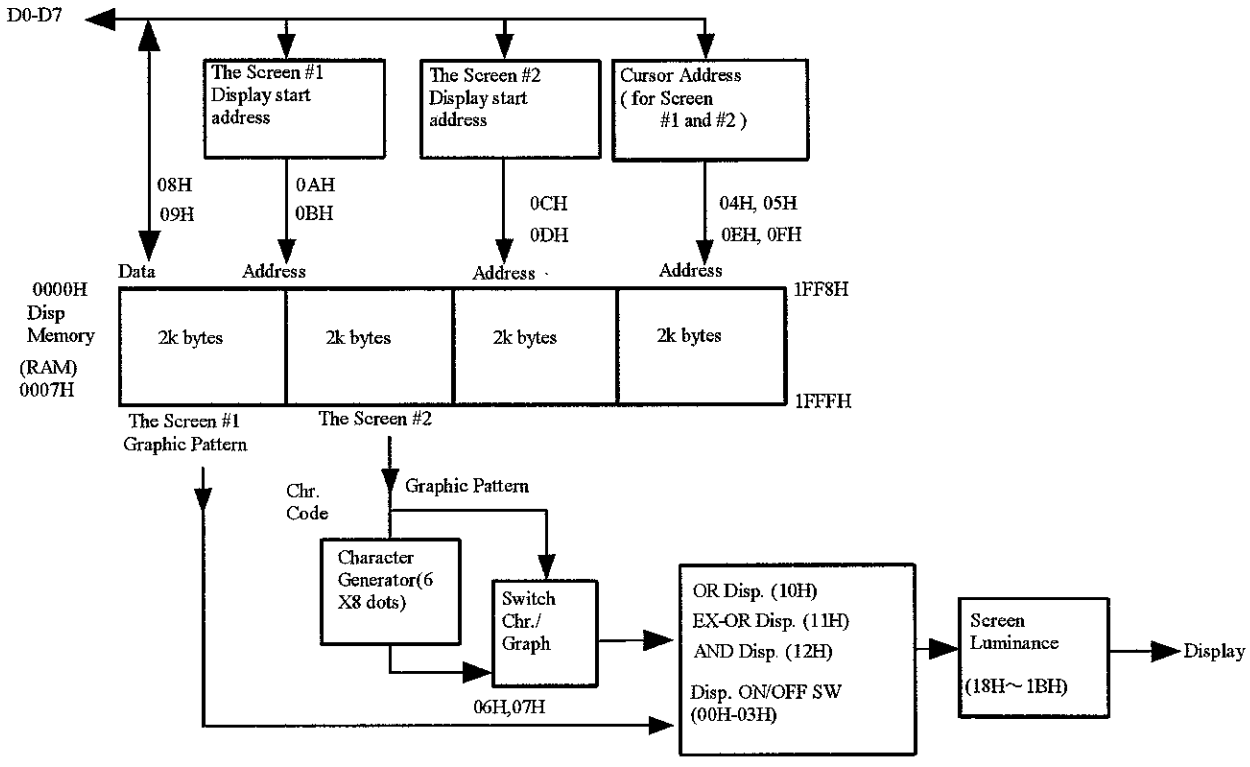
The display pattern data can be written/read to/from the graphic screen and the display character code can be written/read to/from the character screen using data bus
A character consists of 6 x 8 dots
Since display start address can be set independently at both the screen #1 and #2, scrolling or page rolling might be also available independently.
Within the graphic screen, left and right scroll by 1 line (1 dot) unit is doable and the character screen can be able the upper and lower scroll by 1 column(8dots)unit.

9.1 Block Diagram



9.2 The Relationship of Display Memory and Command

(XXH show the commands which will be described hereafter)



10.Commands

Command Table : Following table shows all commands and brief description of functions.

Command(C/$\overline{D}$="1")					Setting Data(C/$\overline{D}$="0")								Function
D4	D3	D2	D1	D0	D7	D6	D5	D4	D3	D2	D1	D0	
0	0	0	0	0				—					Both Screen #1 & #2 are OFF
0	0	0	0	1				—					Only Screen #1 is ON
0	0	0	1	0				—					Only Screen #2 is ON
0	0	0	1	1				—					Both #1 & #2 are ON
0	0	1	0	0				—					Cursor increments automatically
0	0	1	0	1				—					Cursor holds
0	0	1	1	0				—					Screen #2 sets to "Character" disp.
0	0	1	1	1				—					Screen #2 sets to "Graphic" disp.
0	1	0	0	0	X	X	X	X	X	X	X	X	Data write mode.
0	1	0	0	1	X	X	X	X	X	X	X	X	Data read mode.
0	1	0	1	0	A7	A6	A5	A4	A3	A2	A1	A0	Lower byte of disp. start adrs. of #1.
0	1	0	1	1	X	X	X	A12	A11	A10	A9	A8	Upper byte of disp. start adrs. of #1.
0	1	1	0	0	A7	A6	A5	A4	A3	A2	A1	A0	Lower byte of disp. start adrs. of #2.
0	1	1	0	1	X	X	X	A12	A11	A10	A9	A8	Upper byte of disp. start adrs. of #2.
0	1	1	1	0	A7	A6	A5	A4	A3	A2	A1	A0	Set lower byte of cursor adrs. of #1 & #2.
0	1	1	1	1	X	X	X	A12	A11	A10	A9	A8	Set upper byte of cursor adrs. of #1 & #2.
1	0	0	0	0				—					Select screens merge mode. OR #1 & #2.
1	0	0	0	1				—					Select screens merge mode. Ex-OR #1 & #2.
1	0	0	1	0				—					Select screens merge mode. AND #1 & #2.
1	0	1	0	0				—					Set all display ON
1	0	1	0	1				—					Set all display OFF
1	1	0	0	0				—					Set brightness 100%
1	1	0	0	1				—					Set brightness 87.5%
1	1	0	1	0				—					Set brightness 75%
1	1	0	1	1				—					Set brightness 62.5%

The term "Cursor" means the writing or reading position.

Note 1/0: One bit data. X: Don't care

CAUTION! When the command not indicated by the above table is set, display module may cause operation trouble.

10.1Screen Control

10.1.1 Screen ON/OFF Control

Command(C/$\overline{D}$="1")					Function	Default Selection
D4	D3	D2	D1	D0		
0	0	0	0	0	Both Screen #1 and #2 are turned OFF.	X
0	0	0	0	1	Screen #1 is turned ON, Screen#2 is turned OFF.	
0	0	0	1	0	Screen #1 is turned OFF, Screen#2 is turned ON.	
0	0	0	1	1	Both screen #1 and #2 are turned ON.	

The latest command is valid from above table. At power on, Screen#1 and #2 are set to OFF. Therefore appropriate ON command should be written after writing of pattern data or character codes When uses screen#2 as graphic display, command 07Hex should be sent before screen ON command.

10.1.2 OR/EX-OR/AND Display(Screen Merge)

Command(C/$\overline{D}$="1")					Function	Default Selection
D4	D3	D2	D1	D0		
1	0	0	0	0	OR display of Screen #1 &#2	X
1	0	0	0	1	EX-OR display of Screen #1 &#2	
1	0	0	1	0	AND display of Screen #1 &#2	

The latest command is valid from above table.
These commands are only effective, when both screen#1 and #2 are turned on(command 03Hex).
If only one screen is selected, that screen is displayed without merge.

10.2 Display ON/OFF control

Command(C/$\overline{D}$="1")					Function	Default Selection
D4	D3	D2	D1	D0		
1	0	1	0	0	Display is turned ON	X
1	0	1	0	1	Display is turned OFF	

When display is turned off, power converter also inhibited and reduce a power consumption.

10.3 Automatic Increment/ Hold of Cursor address

Command(C/$\overline{D}$="1")					Function	Default Selection
D4	D3	D2	D1	D0		
0	0	1	0	0	Cursor is automatically incremented.	X
0	0	1	0	1	Cursor is not automatically incremented.(Hold)	

The cursor address which will be executed after Data Write or Data Read can be set to automatic INCREMENT or HOLD by above commands
The cursor address will be incremented one address count on the address map covering all RAM area.

10.4 Character /Graphic Display

Command(C/$\overline{D}$="1")					Function	Default Selection
D4	D3	D2	D1	D0		
0	0	1	1	0	Screen #2 is selected to Character Display	X
0	0	1	1	1	Screen #2 is selected to Graphic Display	

As described in para.9,the screen #1 is available graphic display only and where will be displayed bit pattern as is written from external system

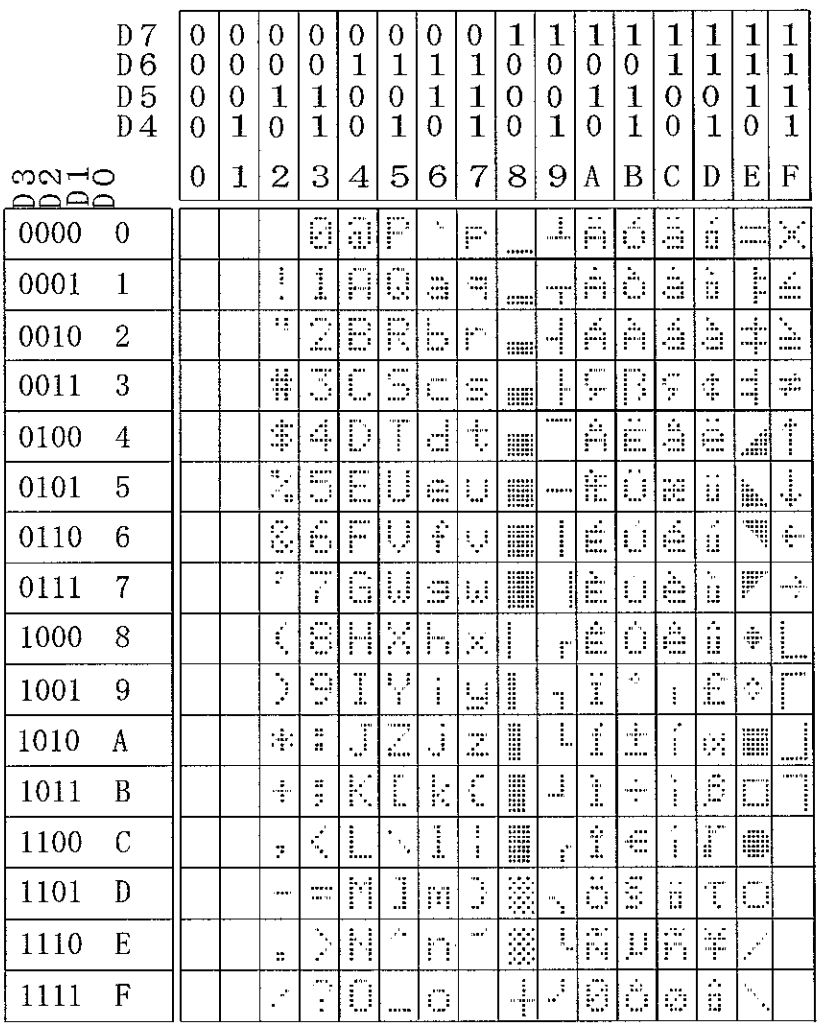
The screen #2,however, is selectable to graphic or character display.

Within the graphic display in the screen #2 ,the bit pattern will be displayed like as the screen #1.

When selects the character display in the screen #2 ,the character which is corresponded to the character code will be displayed. A character consists of 6x8 dots.

The character set is shown in the table(CFX001)

Since there are no control codes in the table ,the writing position should be designated by the Cursor Setting Commands (0EH,0FH) from external system.

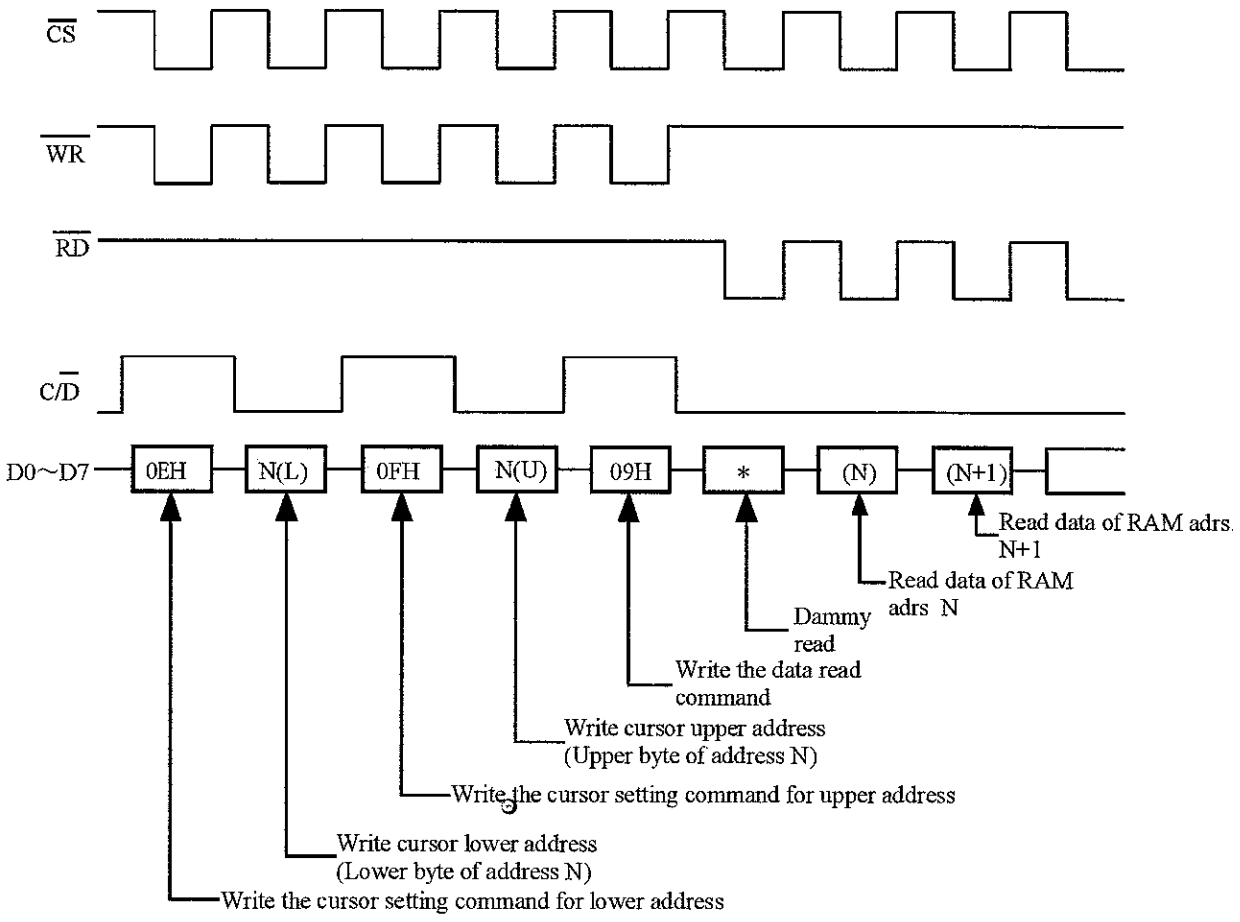


CFX001 (G68001)

10.5 Data Write / Data Read

Command(C/$\overline{D}$="1")					Function
D4	D3	D2	D1	D0	
0	1	0	0	0	Set Data (pattern or character) Write mode.
0	1	0	0	1	Set Data (pattern or character) Read mode.

After cursor setting command, above Data Write or Data Read command is given
The one byte data shall be written or read sequentially.
The cursor address can be incremented automatically by one address after write or read data with 04Hex command
If 05Hex command is given, cursor stay same address even after write or read data operation.
CAUTION ! Within the data read mode, first byte (right after " DATA READ COMMAND") is invalid The correct data will be read from the 2nd byte
It is necessary a dummy read right after the "DATA READ COMMAND".
The correct data will be read from the 2nd byte.



10.6 Setting of Display Start Address

Command(C/$\overline{D}$="1")					Setting Data(C/$\overline{D}$="0")								Function
D4	D3	D2	D1	D0	D7	D6	D5	D4	D3	D2	D1	D0	
0	1	0	1	0	A7	A6	A5	A4	A3	A2	A1	A0	Lower byte of Screen#1 display address.
0	1	0	1	1	X	X	X	A12	A11	A10	A9	A8	Upper byte of Screen#1 display address.
0	1	1	0	0	A7	A6	A5	A4	A3	A2	A1	A0	Lower byte of Screen#2 display address.
0	1	1	0	1	X	X	X	A12	A11	A10	A9	A8	Upper byte of Screen#2 display address.

After writing of appropriate command from above, the display start address will be written into the address register.

The display start address is always pointed to the RAM address where is stored the data will be displayed at most left and the top line of the screen. Using with these commands, page rolling, one-line-left/right scrolling (one dot unit) at graphics display or one-line-upper/lower scrolling(8 dot unit) at character display are available

Since FRP signal is triggered at each frame of display refreshing, the most smooth scrolling can be achieved by synchronizing of changing of the display address with the FRP.

CAUTION: It is necessary to set lower address first, and set upper address

10.7 Cursor Address Set

Command(C/$\overline{D}$="1")					Setting Data(C/$\overline{D}$="0")								Function
D4	D3	D2	D1	D0	D7	D6	D5	D4	D3	D2	D1	D0	
0	1	1	1	0	A7	A6	A5	A4	A3	A2	A1	A0	Set lower byte of cursor address.
0	1	1	1	1	X	X	X	A12	A11	A10	A9	A8	Set upper byte of cursor address.

The cursor address is written into cursor address counter with this command.

The cursor address is a address to read/write RAM data.

It is necessary to set cursor address before execution of data write command (08H) or data read command (09H)

The cursor address is divided into the 2 portions as upper (5 bits) and lower (8 bits) address and there are following restrictions.

Desire to change(set) the address both upper and lower	Firstly, set the lower and then upper address.
Desire to change(set) the lower address only	Upper address set is required after setting of lower address.
Desire to change(set) the upper address only	Set the upper address. Not need to change (set) the lower address.

10.8 Screen Luminance Control.

Command(C/$\overline{D}$="1")					Function
D4	D3	D2	D1	D0	
1	1	0	0	0	Set brightness 100.0%
1	1	0	0	1	Set brightness 87.5%
1	1	0	1	0	Set brightness 75.0%
1	1	0	1	1	Set brightness 62.5%

Screen Luminance can be varied by above command.

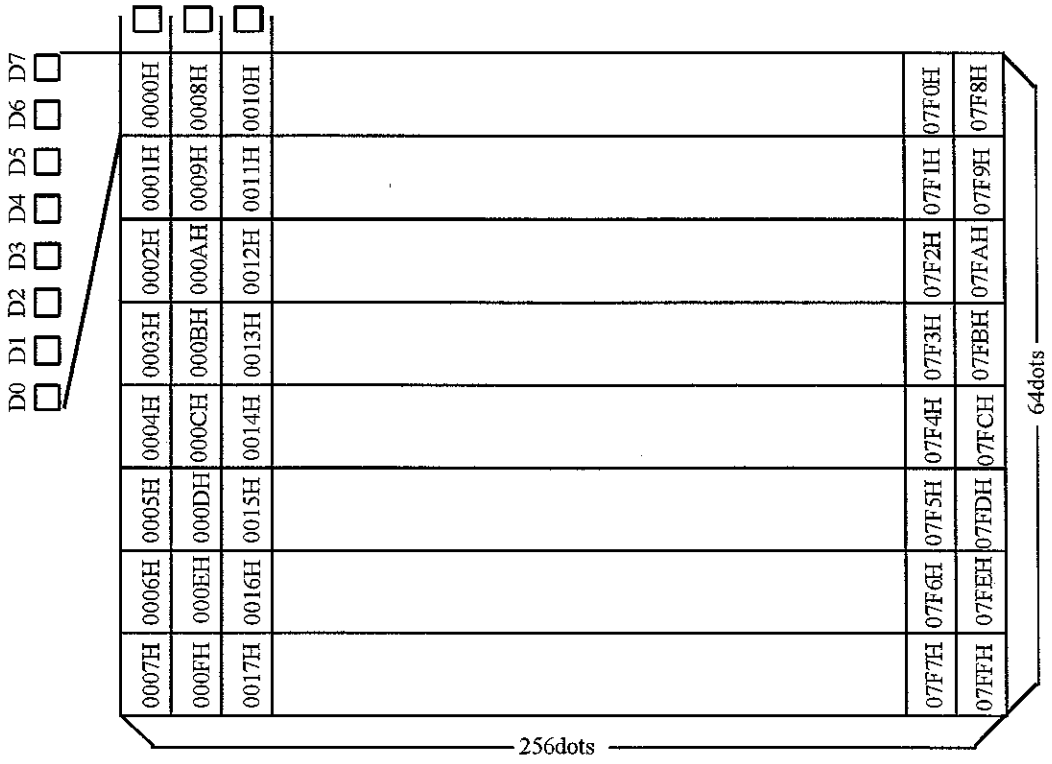
At power on , Screen Luminance is set to 100%.

11. Blanking

Display will be turned off without changing any other register setting or modes, when BL is "0" level. There are no change in the RAM during blanking, previous display will be recovered by BL="0".

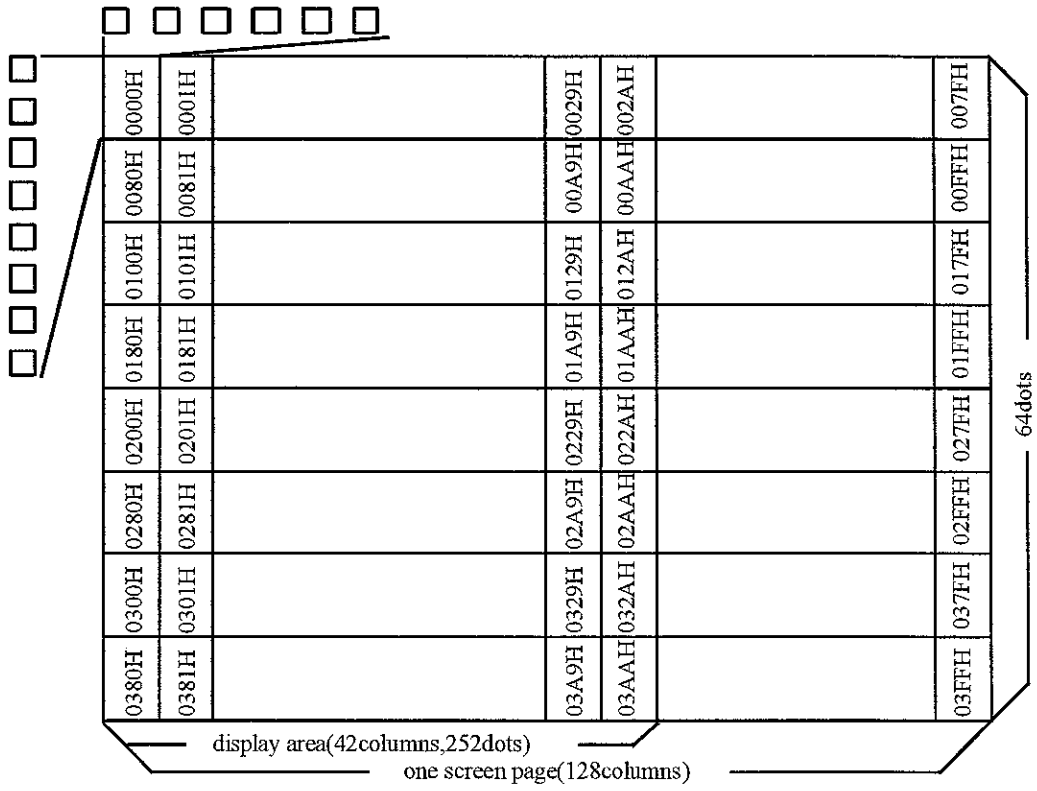
12.Address Map

12.1 Graphic Display



< Above map shows in the case of 0000H of start address. >

12.2 Character Display



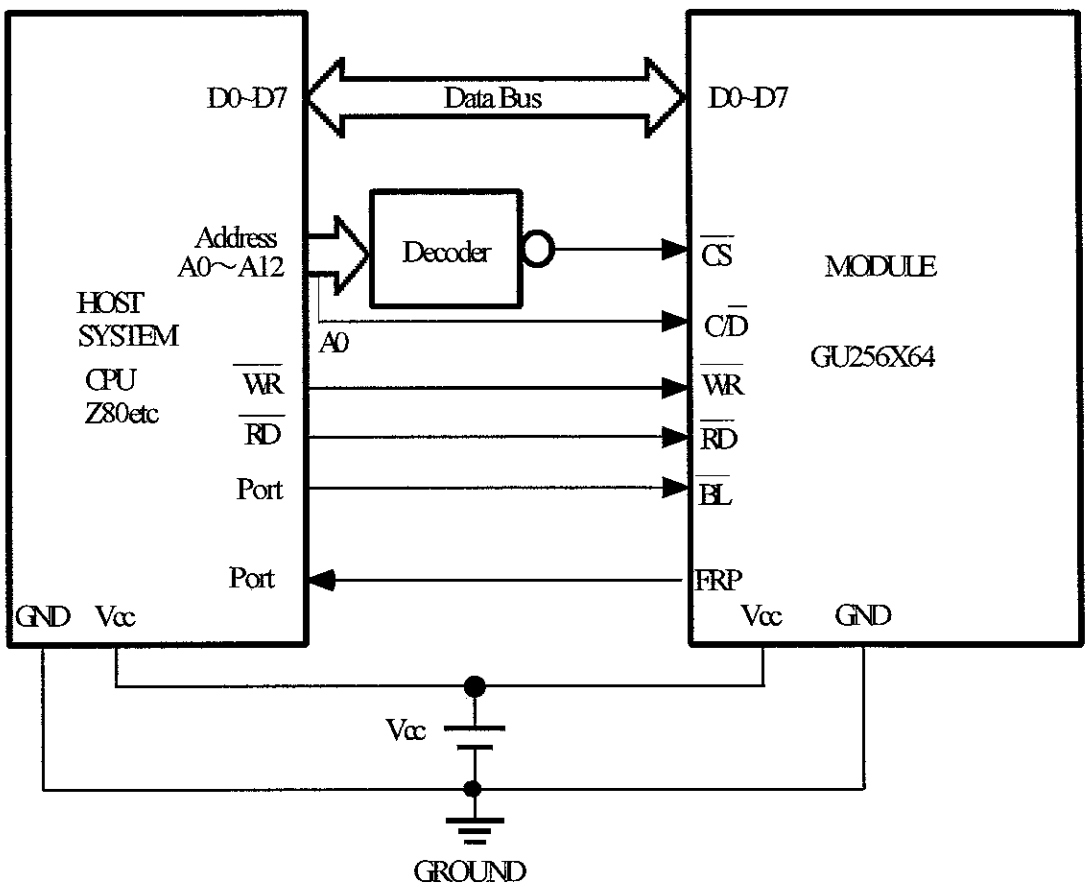
< Above map shows in the case of 0000H of start address >

13.Interfacing

$\overline{CS}$	$\overline{WR}$	$\overline{RD}$	C/$\overline{D}$	$\overline{BL}$	Function
0	0→1	1	1	-	Command write(Host system→ Module)
0	0→1	1	0	-	Data write (Display pattern, Address) (Host system → Module)
0	1	0	1	-	.....
0	1	0	0	-	Display data read(Host system ← Module)
-	-	-	-	0	Display Blanking

Since data execution time of the module is 2us (Max), there are no BUSY or READY output. Therefore more than 2us time period is required between module access.

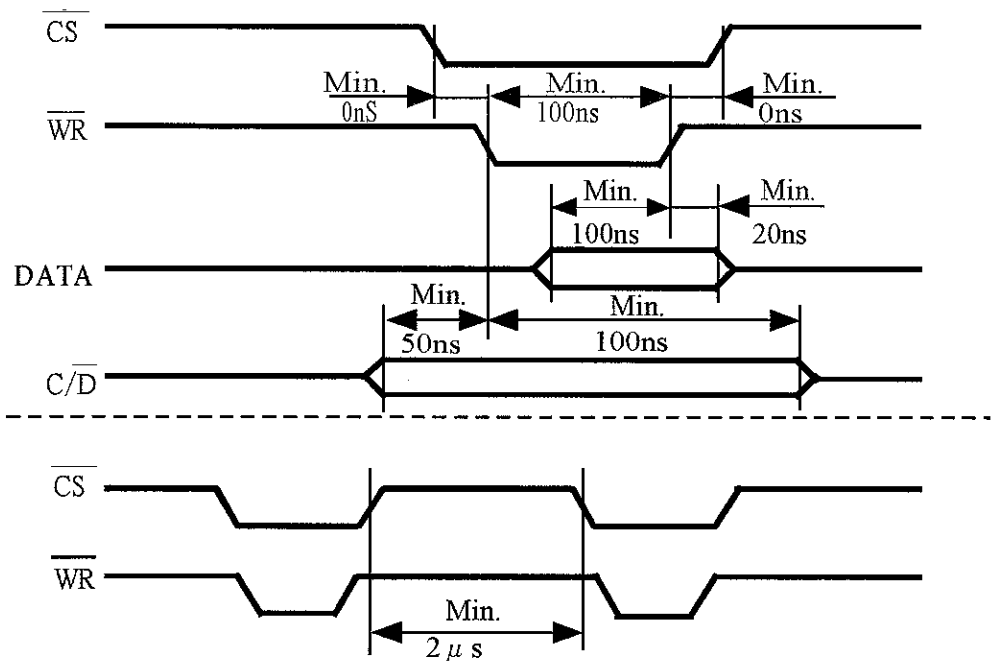
[An example of interfacing]



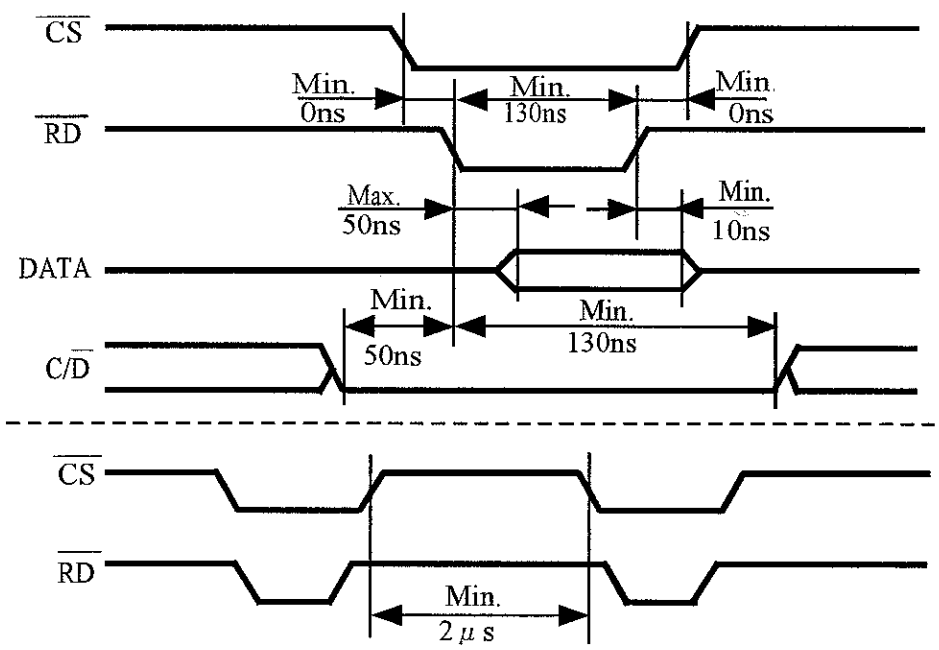
CAUTION : Because of adoption of C-MOS input logic in the module, shorter than 30cm cable length between a host system and the module is kindly suggested for free from permanent damages caused by noise

14.Timing Chart

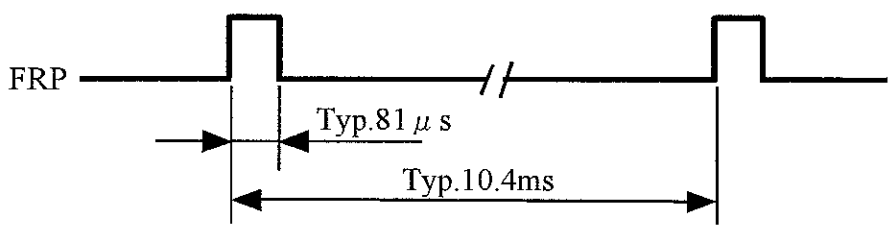
14.1Write Operation



14.2 Read Operation

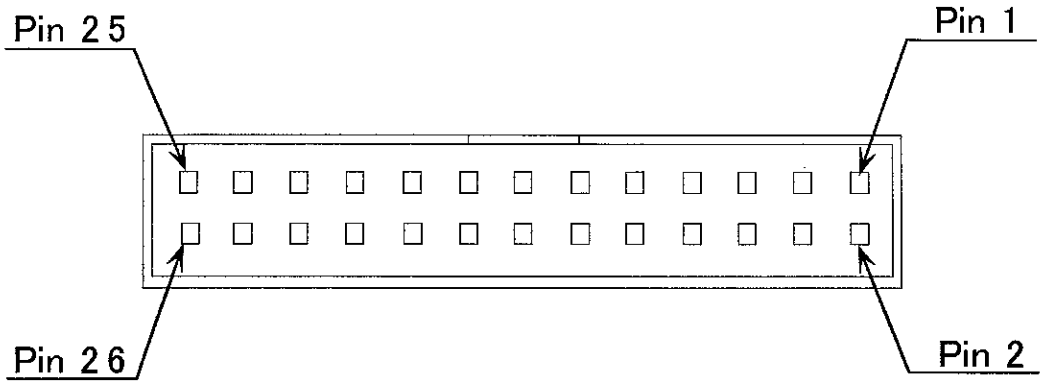


14.3 Output Timing of FRP (Output)



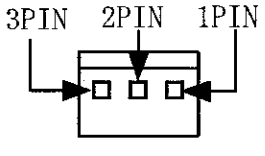
15.Pin Assignment

15.1 Signal Connector



Pin No.	Description	Pin No.	Description
1	D7	2	GND
3	D6	4	GND
5	D5	6	GND
7	D4	8	GND
9	D3	10	GND
11	D2	12	GND
13	D1	14	GND
15	D0	16	GND
17	$\overline{WR}$	18	GND
19	C/$\overline{D}$	20	GND
21	$\overline{RD}$	22	GND
23	$\overline{CS}$	24	GND
25	FRP	26	$\overline{BL}$

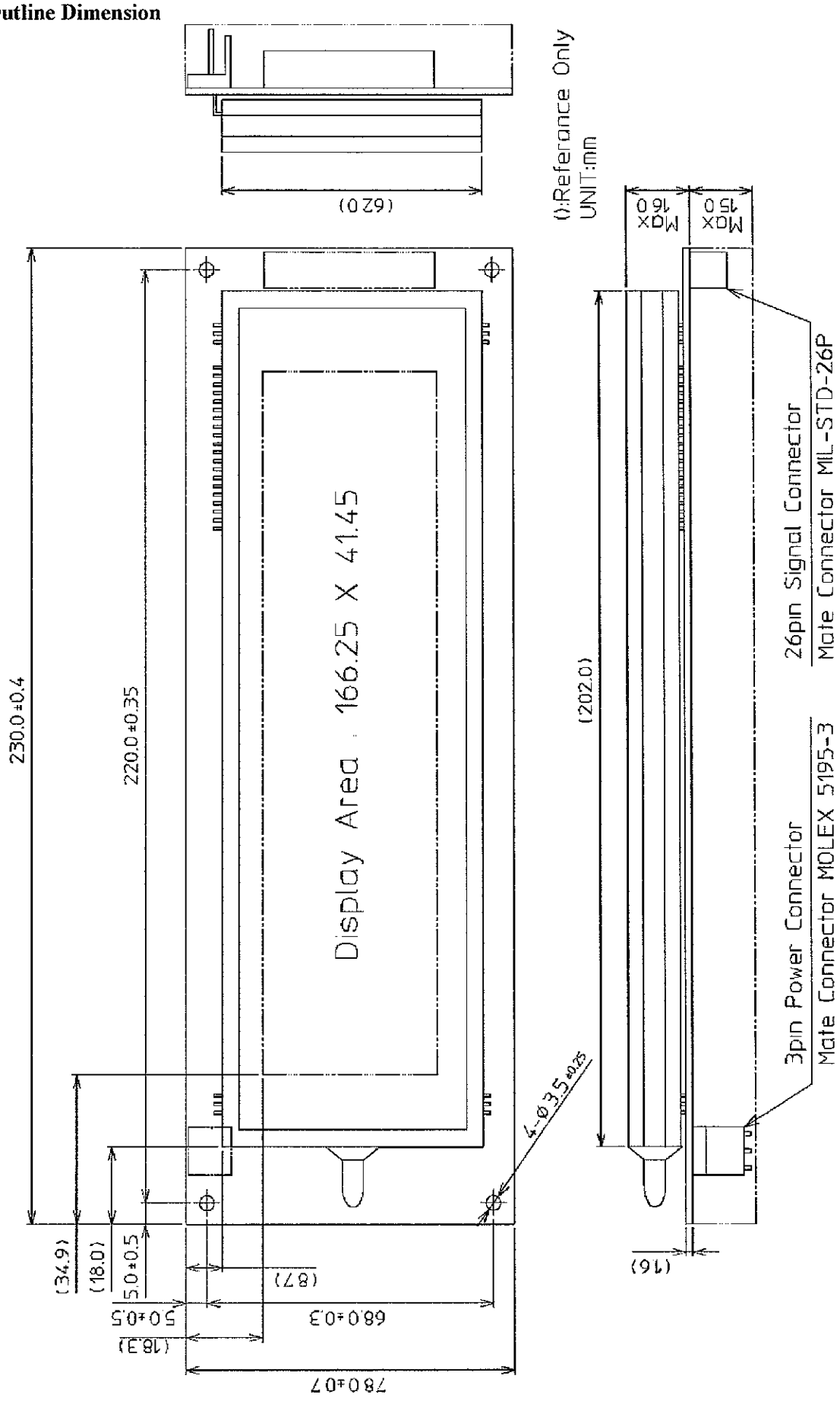
15.2 Power Connector



Pin No.	Description
1	+5V(Vcc)
2	I.C.
3	GND

I C : Internally connected.(Be sure to leave this pin open)

16. Outline Dimension



IMPORTANT PRECAUTIONS

*All VFD Modules contain MOS-LSIs or ICs Anti-Static handling are always required.

*V F Display consist of Soda Lime glass. Heavy shock more than 55G, thermal shock greater than 10degrees/Minutes, direct hit with hard material to the glass surface -- especially to the EXHAUST PIPE may CRACK the glass

*Do not push the display strongly At mounting to the system frame, slight gap between display glass face and front panel is necessary to avoid a contact failure of lead pins of display Twist or warp mounting will make a glass CRACK around the led pin of display.

*Neither DATA CONNECTOR or POWERCONNECTOR should be connected or disconnected while power is applied. As is often the case with most subsystems, caution should be exercised in selectively disconnecting power within a computer based system. The module receive high logic on strobe lines as random signals on all data ports Removal of primary power with logic signals applied may damage input circuitry.

*Stress more than specification listed under the Absolute Maximum Ratings may cause PERMANENT DAMAGE of the modules

*+5Volts power line must be regulated completely since all control logic depend on this line. Do not apply slow start power Provide sufficient output current power source to avoid trouble of RUSH CURRENT at power on.

*Data cable length between module and host system is recommended within 300 mm to be free from a miss-operation caused by noise.

*Do not place the module on the conductive plate right after power off. Due to big capacitors on the module, more than 1 min. of discharging time is required to avoid the failure caused shorting power line.

*2 hours pre-running with the test mode operation may help the stability of the brightness of the VFD when power was not applied more than 2 months.

*Steady repeating of a fixed (static) message displaying, longer than 5 hours in a day may cause the phosphor burn-out problem. An automatic shut down programming, scrolling message using 2 hours test mode operation during the idling of the host is recommended.

*The module contains high voltage(70V) power source Careful handing is required when it is powered on.