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Noritake itron®

U version Vacuum Fluorescent Display Module Application Note

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This Application Note has been compiled as a support material for our customers using U-Version Vacuum Fluorescent Display Modules (described as U-version Modules in the following sections). Since this manual contains only general information, the user is requested to refer to the most recent indivisual product specification for specific values. The measurement data and other particulars that are included in this material are meant to be reference data and do not guarantee the characteristics of the mass-produced modules.

Applicable Models

CU16025ECPB-U1J,-W1J-W2J

CU20025ECPB-U1J,-W1J

CU24025ECPB-U1J,-W1J

CU20045SCPB-U1J,-U2J-W2J

CU40025SCPB-U1J,-W1J

1. Bus Setup

1. 1 M68/i80 Selection

The U-version VFD modules support an M68 interface bus (E&R/W) making it interchangeable with LCDs. In addition, the U-version VFD can be configured to interface to an i80 bus (WR/RD) via the jumpers that are located on the printed-circuit board. To short-circuit the jumpers, a soldering iron will be necessary. To open them, also some kind of tool, such as a knife, will be required.

1. 2 8-Bit/4-Bit Selection

In both the M68 and i80 interface modes, the data bus width can be selected for 8 bit or 4 bit operation. This is setup by using a software command. If you have chosen the 4-bit mode, use the upper nibble (D7-D4). An example of the initialization sequence for each case will be explained in detail in the next chapter.

2. Initializing Procedure

The U-version module has its bus width set at 8 bits by default. However, you will be able to change this setting to 4 bits by taking advantage of the LCD interchangeability function. When initializing the module in the 4-bit mode in particular, you will have to pay special attention.

2. 1 8-bit mode (Example)

(1)	Wait 260m Sec. After Vcc>4.75		: Power on reset.
(2)	Function Set	38H (RS=0)	: 8 Bit Bus Mode
(3)	Function Set	38H (RS=0)	: 8 Bit Bus Mode
(4)	Brightness Set	00H (RS=1)	: 100% Brightness
(5)	Display OFF	08H (RS=0)	: Display OFF, Cursor OFF : Blinking OFF.
(6)	Display Clear	01H (RS=0)	: Display Clear Instruction
(7)	Wait 2.3m Sec.		:
(8)	Display ON	0CH (RS=0)	: Display ON, Cursor OFF. : Blinking OFF.
(9)	Entry Mode	06H (RS=0)	: Cursor Increment.

Note: In preparation for setting 4-bit mode, it is advisable to perform the 'Function Set' twice in case the above initialization does not go through normally.

2. 2 4-bit mode (Example)

(1)	Wait 260m Sec, After Vcc>4.75		: Power on reset.
(2)	Function Set	3xH (RS=0)	: 8 Bit Bus Mode
(3)	Function Set	3xH (RS=0)	: 8 Bit Bus Mode
(4)	Function Set	3xH (RS=0)	: 8 Bit Bus Mode
(5)	Function Set	2xH, 8xH (RS=0)	: Set 4 bit bus mode
(6)	Brightness Set	0xH, 0xH (RS=1)	: 100% Brightness
(7)	Display ON/OFF	0xH, 8xH (RS=0)	: Display OFF, Cursor OFF : Blinking OFF.
(8)	Display Clear	0xH, 1xH (RS=0)	: Display Clear Instruction
(9)	Wait 2.3m Sec.		:
(10)	Display ON/OFF	0xH, CxH (RS=0)	: Display OFF, Cursor OFF : Blinking OFF
(11)	Entry Mode	0xH, 6xH (RS=0)	: Cursor Increment

Note: In order to establish synchronization between the upper and the lower nibble, the U-version module should be first set in the 8-bit mode. To secure perfect synchronization, it is advisable to write it three time.

3. Display Data RAM Addresses for Various Models

When you use a multi-line display, like the CU20025ECPB-U1J(2x20) and write no more than 20 characters on the top line, you will have to change the RAM address pointer before writing the 2nd line. The display data RAM of the U-version modules has an 80 character capacity.
Modules with less than 80 displayed characters use selected areas of the RAM for each row. These selected areas are specified by the address assignment.

3. 1 CU16025ECPB-U1J, W2J

Address assignment in the absence of shift

00H	01H	·····	0EH	0FH
40H	41H	·····	4EH	4FH

LEFT ⟵⟶ RIGHT

3. 2 CU20025ECPB-U1J

Address assignment in the absence of shift

00H	01H	·····	12H	13H
40H	41H	·····	52H	53H

LEFT ⟵⟶ RIGHT

3. 3 CU24025ECPB-U1J

Address assignment in the absence of shift

00H	01H	·····	16H	17H
40H	41H	·····	56H	57H

LEFT ⟵⟶ RIGHT

3. 4 CU20045SCPB-U1J, U2J

The models U1J and U2J differ from each other in the DDRAM address assignment. If the 2nd line and the 3rd line are reversed during evaluation, try the second model. (The U2J is the most common configuration)

3. 4. 1 CU20045SCPB-U1J

Address assignment in the absence of shift

00H	01H	·····	12H	13H
20H	21H	·····	32H	33H
40H	41H	·····	52H	53H
60H	61H	·····	72H	73H

LEFT ⟵⟶ RIGHT

3. 4. 2 CU20045SCPB-U2J

Address assignment in the absence of shift

00H	01H	·····	12H	13H
40H	41H	·····	52H	53H
14H	15H	·····	26H	27H
54H	55H	·····	66H	67H

LEFT ⟵⟶ RIGHT

3. 5 CU40025SCPB-U 1 J

Address assignment in the absence of shift

00H	01H	.....	26H	27H
40H	41H	.....	66H	67H

LEFT ← → RIGHT

4. FAQs

4. 1 The 2nd and the 3rd lines are inter-changed on the 4 x 20

The 4 x 20 LCD has two types of address map. If a module with different address map is used, the 2nd and the 3rd lines are alternated. To cope with this problem, two different versions, i.e., -U 1 J and -U 2 J, are available for the U-module. Check the address, and use the appropriate model.

4. 2 When a character is rewritten or scrolled on a U-version module, the character momentarily appears in a duplicated form, but soon returns to normal.

The phenomenon which sometimes occurs:

"The character last written in the cursor position is displayed during the High period of the E signal."

In the case of an LCD, this phenomenon is not visible because of the slow response, but the fast response of the VFD makes it visible sometimes.

When writing to the module, the High period of the E signal should be as short as possible. With E= 5 μsec or less, this phenomenon will hardly be visible.

This phenomenon only takes place in the ECPB-U (2 x 16 to 2 x 24) since counter measures have been taken in the circuitry of the 2 x 40 model and 4 x 20 model.

4. 3 Which optical filters can be used

Given below is just a short list of contact addresses for the manufacturers of optical filters.
Please note that this material is supplied without representation or warranty of any kind.

◆Japan: Nitto Jushi Kogyo
9 −29, 2 −chome, Hiratsuka, Shinagawa-ku, Tokyo, Japan
Phone : 03−3783−3121

◆U.S.A.: Astra Products, Inc.
P.O.Box 479
Baldwin, New York 11510 U.S.A.
Phone : 516−223−7500 Fax : 516−868−2371
Panelviewn Inc.
Hillsboro. OR. 97123 U.S.A.
Phone : 503−643−9311 Fax : 503−643−8923

(Continued)

◆Hong Kong: Rainbow Enterprise Co.,
Rm. 2504－6 Hong Kong Plaza,
186－191 Connaught Road. W.,Hong Kong.
Phone : 2547－0427 Fax : 2559－0767

◆Sweden: Larsvenson Komponent ab
Ostermalmsgatan 57
114 50 Stockholm Sweden
Phone : 8－663－33－04 Fax : 8－663－67－99

◆Korea: Claire Corporation
197-8, Changshin-1 dong,
Jongro-Ku, Seoul, Korea
Phone : 02－3672－4722 Fax : 02－3672－34724

◆U.K.: Weatherall E & I Ltd.
P.O.Box 69
Tring, Herts, HP23 6PL, U.K.
Phone : 0494－758110 Fax : 0494－758014

4. 4 When one character is entered, 4 characters are output. The operation returns to normal as an LCD is connected.

It is likely that the control signals (especially "E") contain distortion due to impedance mismatch caused by a long cable (30cm or more), and consequently one write cycle is interpreted as several write cycles.

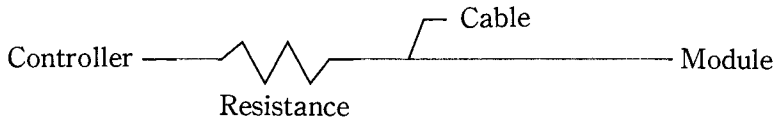
Observe the waveform of the "E" signal on an oscilloscope. If an overshoot or undershoot is found, it is probably the cause of the trouble.

Remedial Action:

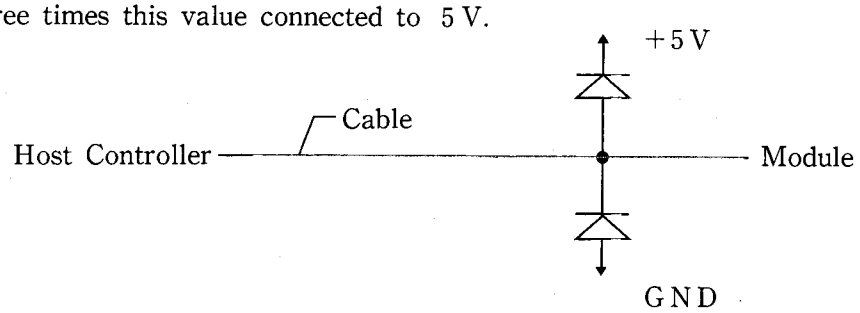
Remove the distortion by terminating the cable.

Method 1 :

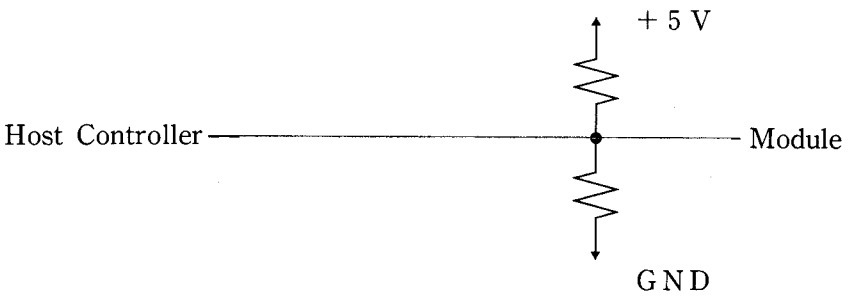
A series resistance of 100 ohms is inserted on the controller side of the signaling cable, preferably on the board. This measure should be enough for "E" alone. If the module is operated in the i80 mode, insert it for "*WR".



Method 2 :
Provide the cable with a diode termination on the module side ("E" signal).
Alternatively, a resistance may be used with a value of between 100 to 200 ohms connected to 0V, and two or three times this value connected to 5 V.



OR



Supplementary note:
Since this controller functions at high speed, it may treat a signal as multiple signals during processing if the waveform is distorted. LCD controllers, which work at low speed, will not produce this false operation in the presence of the same degree of distortion or noise. The U-version controller is resistant to noise but is subject to a trade off in order to provide high speed.

4. 5 Comparison of In-Rush Current

The in-rush currents of the following models have been measured, and are indicated below for information.

Product Model	Rush Current (Peak Value) (A)	Sustained Period (mS) (Note 1)
CU16025ECPB-U 1 J,-W 1 J	Approx. 2.1	Approx. 3.0
CU16025ECPB-W 2 J	Approx. 1.2	Approx. 1.0
CU20025ECPB-U 1 J,-W 1 J	Approx. 1.5	Approx. 0.4
CU24025ECPB-U 1 J,-W 1 J	Approx. 1.5	Approx. 1.0
CU20045SCPB-U 1 J,-U 2 J,W 2 J	Zero (Note 2)	
CU40025SCPB-U 1 J,-W 1 J	Zero (Note 2)	

Note 1 :
The sustained time is the period measured from the time when the in-rush current starts flowing, until it falls to half of the peak value.
Note 2 :
The in-rush currents have been reduced to nearily nil, due to the soft start DC/DC converter adopted. The module uses a power supply input capacitor of 47μF so beware of the charge current when you turn the power on or off through a relay.

4. 6 Sleep Mode—Reducing the Power Consumption

The U-version modules has been designed so as to reduce its power consumption especially for battery operation.

This is achieved by allowing the DC/DC converter to be stopped when the display is shut down by the Display ON/OFF software command. At the same time, the filament power to the VF display tube is cut off, resulting in extended service life for the tube. The current consumption with the display turned off is approximately 5 mA. For a more exact value, check the corresponding specification for each model.

4. 7 The Dot assignment of the UDF in a CU40025SCPB-U1J does not match the UDF in a CU20025ECPB-U1J

The 36th dot (cursor) position in the UDF which is indicated in the CU40025SCPB-U1J specification does not match that of the CU20025-U. With respect to the assignment of UL (Under Line) in the UDF (User Definable Font), the position of UL differs between the models ECPB-U and SCPB-U.

4. 8 Detection of Display OFF

Generally, ON/OFF operation of the display module is controlled by the controller, and, therefore, there is no need to detect it by a circuit. Nonetheless, in case it has to be detected for some reason, the following methods are conceivable:

4. 8. 1 Custom-design module

Since the controller has an output of display-ON/OFF as part of its function, the design can be so devised as to deliver this signal to the outside. (Custom-design specification)

The existing standard modules cannot be made to support this requirement, as soldering to the lead pins of the QFP will be required.

4. 8. 2 Modification existing module by customer

As a way for the customer to modify the existing module, the signal can be picked up through the filament terminal. The terminal has an AC voltage applied while the display is on, which will change to a DC level when the display is turned off.

The filament frequency is several tens of kHz or more. If you have chosen this alternative for modification, you are requested to have good understanding of the following aspects, and verify them thoroughly, before executing the work:

- ○ The lead wire from the filament terminal should be AC-coupled. Do not pick up DC current through it and limit the current to less than 1 mA.
- ○ The modification described above should be conducted by the customer under their own responsibility and after thorough verification. Ise Electronics Corp. or Kyushu Noritake Co., Ltd. assumes no responsibility for the consequences of the modification.

4. 8. 3 Monitoring of current consumption

The current consumption of the module varies from several hundreds of mA (Display-ON) to approximate 5 mA (Display-OFF). By monitoring the amount of current, the ON/OFF status of the display can be determined.

5. Comparison between ECPB-U/SCPB-U modules and LCDs

	ECPB-U/SCPB-U	LCD general
BUS interface	M68 and i80	M68 only
CG RAM SIZE	320bit	512bit
CGROM Font	240characters	192characters
No of lines	2 lines only	1 line, 2 lines
Brightness control	One data following Function set instruction set brightness.	No function
Address set instruction to out of DDRAM.	Set to address as instruction.	Move to next address where within DDRAM.
Data write more than continuos 64 byte.	65th writing operation over write 1st address.	65th writing will be neglected.
Address/data hold time	Min. 700nSec.	Min. 20nSec.
RS, R/W set up time	Min. 20nSec.	Min. 140nSec.
Data delay from "E", and "$\overline{WR}$"	Max. 160nSec.	Max. 320nSec.
Execution Time	Faster than LCD except "Display Clear"	
Reset	C/R delay reset circuit. Time constant is 100mS (Typ.)	No delay circuit.

⚠ Safety information

■The glass portion is exposed on VFD. Handling the glass portion may cause injury.

■Please read User's Manual and the Specifications before using the product.

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