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DOT MATRIX VFD MODULE M402SD07FA

INSTRUCTION MANUAL

GENERAL DESCRIPTION

Futaba Vacuum Fluorescent Display Module M402SD07FA, with Futaba VFD 402-SD-07GK display, produce 40 digit on 2 rows.
Each character is displayed in 5×7 dot matrix with the cursor under it.
Consisting of a VFD, microcomputer, driver IC, the module can be connected directly to the system bus, thus simplifying interfacing.
The bright and aesthetically pleasing VFD makes the module desirable for application in office equipments, such as electronic typewriters, computer terminals, measuring equipment, etc.

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1. FEATURES

1-1. Using a one chip computer, the module can be connected to the system bus directly.

1-2. Two hundred twenty-two different characters consisting of alphanumeric and other symbols can be displayed.

1-3. By using dimming function, brightness can be controlled into four levels.

1-4. Since a DC/DC converter is included, only a 5V power is required to operate the module.

1-5. High quality reliability and long life can be achieved with FUTABA VFD.

1-6. Either parallel or serial input interface can be selected.
In case of serial input, it is possible to choose 1200, 2400, 4800, 7812.5, 9600, 15625, 31250 and 62500 bps.
1200 bps for the serial input shall be set at delivery.

1-7. The module's small, light and thin mechanical sizing allows for maximum mounting flexibility.

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2. GENERAL SPECIFICATIONS

2-1. OUTER DIMENSIONS, WEIGHT (REFER APPENDIX-1)

TABLE-1

Item	Specification	Unit
Outer Dimensions	W 265±1.0 H 65±1.0 T 21 MAX (without connector)	mm
Weight	Approx. 170	g

2-2. SPECIFICATIONS OF THE DISPLAY PANEL

TABLE-2

Item	Specification	Unit
Display Area	186.8(W)×16.4(H)	mm
The Number of Digits	5×7dots(with cursor)	-
Character Size	3.5(W)×5.0(H)	mm
Character Pitch	4.7(W)×10.0(H)	mm
Color of Illumination	Green(505nm)	-

2-3. ENVIRONMENT CONDITIONS

TABLE-3

Item	Symbol	Min.	Max.	Unit
Operating Temperature	Topr	-20	+70	°C
Storage Temperature	Tstg	-40	+85	°C
Operating Humidity	Hopr	20	85	%
Storage Humidity	Hstg	20	90	%
Vibration (10 to 55Hz)	-	-	4	G
Shock	-	-	40	G

Note) Avoid operations and or storage in moist environmental conditions.

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2-4. ABSOLUTE MAXIMUM RATINGS

TABLE-4

Item	Symbol	Min.	Max.	Unit
Supply Voltage	V_{CC}	–	7.0	V
Input Signal Voltage	V_{IS}	-0.4	5.5	V

2-5. RECOMMENDED OPERATING CONDITIONS

TABLE-5

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage	V_{CC}	–	4.5	5.0	5.5	V
H-Level Input Voltage	V_{IH}	V_{CC}=5V	2.0	–	–	V
L-Level Input Voltage	V_{IL}	V_{CC}=5V	–	–	0.8	V

2-6. ELECTRICAL CHARACTERISTICS

TABLE-6

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Current	I_{CC}	V_{CC}=5.0V (All on)	–	0.75	1.0	A
Power Consumption	–		–	3.75	5.0	W
Luminance	L		340 (100)	690 (200)	–	cd/m^2 (fL)
H-Level Input Current	I_{IH}	V_{CC}=5.0V	–	–	20	μA
L-Level Input Current	I_{IL}	V_{CC}=0V	–	–	-0.36	mA
H-Level Output Voltage	V_{OH}	I_{OH}=-2.6mA	2.4	–	–	V
L-Level Output Voltage	V_{OL}	I_{OL}=12mA	0.25	–	0.4	V

Note) The surge current can be approx.10 times the specified supply current at power on.

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3. BASIC FUNCTIONS

The module has data and control code write, self test and power on reset functions.

TABLE-7

$\overline{TEST}$	$\overline{WR}$	$\overline{SEL}$	Function
H or NC	L ・H	L	Data and control code write.
L	–	–	Self Test Mode

TABLE 7 THE BASIC FUNCTIONS

3-1. DATA AND CONTROL CODE WRITE-IN

When the data is being written in, the BUSY signal is active which indicatee that module is processing the data.
(When the data is under processing, the BUSY signal is high "H".)
The data or control command is to be written in at the rising edge of $\overline{WR}$(L→H), when $\overline{SEL}$=low "L".
The display character form follows equivalent to JIS C-6220 (Alphabet, Katakana, Numerics and Symbol etc.).
After a character is written in, the cursor will be shifted to the right one digit automatically.
The above action can be executed, only when the BUSY signal is low "L".

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3-2. CONTROL CODE

The control are available as follows.
The details will be explained on the next page.

(1)	DIM	:	Dimming	:	(04 HEX)
(2)	BS	:	Back Space	:	(08 HEX)
(3)	HT	:	Horizontal Tab	:	(09 HEX)
(4)	LF	:	Line Feed	:	(0A HEX)
(5)	CR	:	Carriage Return	:	(0D HEX)
(6)	DP	:	Display Position	:	(10 HEX)
(7)	DC1	:	Normal Display Mode	:	(11 HEX)
(8)	DC2	:	Vertical Scroll Mode	:	(12 HEX)
(9)	DC3	:	Cursor ON Mode	:	(13 HEX)
(10)	DC4	:	Cursor OFF Mode	:	(14 HEX)
(11)	RST	:	Reset	:	(1F HEX)

(1) DIM (Dimming) :
Brightness can be controlled into four levels by using this function. After writing 04H, another HEX byte mentioned under is written to change the brightness out put.

1 byte	+	1 byte
(DIM command code), 04H		Dimming level data

TABLE-8

Dimming level	Data
100%	FFH
60%	60H
40%	40H
20%	20H

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(2) BS (Back Space) :

DC1 Mode: The cursor position (Write-in position) is shifted to the left one digit. (beyond this point, the position of cursor is identical with write-in position of the display, unless otherwise specified. Under DC4 Mode, the cursor will not show up.)
When the cursor is on the most significant digit of the second row, the cursor moves to the least significant digit of the first row.
When the cursor is on the most significant digit of the first row, the cursor moves to the least significant digit of the second row.

DC2 Mode: The same as above.

(3) HT (Horizontal Tab) :

DC1 Mode: The cursor position is shifted to the right one digit.
When the cursor is on the least significant digit of the first row, the cursor moves to the most significant digit of the second row.
When the cursor is on the least significant digit of the second row, the cursor moves to the most significant digit of the first row.

DC2 Mode: When the cursor is on the least significant digit significant digit of the second row, the characters displayed in the second row are shifted up to the first row and the cursor moves to the most significant digit of the second row. Subsequently, the second row is cleared.

(4) LF (Line Feed) :

DC1 Mode: The cursor moves up or down to another row staying on the same line.

DC2 Mode: When the cursor is in the second row, the character displayed there, is shifted up to the first row, leaving the cursor at its present position, then the second row is cleared. When the cursor is in the first row, the same as DC1 Mode operation.

(5) CR (Carriage Return) :

DC1 Mode: The cursor moves to the most significant digit of the same row.

DC2 Mode: The same as DC1 Mode operation.

(6) DP (Display Position) :

Instead of writing the character from the first digit, the write-in starting position can be pointed by using this function.
After writing 10 HEX to prepare module for this command, another HEX byte is written to specify the position desired.
A third byte representing data is then sent.

	The most significant digit	The least significant digit
1st row	00 HEX	27 HEX
2nd row	28 HEX	4F HEX

DC1 - DC4 selects the displayed mode.

(7) DC1 (Normal Display Mode) :

After writing a character, the cursor is shifted to the right one digit automatically.
When the cursor is on the least significant digit of the first row, the cursor moves to the most significant digit of the second row.
When the cursor is on the least significant digit of the second row, the cursor moves to the most significant digit of the first row.

(8) DC2 (Vertical Scroll Mode) :
After writing the characters up to the significant digit of the second row, all the characters displayed in the second row are shifted to the upper row (first row), clearing the second row.
When the power is turn on, this DC2 Mode is selected, and will be held until another mode is selected.

(9) DC3 (Cursor ON Mode) :
The cursor is displayed. When the power is turn on, this DC3 Mode is selected and will be held until another mode (DC4) is selected.

(10) DC4 (Cursor OFF Mode) :
The cursor won't be displayed.

(11) RST (Reset) :
Resetting the module.
All the characters displayed are erased, then the write-in position (cursor position) is set on the most significant digit of the first row.
The displaying status is the same as the Power on Reset.
The display mode is set for DC2. The cursor mode is set for DC3.

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3-3. SELF-TEST

$\overline{\text{TEST}}$ = Low "L" (Signal connectoe pin #25 is connected to GND.) starts the Self-Test. Then the display shows all characters, Alphabet, Katakana, numerics and symbols, in that order.
Eighty (2×40) characters are displayed at a time.
Using this mode, neither data write-in nor control code write-in is allowed.
To release this mode, $\overline{\text{TEST}}$ must be set to "H".

3-4. POWER ON RESET

When the module is turned on, the display and the memory are cleared and the module is initialized.
The display mode is set for DC2, and the cursor mode is set DC3.

3-5. SELECTION OF INPUT MODE

TABLE-4 shows the combinations of the signal lines for the parallel or serial input. Users must choose one of the combinations.
Unused signal lines are to be open (internally pulled up).

Serial Input
Baud rate is selected by J1~J3.

J1, J2 } Baud rate select
J3 clock select

J3 { open : Outside Clock (307.2 kHz) OSC,
short : Internal Clock (4 MHz) X1,

TABLE-9

J1	Short	Open	Short	Open
J2	Short	Short	Open	Open
J3 Short	62500 (bps)	31250	15625	7812.5
J3 Open	9600	4800	2400	1200

TABLE-9 BAUD RATE SELECTION

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4. INTERFACE CONNECTION

4-1. SIGNAL CONNECTOR PIN CONNECTION

Connector : FM34A2MAC (OKI) or equivalent
Socket : FM34A2FO (OKI) or equivalent

TABLE-10

PIN No.	Signal	Parallel	Serial	PIN No.	Signal
1	D7	O	NC	2	GND
3	D6	O	NC	4	GND
5	D5	O	NC	6	GND
7	D4	O	NC	8	GND
9	D3	O	NC	10	GND
11	D2	O	NC	12	GND
13	D1	O	NC	14	GND
15	D0	O	NC	16	GND
17	$\overline{WR}$	O	NC	18	GND
19	NC	NC	NC	20	GND
21	NC	NC	NC	22	GND
23	$\overline{SEL}$	O	NC	24	GND
25	$\overline{TEST}$	O	O	26	GND
27	BUSY	O	O	28	GND
29	NC	NC	NC	30	GND
31	NC	NC	NC	32	GND
33	RXD	NC	O	34	GND

NC : NO-CONNECTION

TABLE-10 SIGNAL CONNECTOR PIN CONNECTION

4-2. POWER CONNECTOR PIN CONNECTION

Connector : 5046-03A (MOLEX) or equivalent
Socket : 5051-03 (MOLEX) or equivalent

TABLE-11

PIN No.	Power
1	GND (0V)
2	V_{CC} (+5V)
3	GND (0V)

TABLE-11 POWER CONNECTOR PIN CONNECTION

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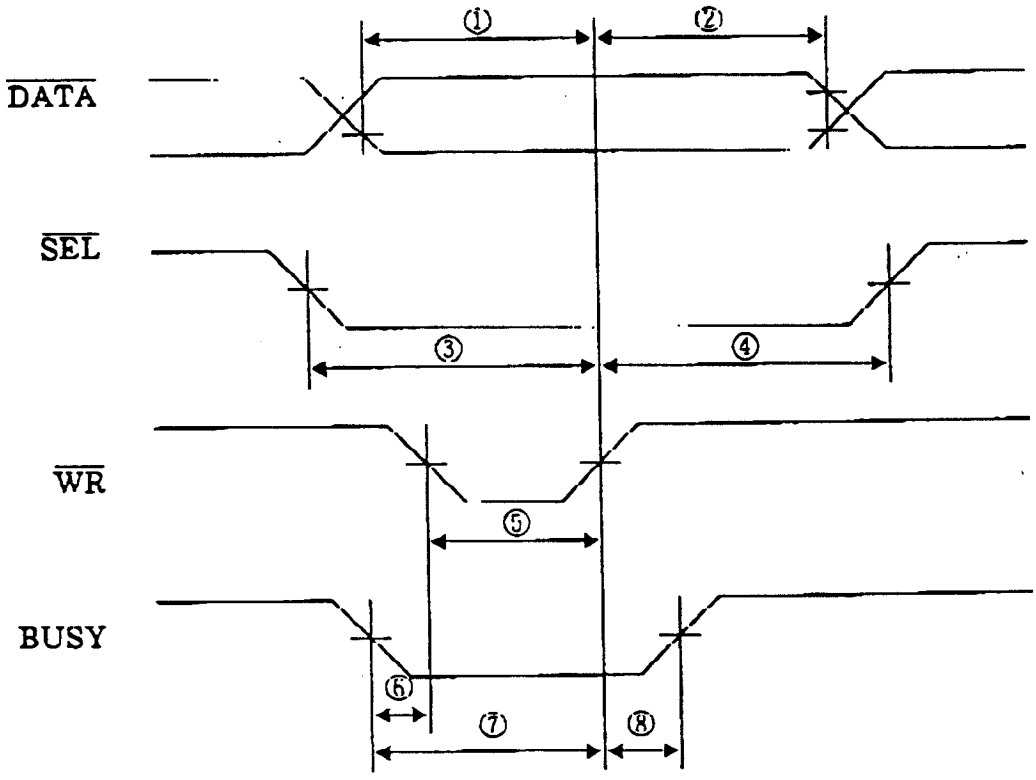
4-3. WRITE-IN TIMING

4-3-1. PARALLEL INPUT



		Min.	Max.	Note
①	tsu (DATA)	50 ns	–	
②	th (DATA)	50 ns	–	
③	tsu (SEL)	50 ns	–	
④	th (SEL)	50 ns	–	
⑤	tpw (WR)	50 ns	–	
⑥	twait (1)	0ns	–	
⑦	twait (2)	250 ns	–	For Min 250ns, $\overline{WR}$ should not be active (positive H), after BUSY is "L".
⑧	tdelay	–	50 ns	

FIG.1 WRITE-IN TIMING

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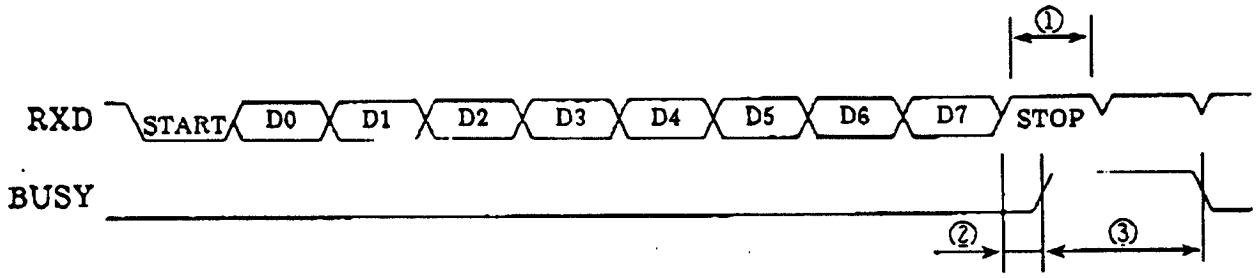
1-3-2. SERIAL INPUT



① t(DATA) = 106/baud rate [μs]
(This depends on the selection of the baud rate.)

② t(DATA)/2 [μs] (BUSY becomes "H" at the center of stop bit.)

③ t(WAIT): 0 [Min]

FIG.2 WRITE-IN TIMING

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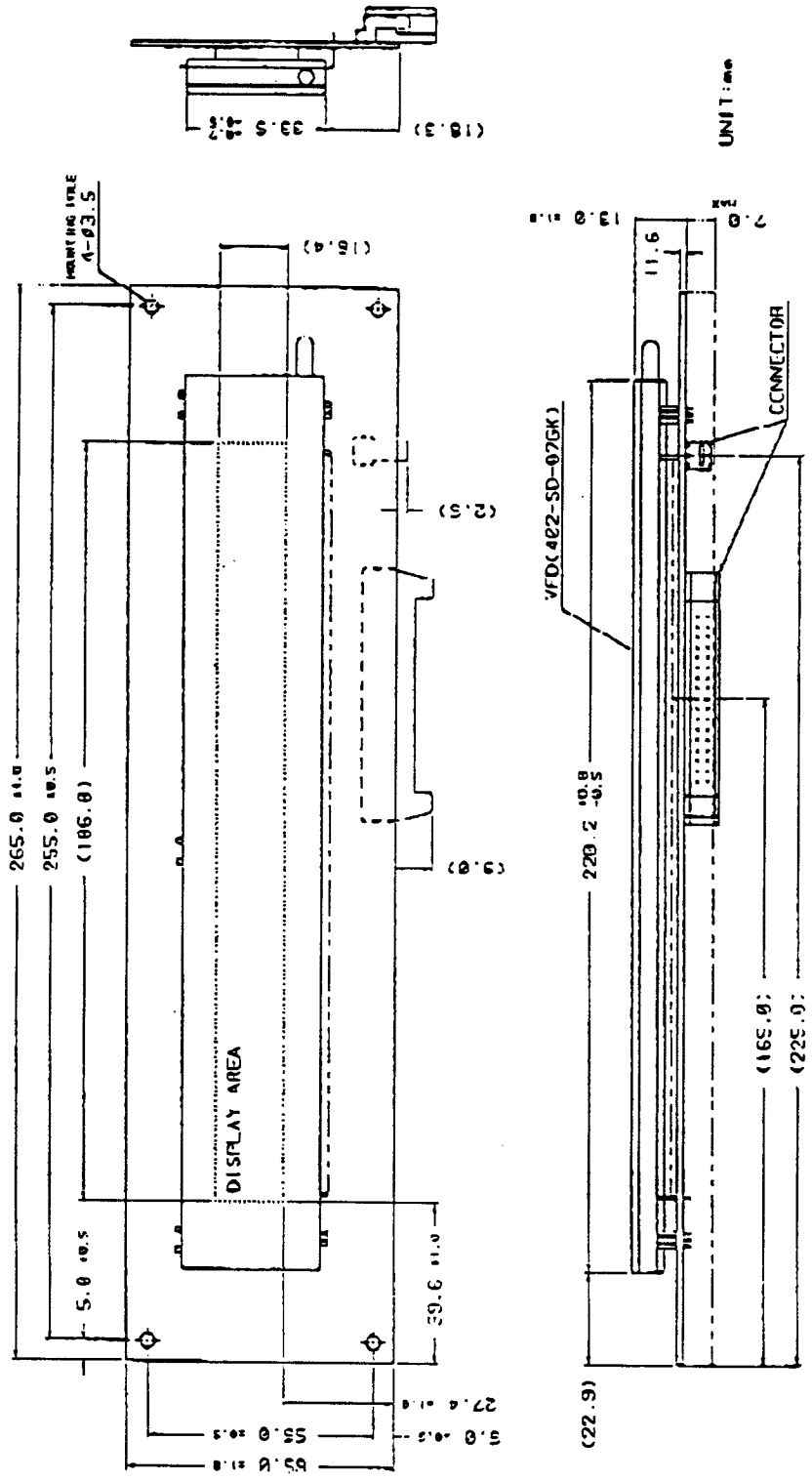
M402SD07FA OUTER DIMENSIONS

APPENDIX - 1



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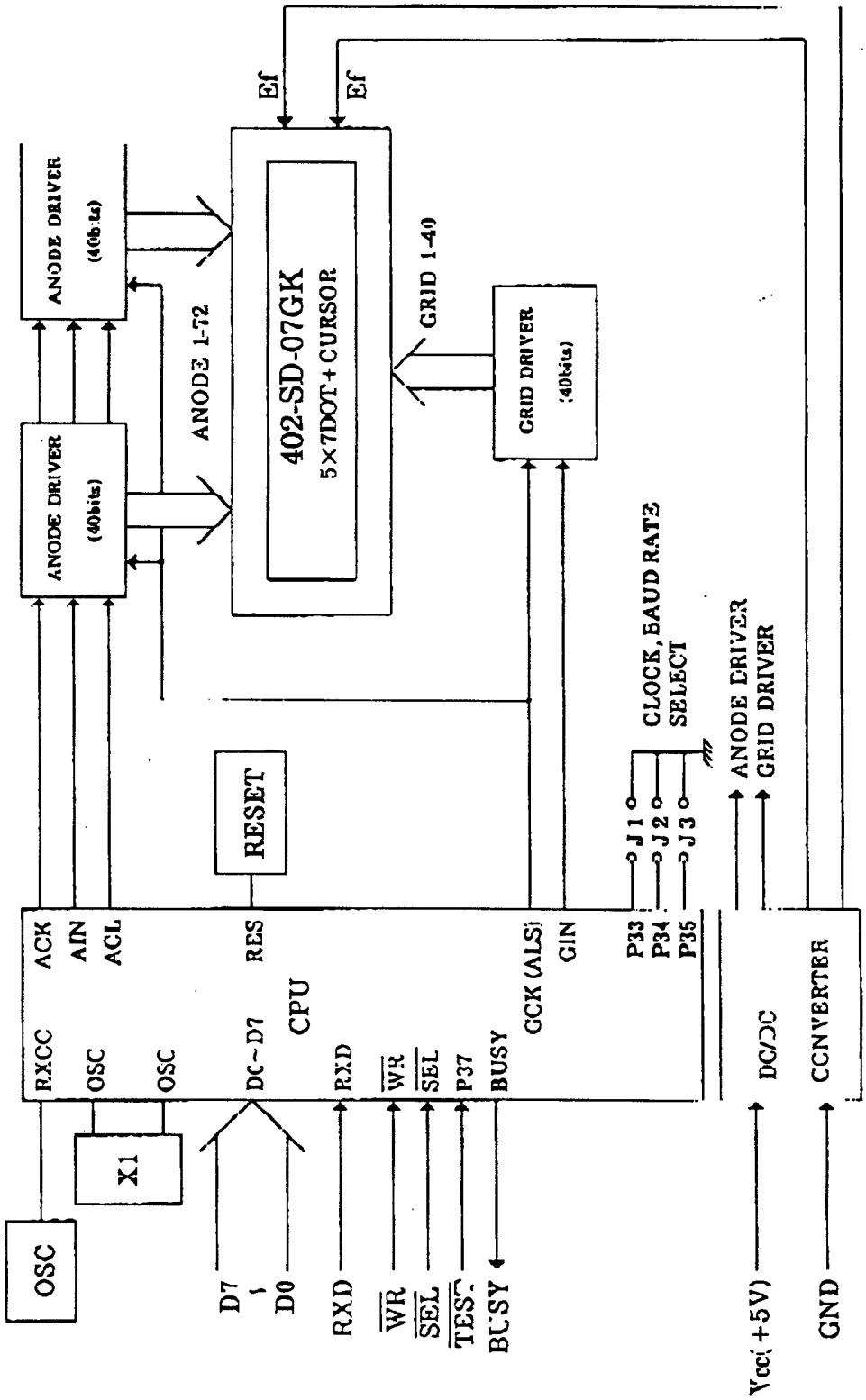
M402SD07FA CIRCUIT BLOCK DIAGRAM

APPENDIX-2



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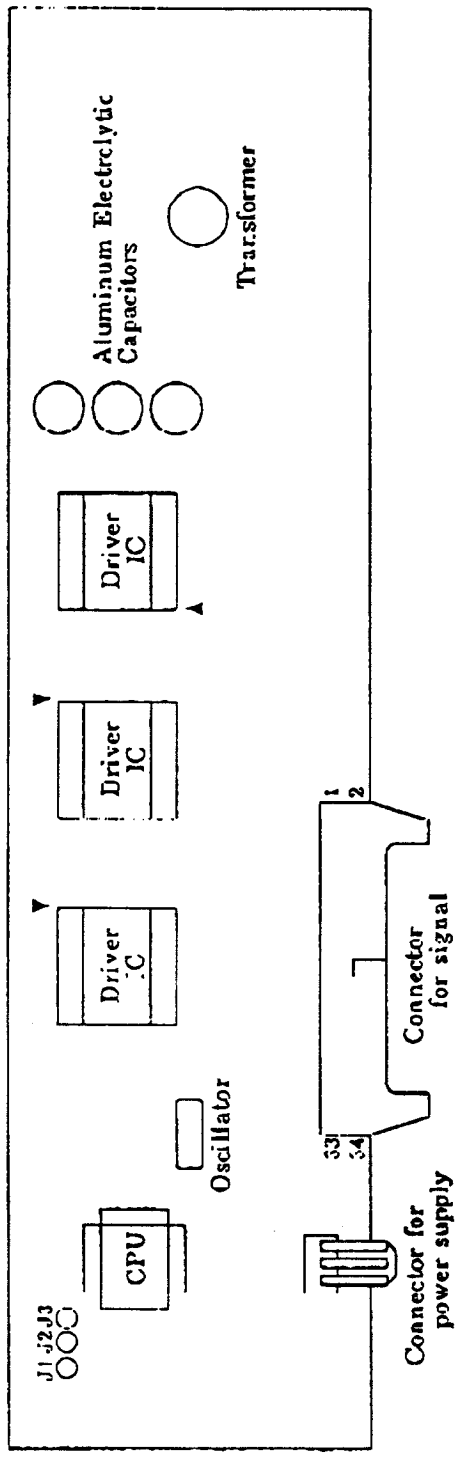
M402SD07FA THE LOCATION OF THE COMPONENTS

APPENDIX - 3



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M402SD07FA DISPLAY CHARACTER CODE

APPENDIX - 4

D7 D6 D5 D4 \ D3 D2 D1 D0		0 0 0 0	0 0 0 1	0 0 1 0	0 0 1 1	0 1 0 0	0 1 0 1	0 1 1 0	0 1 1 1	1 0 0 0	1 0 0 1	1 0 1 0	1 0 1 1	1 1 0 0	1 1 0 1	1 1 1 0	1 1 1 1
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0 0 0 0	0		DP	SP	0	@	P	`	p	｠	ﾀ		―	ﾐ	ﾑ	｡	ｰ
0 0 0 1	1		DC1	!	1	A	Q	a	q	｡	ﾁ	ｱ	ｱ	ﾑ	ﾒ	｢	ｱ
0 0 1 0	2		DC2	"	2	B	R	b	r	｢	ﾂ	ｲ	ｲ	ﾒ	ﾓ	｣	ｲ
0 0 1 1	3		DC3	#	3	C	S	c	s	｣	ﾃ	ｳ	ｳ	ﾓ	ﾔ	､	ｳ
0 1 0 0	4	DIM	DC4	$	4	D	T	d	t	､	ﾄ	ｴ	ｴ	ﾔ	ﾕ	･	ｴ
0 1 0 1	5			%	5	E	U	e	u	･	ﾅ	ｵ	ｵ	ﾕ	ﾖ	ｦ	ｵ
0 1 1 0	6			&	6	F	V	f	v	ｦ	ﾆ	ｶ	ｶ	ﾖ	ﾗ	ｧ	ｶ
0 1 1 1	7			'	7	G	W	g	w	ｧ	ﾇ	ｷ	ｷ	ﾗ	ﾘ	ｨ	ｷ
1 0 0 0	8	BS		(	8	H	X	h	x	ｨ	ﾈ	ｸ	ｸ	ﾘ	ﾙ	ｩ	ｸ
1 0 0 1	9	HT		)	9	I	Y	i	y	ｩ	ﾉ	ｹ	ｹ	ﾙ	ﾚ	ｪ	ｹ
1 0 1 0	A	LF		*	:	J	Z	j	z	ｪ	ﾊ	ｺ	ｺ	ﾚ	ﾛ	ｫ	ｺ
1 0 1 1	B			+	;	K	[	k	{	ｫ	ﾋ	ｻ	ｻ	ﾛ	ﾜ	ｬ	ｻ
1 1 0 0	C			,	<	L	¥	l	|	ｬ	ﾌ	ｼ	ｼ	ﾜ	ﾝ	ｭ	ｼ
1 1 0 1	D	CR		-	=	M	]	m	}	ｭ	ﾍ	ｽ	ｽ	ﾝ	ﾞ	ｮ	ｽ
1 1 1 0	E			.	>	N	^	n	~	ｮ	ﾎ	ｾ	ｾ	ﾞ	ﾟ	ｯ	ｾ
1 1 1 1	F		RST	/	?	O	_	o	▒	ｯ	ﾏ	ｿ	ｿ	ﾟ	ｱ	ｰ	ｿ

SP : SPACE

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5. WARRANTY

This display module is guaranteed for 1 year after the shipment from FUTABA.

6. OPERATING RECOMMENDATIONS

6-1. Since VFDs are made of glass material.
Avoid applying excessive shock or vibration beyond the specification for the module.
Careful handing essential.

6-2. Applying lower voltage than the specified may cause non activation for selected pixels.
Conversely, higher voltage may cause non-selected pixel to be activated.
If such phenomenon is observed, check the voltage level of the power supply.

6-3. Avoid plugging or unplugging the interface connection with the power on.

6-4. If the start up time of the supply voltage is show, the controller may not be reset.

6-5. DC/DC converter is equipped on the module, the surge current may be approximately 10 times the specified supply current at the power on.

6-6. Avoid using the module where excessive noise interface is expected.
Noise affects the interface signal and causes improper operation.
Keep the length of the interface cable less than 50cm.
(When the longer cable is required, please confirm there is no noise affection.)

6-7. When power is turned off, the capacitor will not discharge immediately.
Avoid touching IC and others.
(The shorting of the mounted components within 30 sec., after power off, may cause damage.)

6-8. The fuse is mounted on the module as circuit protection.
If the fuse is blown, the problem shall be solved first and change the fuse.

6-9. When fixed pattern is displayed for a long time, you may see uneven luminance.It is recommended to change the display patterns sometime in order to keep best display quality.

REMARKS :

This specification is subject to change without prior in order to improve the design and quality.
Your consultation with FUTABA sales office is recommended for the use of this module.