DisplayMaster™

VGA

Reference Manual

YDM6448-P

YAMAHA Corporation of America,
Systems Technology Division

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FCC NOTICE

This equipment complies with the limits for a Class B digital device pursuant to Part 15 of FCC Rules.

WARNING: This equipment generates and uses radio frequency signals which may cause interference with radio and television reception, even if installed and used properly. Class B limits provide reasonable protection against interference in residential installations; however, there is no guarantee that interference will not occur.

TROUBLESHOOTING: If interference occurs, which can be determined by turning the equipment on and off, you should attempt the following measures:

- Reorient the receiving antenna.
- Increase the distance between equipment and receiver.
- Use a separate electrical branch circuit for the equipment.
- Consult a dealer or experienced radio/television technician.

NOTE: To meet FCC requirements, use shielded cables and power cords to connect this equipment to any external device. Also, secure the snap-on ferrite ring (provided with this unit) around the video cable, directly behind the computer connector.

You may find the following booklet helpful, prepared by the Federal Communications Commission: "How to Identify and Resolve Radio-TV Interference Problems" (stock number 004–000–00345–4). This booklet is available from the U.S. Government Printing Office, Washington, DC 20402.

DISPLAY MASTER™ VGA FEATURES

The *Display Master*™ VGA card is based on the YAMAHA VPDC V6388 chip and is capable of controlling all the leading display technologies, from high resolution flat panel displays to CRTs. This VGA card is BIOS compatible with software written for the IBM PC/XT/AT VGA display standard.

The *Display Master* VGA features are as follows:

- Supports all display technologies with full text and graphics:
  - — Analog and Multisync CRTs
  - — Liquid Crystal Display (LCD)
  - — Electro Luminescent (EL)
  - — Color LCDs
  - — Gas Plasma
- Supports panels and CRTs for the following resolutions:
  - — 640X400
  - — 640X480
  - — 720X400
- Provides a choice of 16 gray scales on LCDs and gray scale panels; eight hatching patterns on monochrome, EL, and Plasma panels
- Provides 256 KB of dynamic random-access memory (DRAM)
- Provides built-in VGA Basic Input/Output System (BIOS) support
- Includes built-in SoftSwitch capability via an extended BIOS call

- Provides up to 512 characters that can be user-defined
- Supports both one- and two-screen flat panels, and serial or four bit parallel data transmissions to flat panels
- Expands CGA (640X200) color software to fill the display area on EL, Plasma, and LCD displays at 640X480 and 640X400 resolutions
- Expands EGA (640X350) software to fill the display area on EL, Plasma, and LCD displays at 640X480 and 640X400 resolutions
- Provides four separate outputs:
  - — Header connector for flat panels
  - — 15-pin analog CRT
  - — Nine-pin digital CRT
  - — VGA feature connector

ABOUT THIS MANUAL

This reference manual is for experienced VGA users as well as those who are using this hardware for the first time. We recommend that first-time users review the entire manual. For orientation, experienced users may scan the section entitled "*Display Master* VGA Layout" and then proceed to the sections "Configuration" and "Installation."

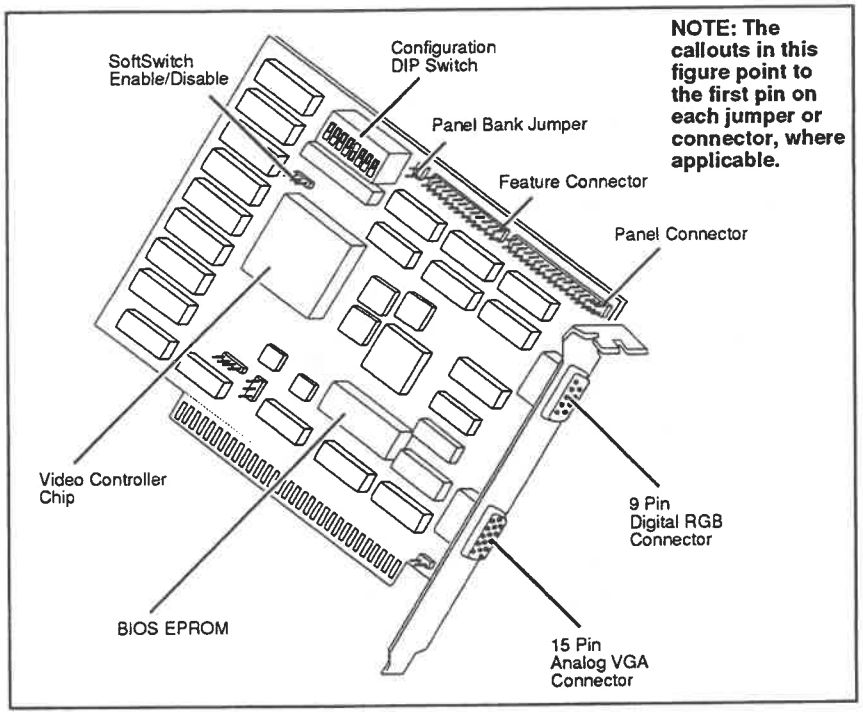
Panel users may want to go directly to the section entitled "Panel Users" to find a particular panel configuration and cabling diagram with the appropriate switch settings.

The appendices introduce information that is not integral with efficient installation and operation of the *Display Master* VGA card. Appendix A provides pinouts for the 26-pin feature connector and the 34-pin header connector. Appendix B provides general panel configurations and is intended to supplement the "Panel Users" section. Appendix C provides standard VGA modes for users familiar with assembly language programming. Appendices D and E offer a troubleshooting guide and information necessary to contact YAMAHA technical support.

This manual has been revised according to the layout of Revision 3 of the YAMAHA *Display Master* VGA card.

DISPLAY MASTER VGA LAYOUT

The following figure illustrates the general features of the *Display Master* VGA card. These features will be referenced throughout this manual. The paragraphs below briefly describe the function of each item called out in the figure.



Display Master VGA Layout

- **Configuration DIP Switch**
  This is a row of eight switch levers that control the following: Levers 1~ 4 select display/panel type. Lever 5 selects analog or digital display. Lever 6 selects CRT or panel display. Levers 7 and 8 are reserved.

- **Panel Bank Jumper**
  This jumper is used to select either LCD/Plasma or EL displays.

- **Feature Connector**
  This 26-pin connector is provided to maintain compatibility with the IBM VGA card. The feature connector may be used for external clock and video signals (such as frame grabbers). Pinouts for the feature connector are provided in Appendix A of this manual.

- **Panel Connector**
  This is a 34-pin header connector for panel interface. The panel connector is identical to the panel connector on the *Display Master* EGA card. Pinouts for the panel connector are provided in Appendix A of this manual.

- **9 Pin Digital RGB Connector**
  This is used to connect digital CRTs and multisync CRTs in digital mode.

- **15 Pin Analog VGA Connector**
  This is used to connect analog VGA CRTs and analog/digital multisync CRTs in analog mode.

- **SoftSwitch Enable/Disable**
  This jumper is used to enable or disable SoftSwitch capability.

- **BIOS EPROM**
  This VGA BIOS EPROM is labeled with the current BIOS version number. This version number indicates which version of the VGA BIOS is installed on your *Display Master* VGA card.

CONFIGURATION

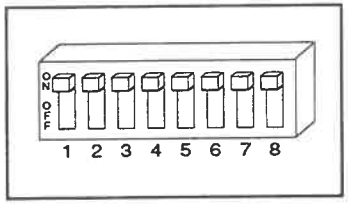
To configure the *Display Master* VGA card for your hardware, verify the DIP switch and jumper settings. Some of the jumpers are preset or have a factory default, but the eight position DIP switch and the panel bank jumper must be set by the user to avoid problems. All should be checked before installation.

DIP Switch Settings

DIP switch SW1 contains eight switch levers that control the following:
Levers 1 ~ 4 select the display/panel type.
Lever 5 selects analog or digital display.
Lever 6 selects CRT or panel display.
Levers 7 and 8 are reserved.

CRT Only Users

You must manually configure DIP switch SW1 when using a CRT display. To configure the *Display Master* VGA for use with a CRT, make sure that levers 1 through 8 are in the ON position.



Switch Setting for CRTs

NOTE: Even when using a multisync monitor in the digital mode, lever 5 should be in the analog, or ON position.

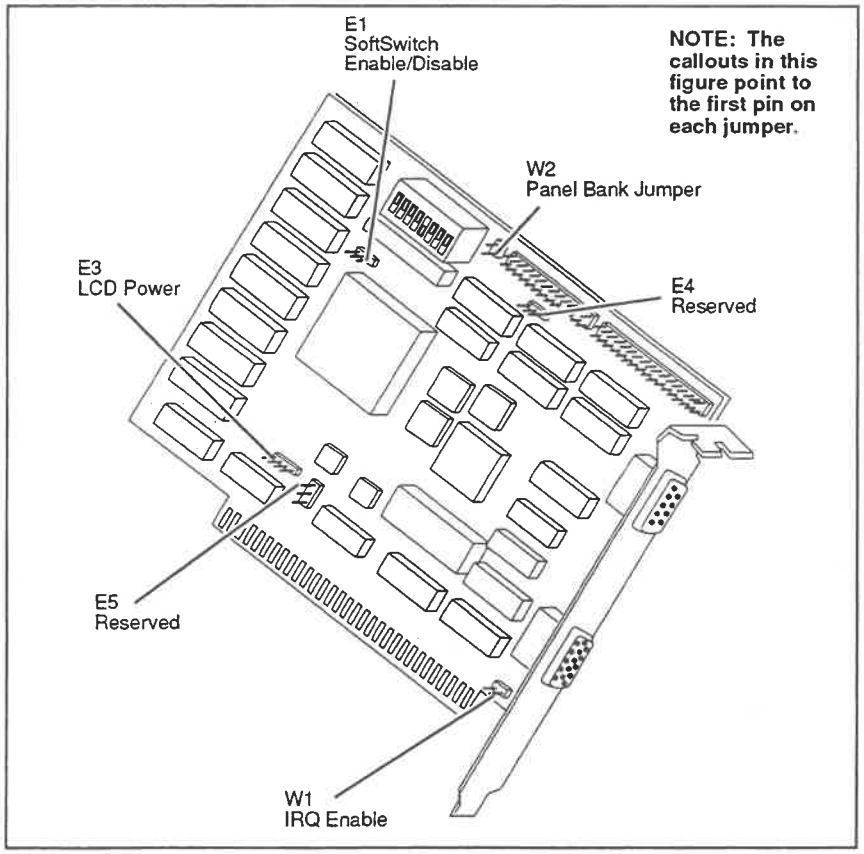
NOTE: Lever 6 must be ON when using a CRT.

Panel Users

You must manually configure DIP switch SW1 when using a panel display. The section entitled "Panel Users" and Appendix B provide these switch settings.

Jumper Settings

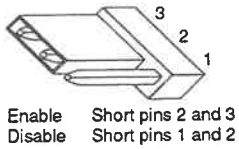
The following figure illustrates the jumper blocks on the *Display Master* VGA card. The functions of these jumpers, as well as how to configure them, are described in the following sections.



Display Master VGA Jumpers

Jumper E1

This jumper block enables SoftSwitch. SoftSwitch is the ability to switch back and forth from a CRT to flat panel via an extended BIOS call. The *Display Master* VGA card is shipped with SoftSwitch enabled. To disable SoftSwitch, short pins 1 and 2.



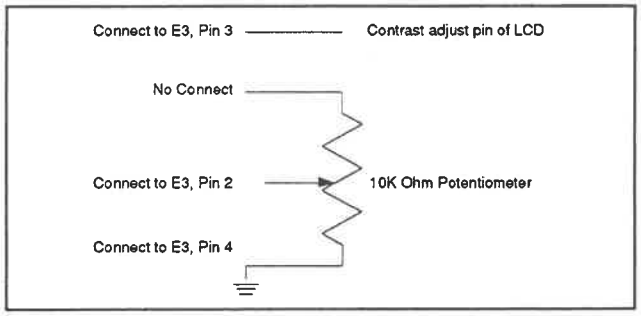
Jumper E3

This jumper block provides an alternative to using the 34-pin header connector for delivering power to an LCD panel. The jumper provides -24V DC via an on board DC/DC converter. A 10K Ω potentiometer can be connected to provide the contrast adjust voltage. The following figure illustrates the function of each pin on Jumper E3 and their header connector equivalents.

Jumper E3 Pin	Pin Function	J1 Pin Equivalent
Pin 1	Provides -24V DC (30 mA maximum current drain)	Pin 31
Pin 2	Adjusts -24V DC regulator output to Pin 3 (34)	Pin 34
Pin 3	Provides -VLCD or the adjusted output from the DC regulator (30 mA maximum current drain)	Pin 33
Pin 4	Provides ground source	Pins 2, 10, 14, 18, and 24

Jumper E3 Pin Description

The following figure illustrates the proper way to connect a 10K Ω potentiometer to Jumper E3 for LCD contrast voltage adjustment.



LCD Contrast Adjustment

Jumper E4

This jumper block is reserved. It is set at the factory and should not be changed.

Jumper E5

This jumper block is used to select the RAMDAC chip used on the card. It is set at the factory and should not be changed. For more information about this jumper, refer to Appendix D, Troubleshooting.

Jumper W1

The *Display Master* VGA has the ability to generate interrupt requests on IRQ 9 or the PC bus. This feature can be enabled or disabled using Jumper W1. To enable IRQ 9, Jumper W1 should be shorted. To disable IRQ 9, Jumper W1 should be open.

Jumper W2

This jumper block is the panel bank jumper, and is used to select either EL, LCD, or Plasma displays. The setup information is stored in the VGA BIOS EPROM as two separate banks of information. To select an LCD or Plasma display, Jumper W2 should be shorted. To select an EL display, Jumper W2 should be open.

INSTALLATION

To install the *Display Master* VGA card, you will need a medium size phillips head screwdriver or a 3/16" nutdriver or wrench, as well as this manual.

Procedures

To properly install the *Display Master* VGA card:

1. Verify configuration of the card from the section in this manual entitled "Configuration."

   If you are using a panel, refer to Appendix B or the section entitled "Panel Users" for specific switch settings and cabling diagrams.

2. Make sure the power to your system is OFF.

3. Make sure that no other display adapter is installed in the computer. An optional display card may be co-resident.

4. Select an empty slot for the card, and remove the rear bracket screw (if installed) for that slot.

5. Hold the *Display Master* VGA card by its top corners and slide it into the empty slot. Make sure that the *Display Master* VGA card is fully seated in the expansion slot.

6. Secure the card by fastening the bracket of the card with the screw removed in step 4.

7. **When installing the *Display Master* VGA into an AT type computer**, use the SETUP program provided by the compter manufacturer to set the display type for EGA/VGA resolution and the bus clock speed to 8MHz or "ATCLOCK."

   If installing in a PC/XT, set the motherboard display type switches for NO display (XT Switch 1, lever 5 OFF and lever 6 OFF).

8. Connect the monitor or panel cable to the *Display Master* VGA card. (See the section in this manual entitled "Panel Users.")

9. Replace and secure the system cover.

Installation is complete. You should now be able to turn on your system and take advantage of the *Display Master* VGA card.

If problems arise, consult Appendix D, Troubleshooting, in this manual.

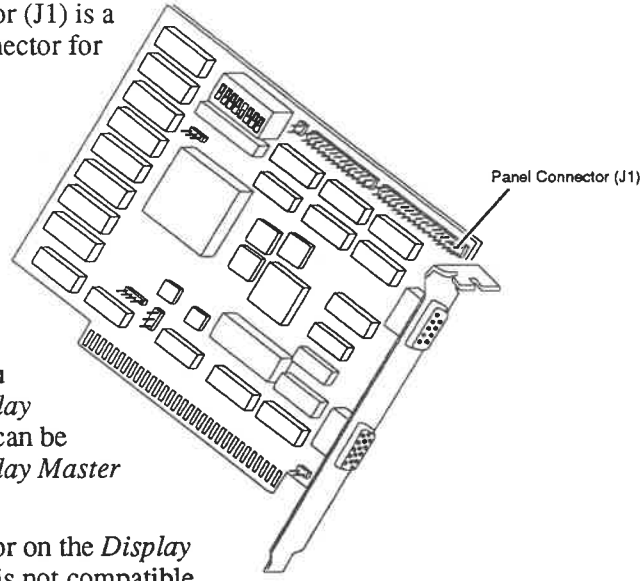
NOTE: After configuration and installation, refer to Appendix E in this manual. We suggest that you fill out the technical support form provided in Appendix E at this time.

PANEL USERS

This section provides specific information for panel users. The section entitled "Panel Connector" provides detailed information on the 34-pin header connector. The section entitled "LCD Contrast" provides information for controlling the contrast voltage on LCD panels. The section entitled "SoftSwitch" provides information necessary when switching back and forth between CRT and flat panel displays. The section entitled "Cabling Diagrams and Switch Settings" provides specific panel configurations and cabling diagrams.

Panel Connector

The panel connector (J1) is a 34-pin header connector for panel interface.



The 34-pin panel connector on the *Display Master* VGA card is identical to the panel connector on the *Display Master* EGA card. The cables that you used with the *Display Master* EGA card can be used with the *Display Master* VGA card.

The panel connector on the *Display Master* VGA card is not compatible with the original *Display Master* card.

The following figure details the 34-pin header connector (J1) on the *Display Master* VGA card.

Pin	Description	Pin	Description
1	+12V (from PC board)	2	Ground (VSS)
3	M (AC drive pulse for LCD)	4	LR0 (red data bit 0)
5	LC (Hsync)	6	LR1 (red data bit 1)
7	SCK	8	BDSCLK (delayed SCK of 30–50 nS)
9	N/C	10	Ground (VSS)
11	LB0 * (blue data bit 0)	12	BNCLK (negative SCK)
13	LB1 * (blue data bit 1)	14	Ground (VSS)
15	LB2 * (blue data bit 2)	16	N/C
17	LB3 *[1] (blue data bit 3)	18	Ground (VSS)
19	LG0 † (green data bit 0)	20	LR2 (red data bit 2)
21	LG1 † (green data bit 1)	22	LR3 (red data bit 3)
23	LG2 † (green data bit 2)	24	Ground (VSS)
25	LG3 † (green data bit 3)	26	EXT-ON (panel ON)
27	+5V (Max. 50 mA) (VCC, from PC board)	28	Reserved
29	FLM (Vsync, S, Frame)	30	-12V (Max. 50 mA) (from PC board)
31	-24V (VEE) *(Max. 30 mA when combined with Pin 33)*	32	Reserved
33	-VLCD (output to LCD) *(Max. 30 mA when combined with Pin 31)*	34	-VLCD ADJ (external adjust)

* Drives upper half of dual LCD screens † Drives lower half of dual LCD screens
[1] Drives single bit panel data line

J1 Panel Connector

NOTE: Pins 27, 30, 31, and 33 have a maximum combined current of 30 mA.

The J1 panel connector can be used to adjust the contrast on LCD panels using pins 24, 33, and 34. The section "LCD Contrast" provides information needed when connecting the panel connector to a 10K Ω potentiometer for contrast adjusment on an LCD panel.

You may use any standard "IDC" 34-pin mating connector (female) with the J1 panel connector.

External Panel Control

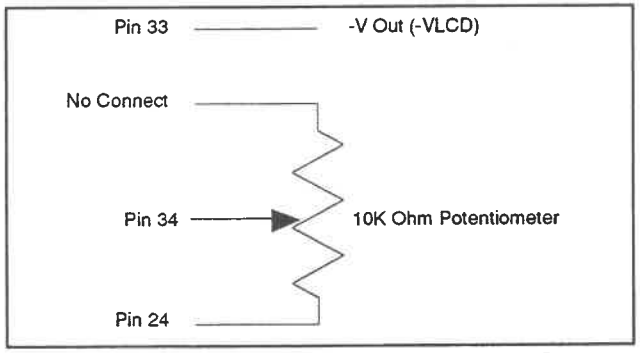
Pin 26 on connector J1 is an external control pin which can be turned ON (+5V) or OFF (0V), using an I/O control bit at I/O address 3CBH. The ON/OFF position is bit 1.

LCD Contrast

The *Display Master* VGA card contains a built-in -12V to -24V DC/DC converter for the LCD contrast voltage (-VLCD). This voltage is switched using an I/O control bit at I/O address 3CBH. The DC ON/OFF position is bit 0. Setting this bit high (logic 1) turns the supply ON, while setting the bit low (logic 0) turns the supply OFF. At power on, or when switching from a CRT to an LCD, the default is ON. When using a Plasma or EL display the default is OFF.

A negative voltage regulator (LM337L) is provided for user adjusment of the contrast voltage, and can be controlled using a 10K Ω potentiometer. You can use either Jumper E1 or the panel connector (J1, pins 24, 33, and 34) to adjust the contrast.

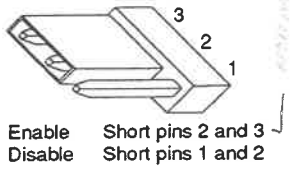
The following figure illustrates the proper way to connect a 10K Ω potentiometer.



LCD Voltage Contrast

Verify that the potentiometer is supplying a voltage that is within the specifications of your particular panel display.

SoftSwitch



SoftSwitch is the ability to switch back and forth between a CRT and flat panel via an extended BIOS call. Jumper E1 enables or disables SoftSwitch.

During SoftSwitch, the BIOS determines if you are currently displaying on a CRT or flat panel display. If you are currently on a CRT, the VPDC registers are changed to match the panel selected on the eight position DIP switch and the RAMDAC controlling

the CRT is turned OFF. If changing to an LCD the -24V power supply is turned ON.

NOTE: When switching between a CRT and EL or Plasma display the -24V power supply remains OFF.

If you are currently switching from a flat panel to a CRT, the VPDC registers are changed to a CRT, the RAMDAC is turned ON, and the -24V power supply is turned OFF.

When performing the SoftSwitch, it is necessary to execute a mode set command via the VGA BIOS.

The SoftSwitch does not clear the display memory. The mode change, however, does clear the memory and move the cursor to the upper left corner of the display. The screen information can be preserved during a mode set by setting the high bit in the AL register during the second INT 10H call.

If you preserve the screen during the switch, the cursor position is always moved to the upper left hand corner during the mode set. You can save the current cursor position before calling the SoftSwitch routine, and then reset the cursor after the mode set, to save complete screen integrity.

The following assembly language code will perform a switch from a CRT to a flat panel display, or the reverse.

```
MOV     AX,2000H        ;Perform extended function 20H
INT     10H             ;video BIOS function call
MOV     AX,0003H        ;AH = 00 (setmode);AL = 03 (mode)
INT     10H             ;video BIOS function call
```

The following is a C source listing to implement SoftSwitch. The code illustrates how to store and reposition the cursor, as well as maintain the video buffer. If your particular application is not concerned with saving the current video buffer and cursor position, then those lines may be commented out.

```
#include <std:oh>
#include <dos.h>
main ( ){
        union REGS ir, sr;

        ir.x.ax = 0x2000 ;          /* Perform Interrupt 10 function 20H   */
        int86 (VIDEO, &ir, &ir);    /* to switch from CRT to LCD and back  */

        ir.x.ax = 0x0003 ;          /* Read the cursor position, to restore*/
        int86 (VIDEO, &ir, &sr);    /* after the switch. Save in sr.       */

        ir.x.ax = 0x0083            /* Set the video mode to 3, text mode  */
        int86 (VIDEO, &ir, &ir);    /* By setting the high bit in AL,      */
                                    /* the video buffer will not be cleared.*/
                                    /* If clearing the video buffer is     */
                                    /* desired set ir.x.ax equal to 0x0003. */

        sr.x.ax = 0x0200 ;          /* Set the cursor position to the      */
        int86 (VIDEO, &sr, &sr);    /* location before the softswitch.     */

}
```


Cabling Diagrams and Switch Settings

The following section provides cabling diagrams for flat panel displays. The diagrams are arranged alphabetically by manufacturer. To find your particular panel, use the "Table of Contents" on the following pages.

Each diagram lists the panel manufacturer, part number(s), and pinouts. Configurations for DIP switch SW1 and panel bank jumper W2 are also provided. The figure on the following page illustrates how the cabling diagrams are presented in this section.

WARNING: When using a potentiometer for LCD contrast, verify the potentiometer is supplying a voltage within the specifications of your particular panel display.

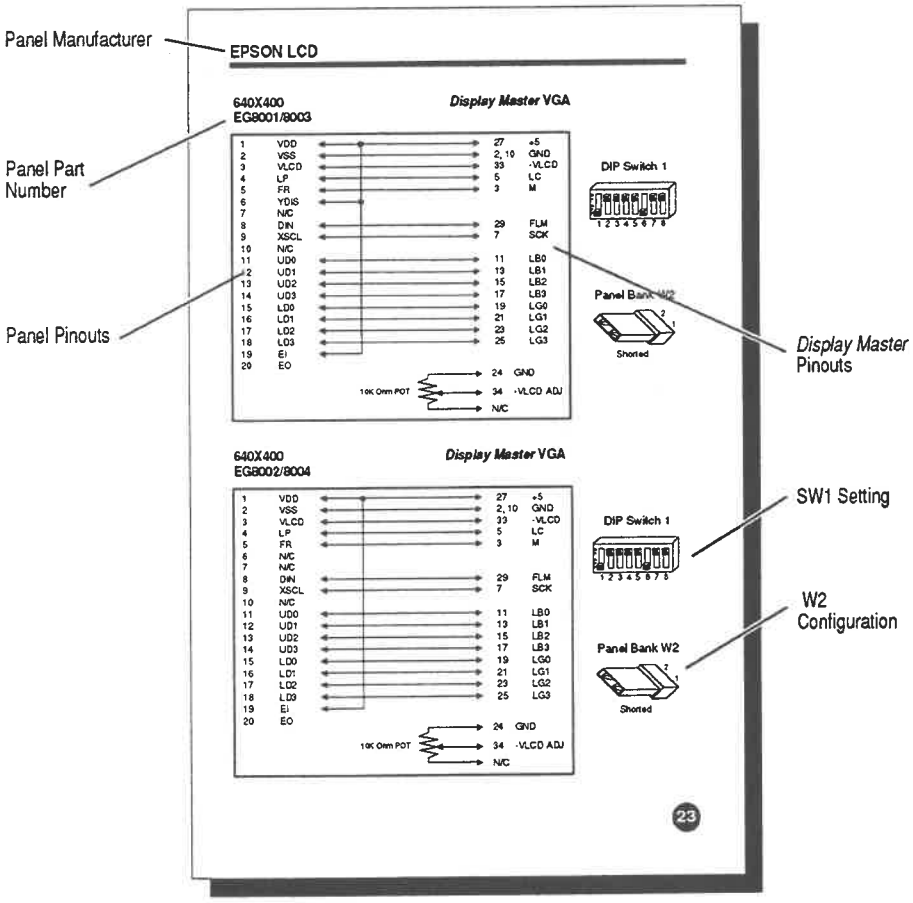


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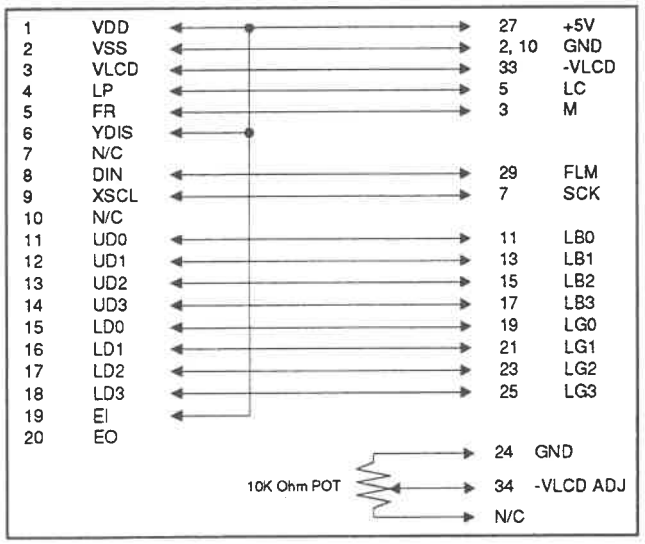
Table of Contents (Continued)

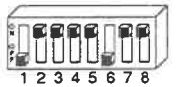
EPSON LCD

640X400
EG8001/8003

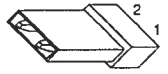
***Display Master* VGA**



DIP Switch 1



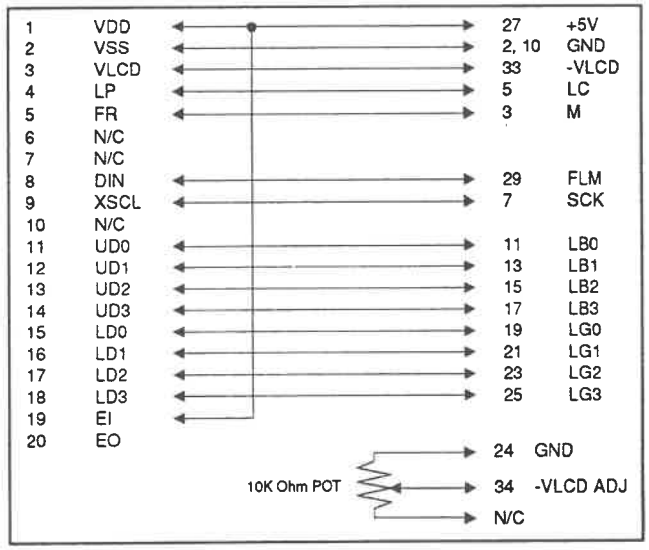
Panel Bank W2



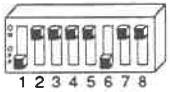
Shorted

640X400
EG8002/8004

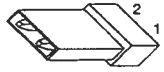
***Display Master* VGA**



DIP Switch 1



Panel Bank W2



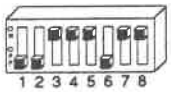
Shorted

640X480
EG9001/9002

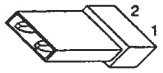
***Display Master* VGA**

1	VDD	→	27	+5V
2	VSS	→	2, 10	GND
3	VLCD	→	33	-VLCD
4	LP	→	5	LC
5	FR	→	3	M
6	N/C			
7	N/C			
8	DIN	→	29	FLM
9	XSCL	→	7	SCK
10	N/C			
11	UD0	→	11	LB0
12	UD1	→	13	LB1
13	UD2	→	15	LB2
14	UD3	→	17	LB3
15	LD0	→	19	LG0
16	LD1	→	21	LG1
17	LD2	→	23	LG2
18	LD3	→	25	LG3
19	EI			
20	EO			
21	BL			
22	VSS	→	14	GND
23	INVG	→	18	GND
24	INVV	→	1	+12V
		→	24	GND
	10K Ohm POT	→	34	-VLCD ADJ
		→	N/C	

DIP Switch 1



Panel Bank W2



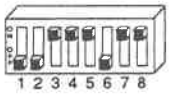
Shorted

640X480
EG9003N–NZ

***Display Master* VGA**

1	VLCD	→	33	-VLCD
2	N/C			
3	VDD	→	27	+5V
4	VSS	→	2	GND
5	DIN	→	29	FLM
6	YSCL	→	5	LC
7	LP			
8	N/C			
9	VSS	→	10	GND
10	XSCL	→	7	SCK
11	UD0	→	11	LB0
12	UD1	→	13	LB1
13	UD2	→	15	LB2
14	UD3	→	17	LB3
15	VSS	→	14	GND
16	LD0	→	19	LG0
17	LD1	→	21	LG1
18	LD2	→	23	LG2
19	LD3	→	25	LG3
20	EI			
21	EO			
22	N/C			
		→	24	GND
	10K Ohm POT	→	34	-VLCD ADJ
		→	N/C	

DIP Switch 1



Panel Bank W2

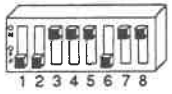
Shorted

640X480
EG9004

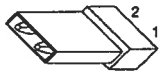
***Display Master* VGA**

1	VDD	→	27	+5V
2	VSS	→	2, 10	GND
3	VLCD	→	33	-VLCD
4	LP	→	5	LC
5	FR	→	3	M
6	N/C			
7	YSCL			
8	DIN	→	29	FLM
9	XSCL	→	7	SCK
10	N/C			
11	UD0	→	11	LB0
12	UD1	→	13	LB1
13	UD2	→	15	LB2
14	UD3	→	17	LB3
15	LD0	→	19	LG0
16	LD1	→	21	LG1
17	LD2	→	23	LG2
18	LD3	→	25	LG3
19	EI			
20	EO			
		→	24	GND
	10K Ohm POT	→	34	-VLCD ADJ
		→	N/C	

DIP Switch 1



Panel Bank W2

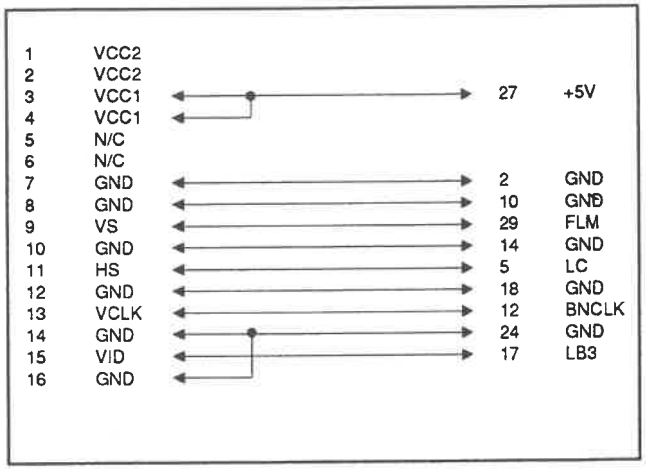


Shorted

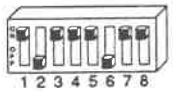
FINLUX EL

640X400
MD640400

***Display Master* VGA**



DIP Switch 1



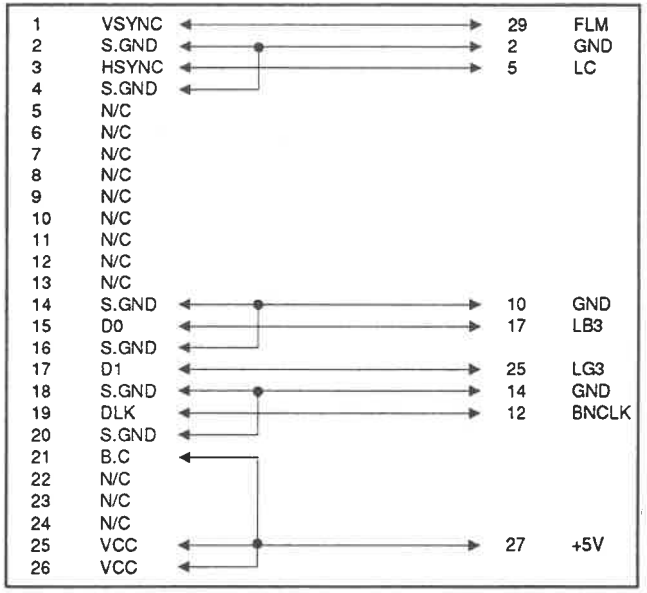
Panel Bank W2

Open

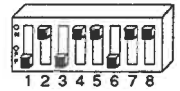
FUJITSU PLASMA

640X480
FPF8060HRUC

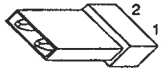
***Display Master* VGA**



DIP Switch 1



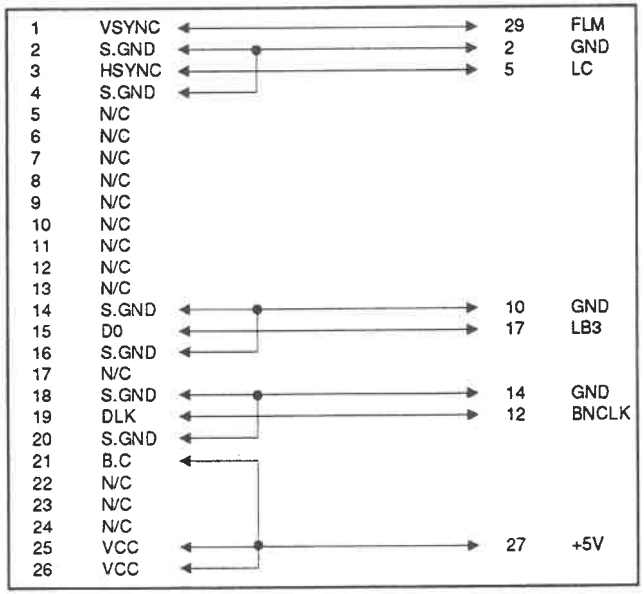
Panel Bank W2



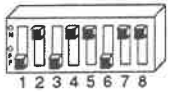
Shorted

640X480
FPF8060HRUM

Display Master VGA



DIP Switch 1

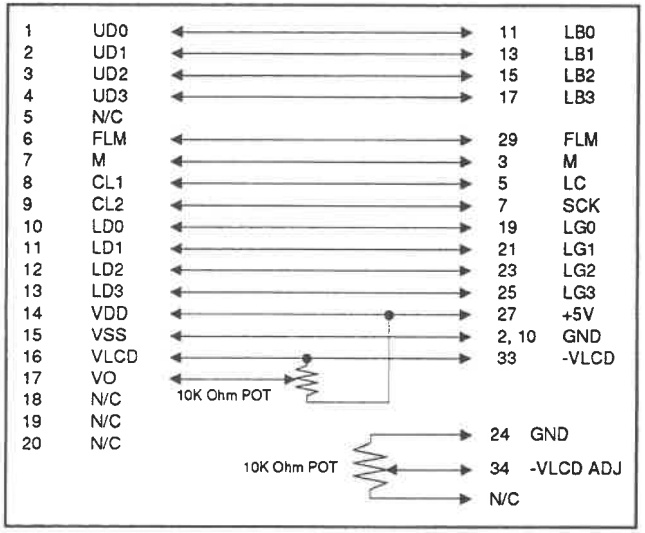


Panel Bank W2

Shorted

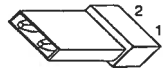
640X400
LM252, LM282, LM283

Display Master VGA



DIP Switch 1

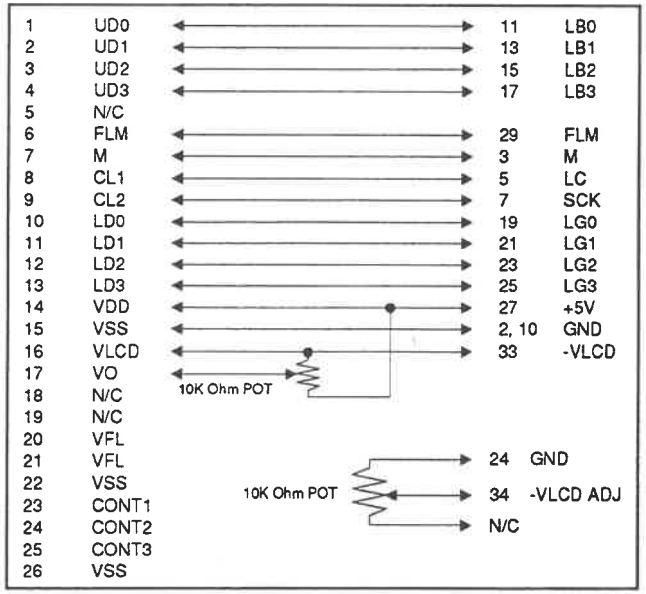
Panel Bank W2



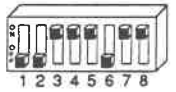
Shorted

640X480
LM298

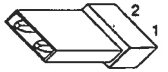
Display Master VGA



DIP Switch 1



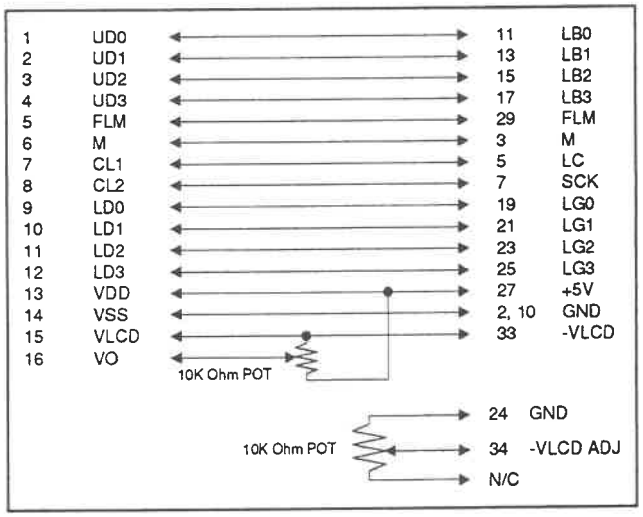
Panel Bank W2



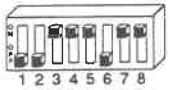
Shorted

640X480
LMG6011

***Display Master* VGA**



DIP Switch 1

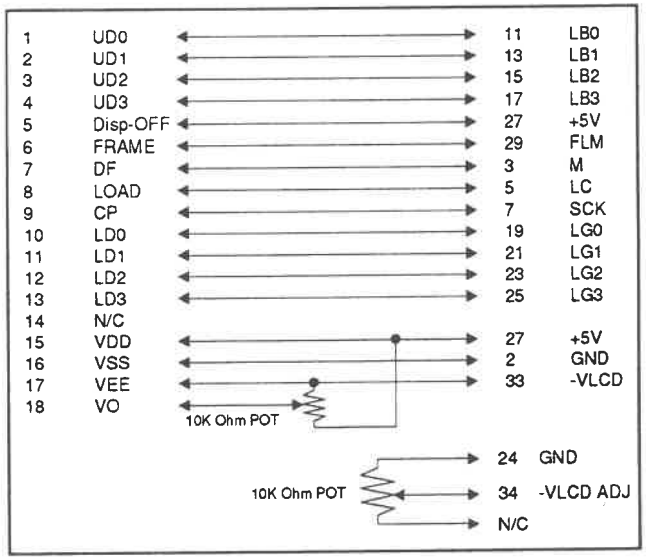


Panel Bank W2

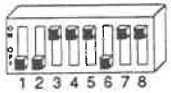
Shorted

640X480
LMG6151XUFE

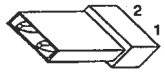
***Display Master* VGA**



DIP Switch 1



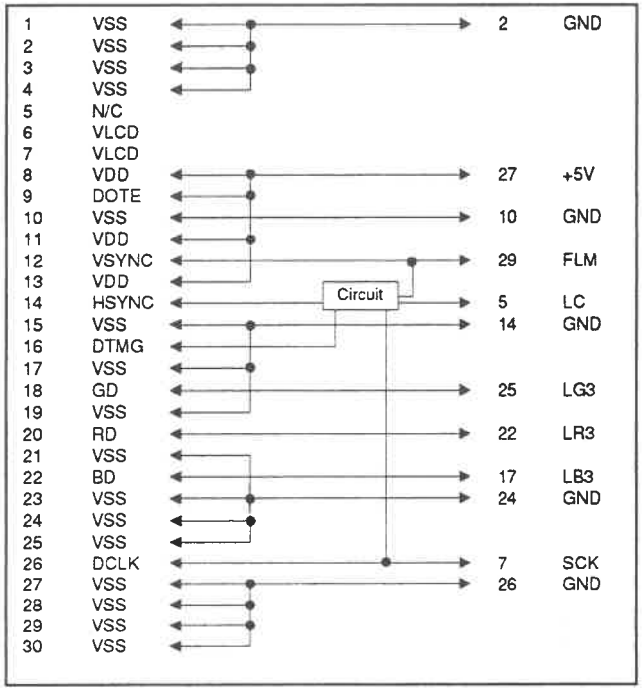
Panel Bank W2



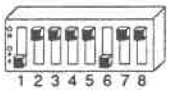
Shorted

640X480 (8 color)
TM26D01VC

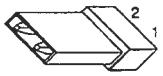
***Display Master* VGA**



DIP Switch 1



Panel Bank W2



Shorted

NOTE: Please contact YAMAHA Technical Support regarding special BIOS support for this panel.

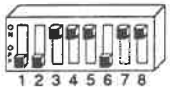
NOTE: See schematic on page 33.

640X480 (16 Color) ***Display Master*** **VGA**
TM26D01VC

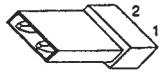
1	VSS	→	2	GND
2	VSS			
3	VSS			
4	VSS			
5	N/C			
6	VLCD			
7	VLCD			
8	VDD	→	27	+5V
9	DOTE			
10	VSS	→	10	GND
11	VDD			
12	VSYNC	→	29	FLM
13	VDD			
14	HSYNC	→	5	LC
15	VSS	→	14	GND
16	DTMG			
17	VSS			
18	GD	→	25	LG3
19	VSS			
20	RD	→	22	LR3
21	VSS			
22	BD	→	17	LB3
23	VSS	→	24	GND
24	VSS			
25	VSS			
26	DCLK	→	7	SCK
27	VSS	→	26	GND
28	VSS			
29	VSS			
30	VSS			

Circuit

DIP Switch 1



Panel Bank W2

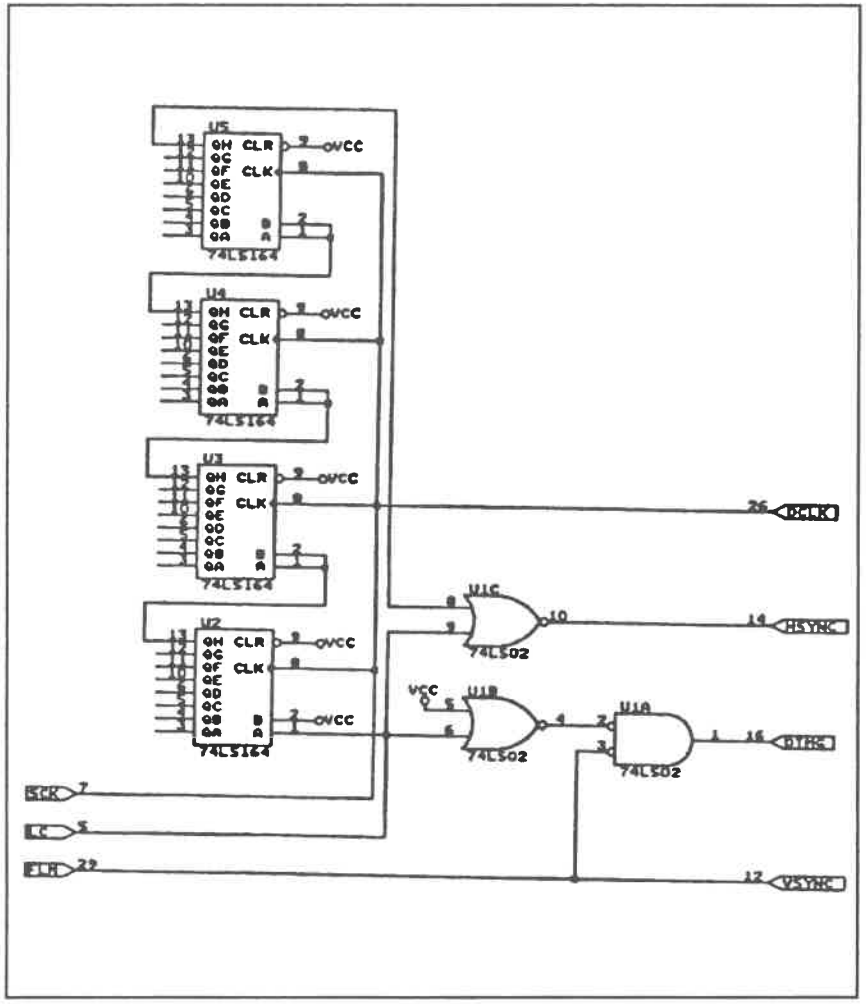


Shorted

NOTE: Please contact YAMAHA Technical Support regarding special BIOS support for this panel.

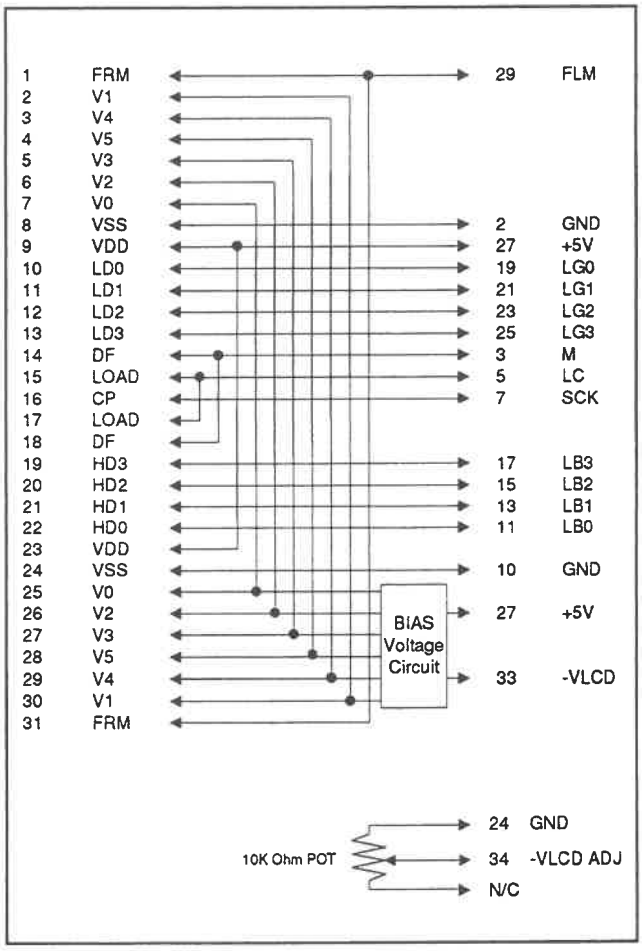
NOTE: See schematic on page 33.

Hitachi Display Timing Circuit

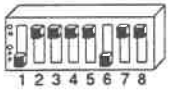


640X400
KL6440AST

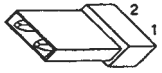
***Display Master* VGA**



DIP Switch 1



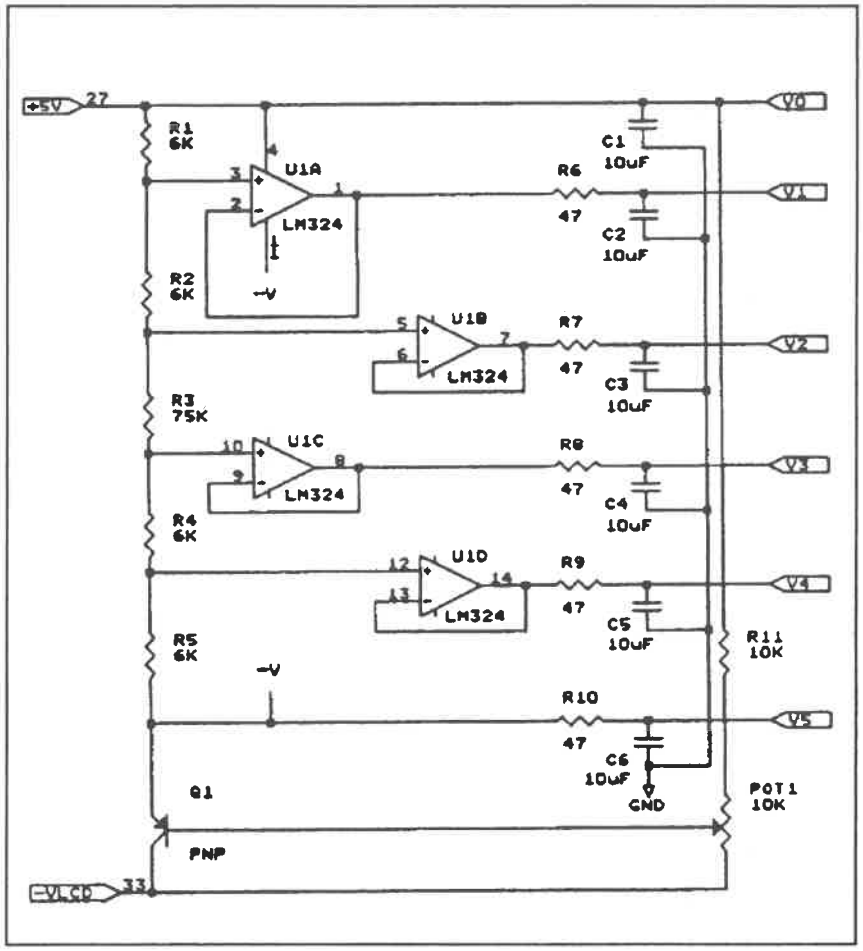
Panel Bank W2



Shorted

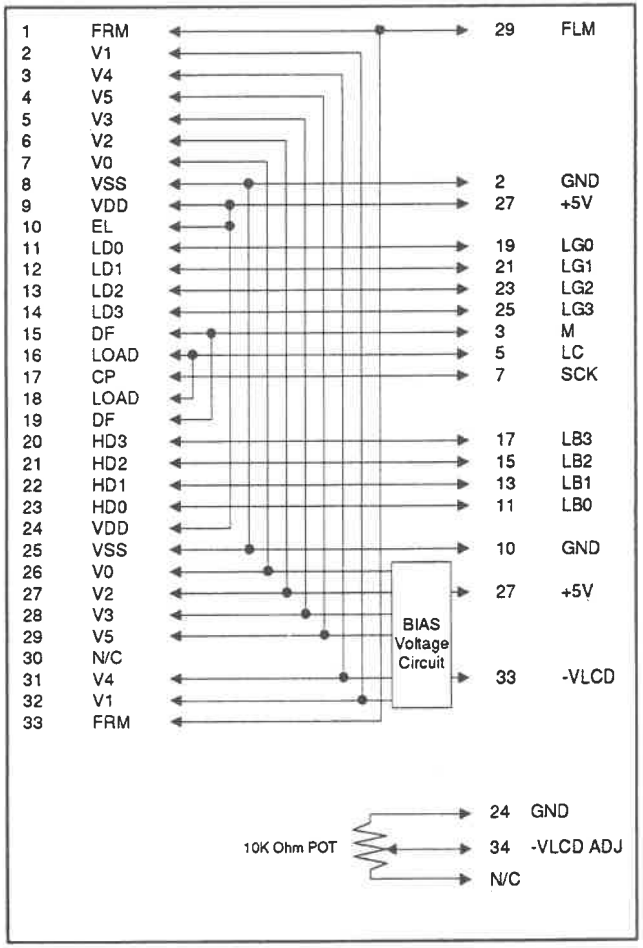
NOTE: See schematic on page 35.

Kyocera Bias Voltage Circuit

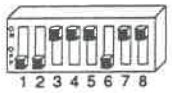


640X480
KL6448AVTP-Y

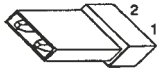
Display Master VGA



DIP Switch 1



Panel Bank W2

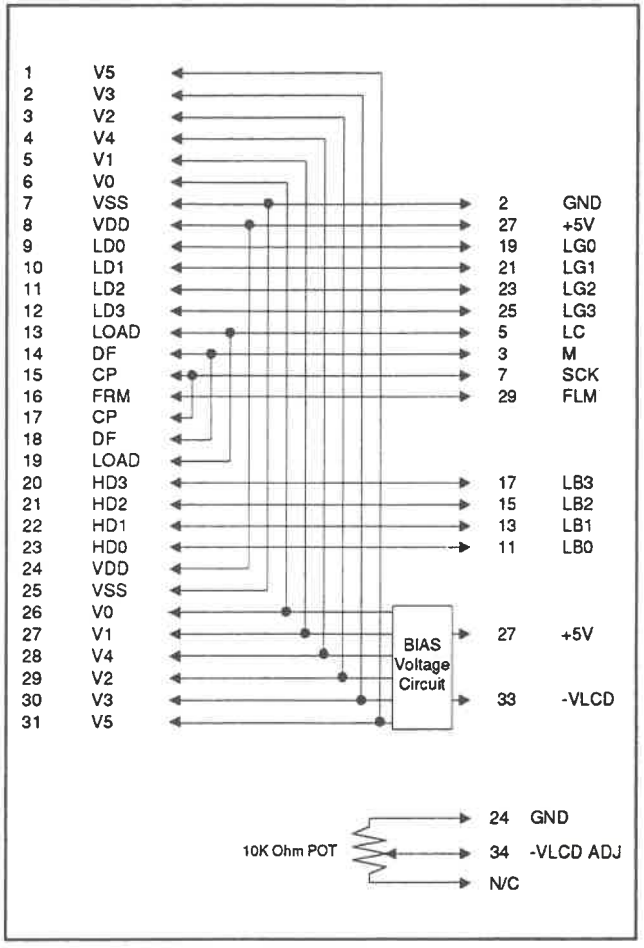


Shorted

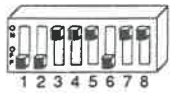
NOTE: See schematic on page 35.

640X480
KL6448FST

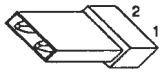
Display Master VGA



DIP Switch 1



Panel Bank W2

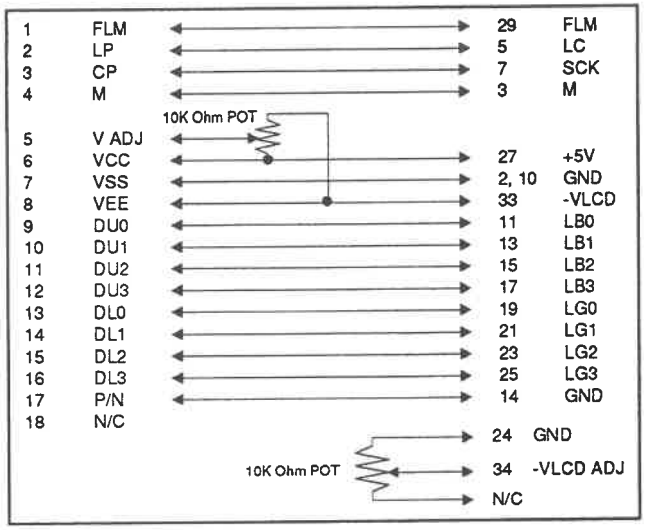


Shorted

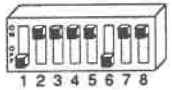
NOTE: See schematic on page 35.

640X400 DMF666AN

***Display Master* VGA**



DIP Switch 1

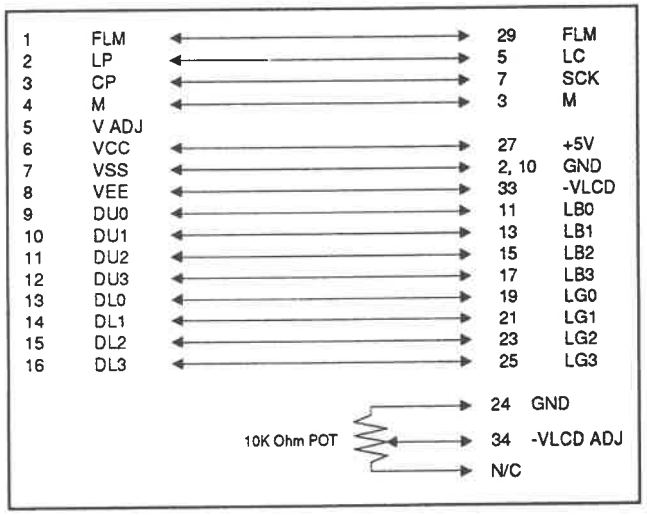


Panel Bank W2

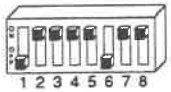
Shorted

640X400 DMF694NWU

***Display Master* VGA**



DIP Switch 1

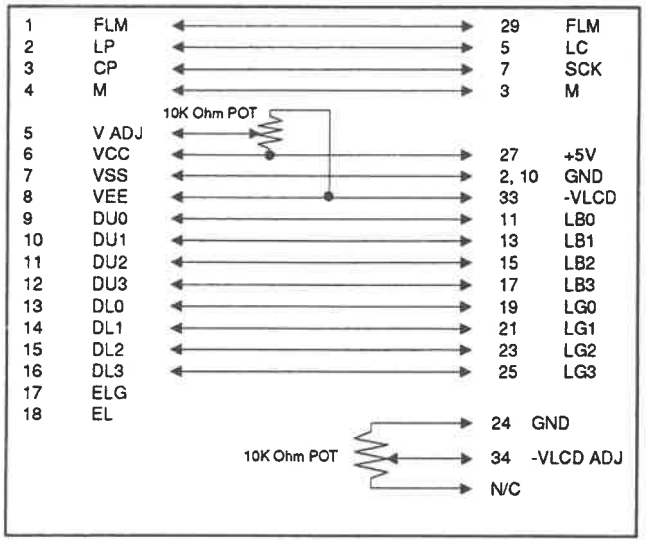


Panel Bank W2

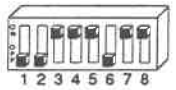
Shorted

640X480 DMF6106

***Display Master* VGA**



DIP Switch 1



Panel Bank W2

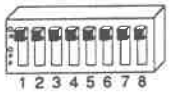
Shorted

PANASONIC PLASMA

640X480 *Display Master* **VGA**
MD480F640PG1/PG2, MD480L640PG2/PG3

1	+5V	→	27	+5V
2	+5V			
3	ENA			
4	BACKG			
5	VSYNC	→	29	FLM
6	GND	→	2	GND
7	HSYNC	→	5	LC
8	GND	→	10	GND
9	BLANK	→	3	M
10	GND	→	14	GND
11	CLOCK	→	12	BNCLK
12	GND	→	18	GND
13	Data0	→	4	LR0
14	GND	→	24	GND
15	Data1	→	6	LR1
16	GND			
17	Data2	→	20	LR2
18	GND			
19	Data3	→	22	LR3
20	GND			

DIP Switch 1



Panel Bank W2

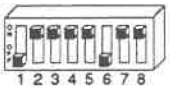
Shorted

PLANAR EL

640X400 *Display Master* **VGA**
8358HR

1	VH	→	1	+12V
2	VH			
3	N/C			
4	N/C			
5	SMODE1			
6	SMODE2			
7	GND	→	2	GND
8	GND	→	10	GND
9	VSYNC	→	29	FLM
10	GND	→	14	GND
11	HSYNC	→	5	LC
12	GND	→	18	GND
13	VCLK	→	12	BDSCLK
14	GND	→	24	GND
15	VID	→	17	LB3
16	GND			

DIP Switch 1



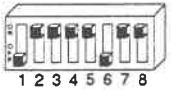
Panel Bank W2

Open

640X400 *Display Master* **VGA**
EL8358M/HR

1	VSYNC	→	29	FLM
2	HSYNC	→	5	LC
3	GND	→	2	GND
4	VID1			
5	GND	→	10	GND
6	VID0	→	17	LB3
7	GND	→	14	GND
8	VCLK	→	7	SCK
9	GND	→	18	GND
10	VCLKPOL	→	27	+5V
11	VIDPOL			
12	MODE1	→	24	GND

DIP Switch 1



Panel Bank W2

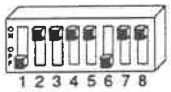
Open

640X400
EL8358M/HR2

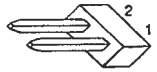
***Display Master* VGA**

1	VSYNC	⟷	29	FLM
2	HSYNC	⟷	5	LC
3	GND	⟷	2	-GND
4	N/C			
5	GND	⟷	10	GND
6	VID	⟷	17	LB3
7	GND	⟷	14	GND
8	VIDCLK	⟷	12	BNCLK
9	GND	⟷	18	GND
10	VCLKPOL	⟷	24	GND
11	VIDPOL	⟷	27	+5V
12	N/C			

DIP Switch 1



Panel Bank W2



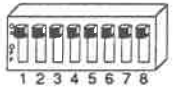
Open

640X480
EL7768MS

***Display Master* VGA**

1	GND	⟷	2	GND
2	D0	⟷	4	LR0
3	GND	⟷	14	GND
4	D1	⟷	6	LR1
5	GND	⟷	18	GND
6	D2	⟷	20	LR2
7	N/C			
8	D3	⟷	22	LR3
9	N/C			
10	N/C			
11	N/C			
12	N/C			
13	N/C			
14	N/C			
15	GND	⟷	24	GND
16	N/C			
17	GND			
18	VCLK	⟷	12	BNCLK
19	GND			
20	BLANK	⟷	3	M
21	GND			
22	HSYNC	⟷	5	LC
23	N/C			
24	VSYNC	⟷	29	FLM
25	N/C			
26	Self Test	⟷	10	GND
27	N/C			
28	N/C			
29	N/C			
30	N/C		24	GND
31	N/C			
32	N/C	10K Ohm POT	34	-VLCD ADJ
33	N/C			
34	N/C		N/C	

DIP Switch 1

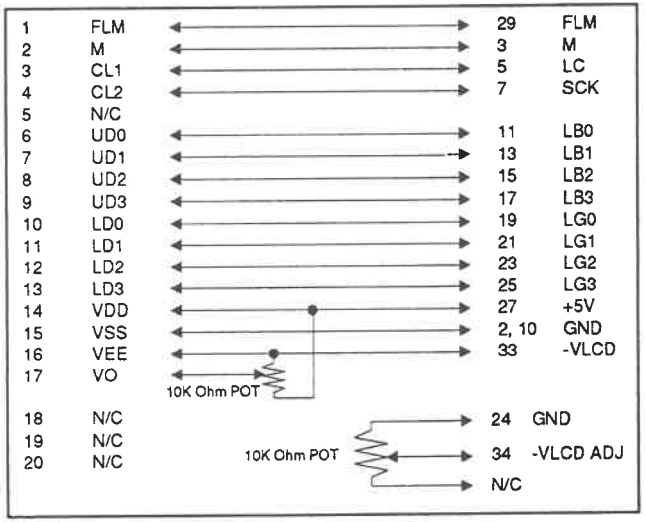


Panel Bank W2

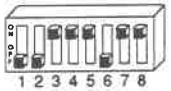
Open

SANYO

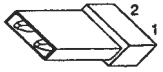
640X480 *Display Master* **VGA**
LCM5237/LCM5433, LCM5602/LCM5449



DIP Switch 1

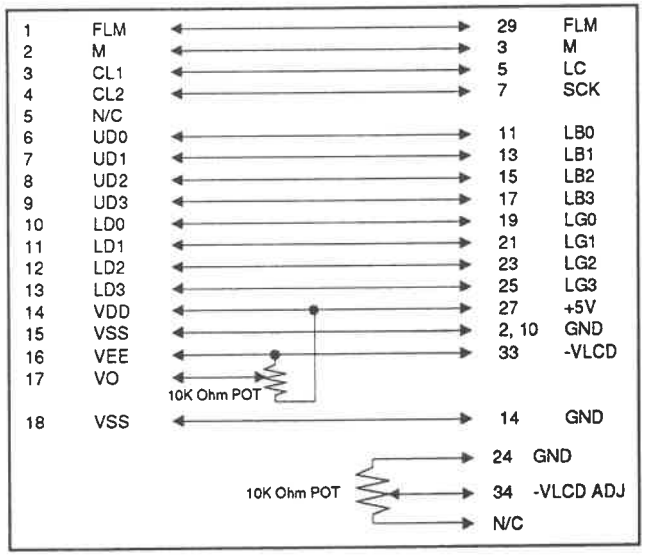


Panel Bank W2

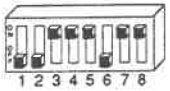


Shorted

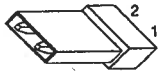
640X480 *Display Master* **VGA**
LCM5450/LCM5650



DIP Switch 1



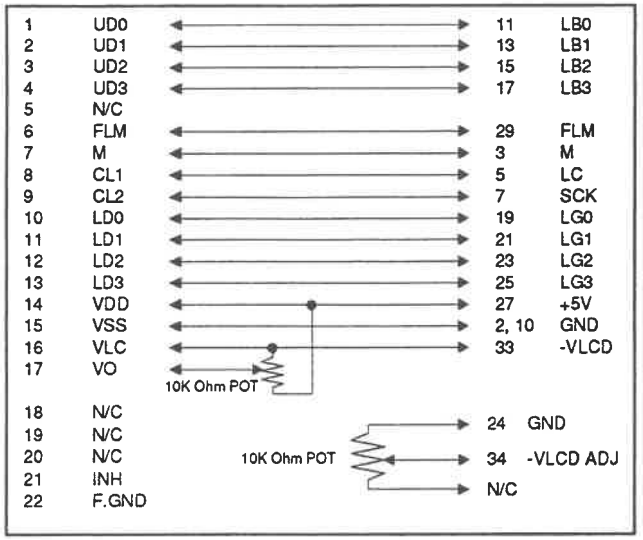
Panel Bank W2



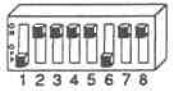
Shorted

SEIKO LCD

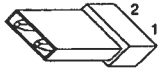
640X400 *Display Master* **VGA**
F642F, G644F



DIP Switch 1

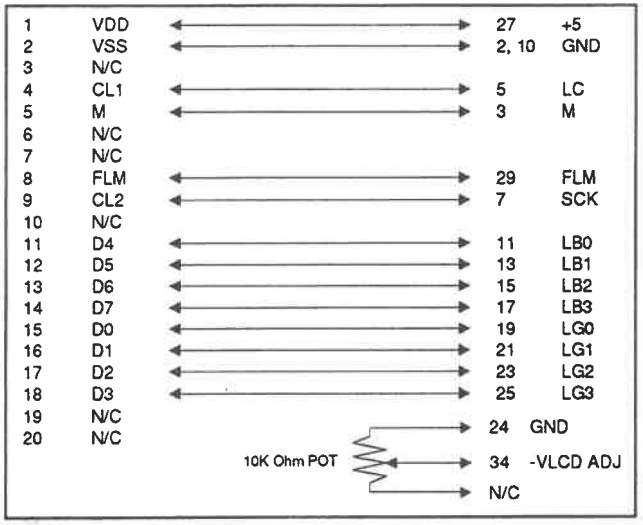


Panel Bank W2

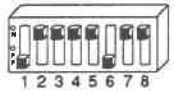


Shorted

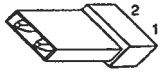
640X400 *Display Master* **VGA**
G644G



DIP Switch 1



Panel Bank W2

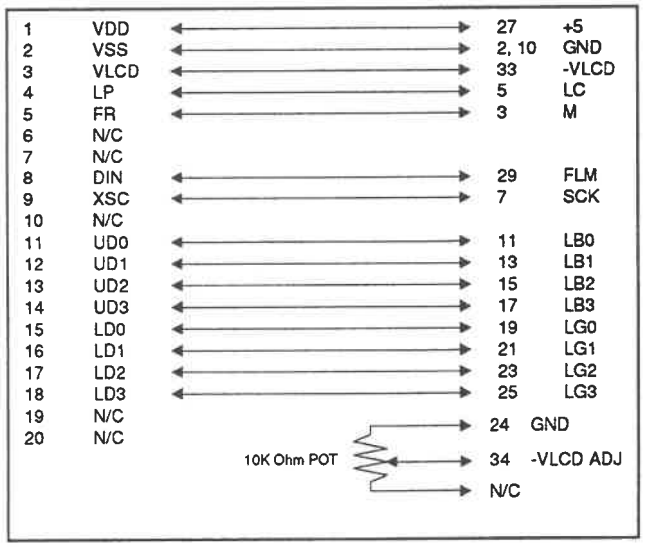


Shorted

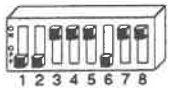
SEIKO LCD (Continued)

640X480
G642G

***Display Master* VGA**



DIP Switch 1



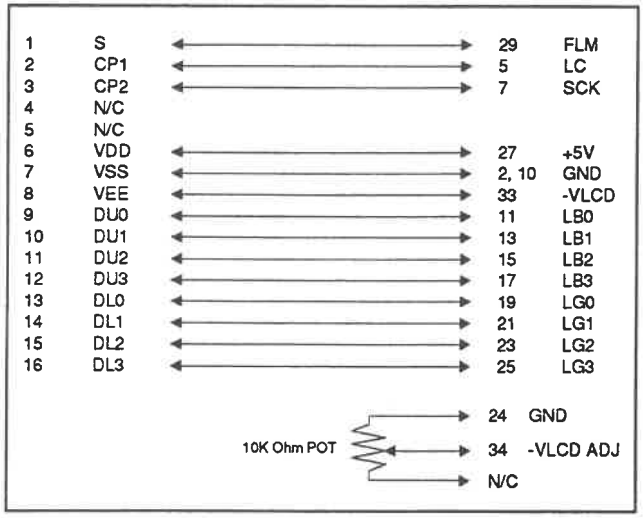
Panel Bank W2

Shorted

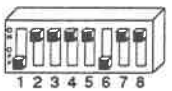
SHARP LCD

640X400
LM64O60F

***Display Master* VGA**



DIP Switch 1

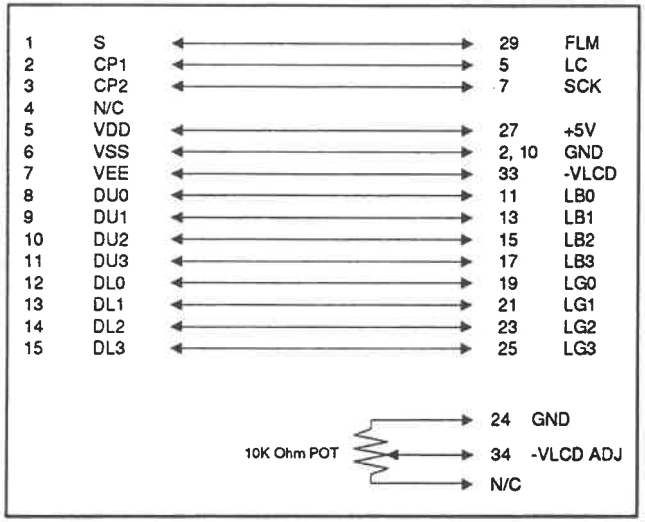


Panel Bank W2

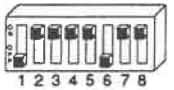
Shorted

640X400
LM64P402

***Display Master* VGA**



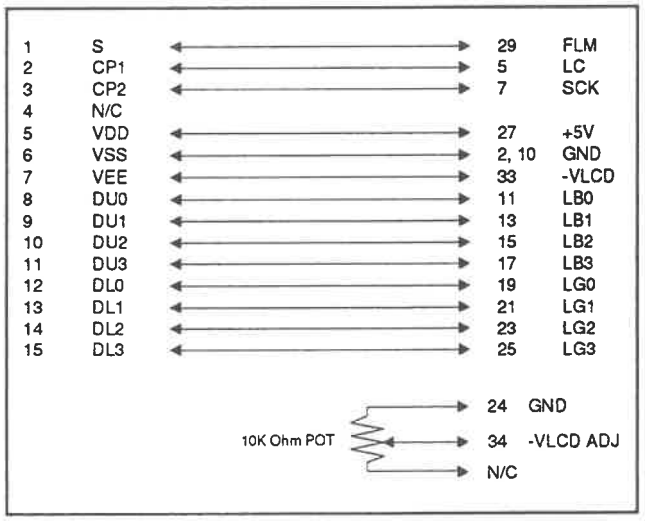
DIP Switch 1



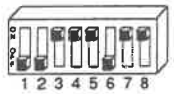
Panel Bank W2

Shorted

640X480 *Display Master* VGA
LM64P60, LM64P722, LM64P723, LM64152F



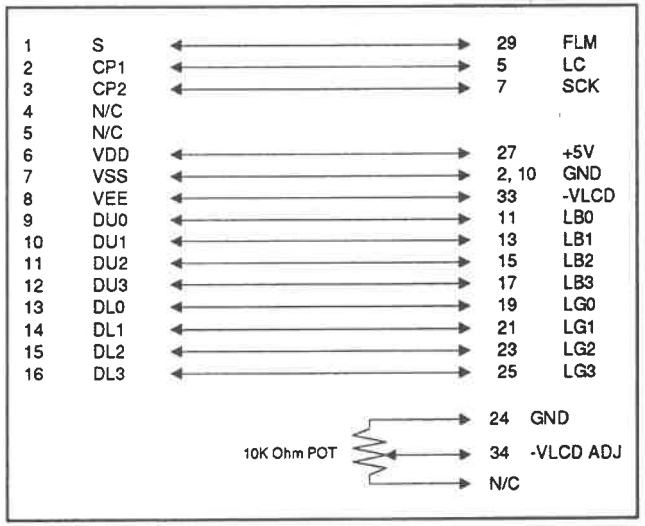
DIP Switch 1



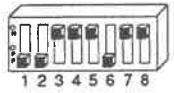
Panel Bank W2

Shorted

640X480 *Display Master* VGA
LM64P62, LM64P602, LM64P623



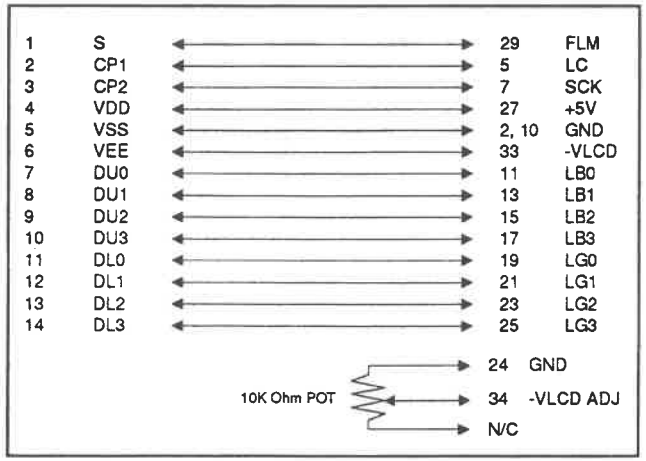
DIP Switch 1



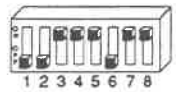
Panel Bank W2

Shorted

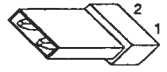
640X480 *Display Master* VGA
LM64P64, LM64P70, LM64P762



DIP Switch 1

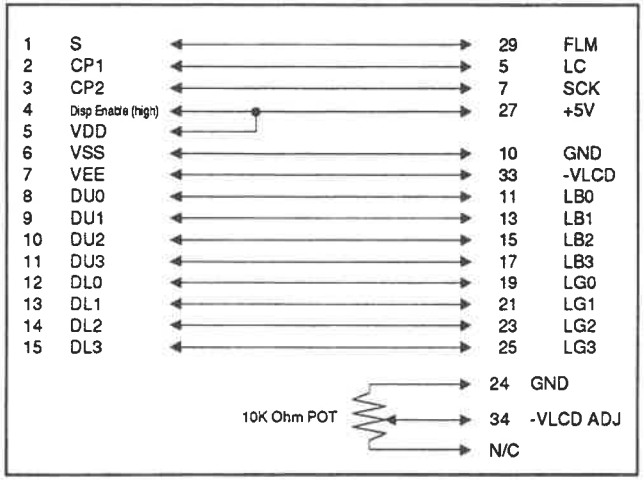


Panel Bank W2

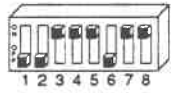


Shorted

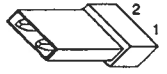
640X480 *Display Master* VGA
LM64P80



DIP Switch 1



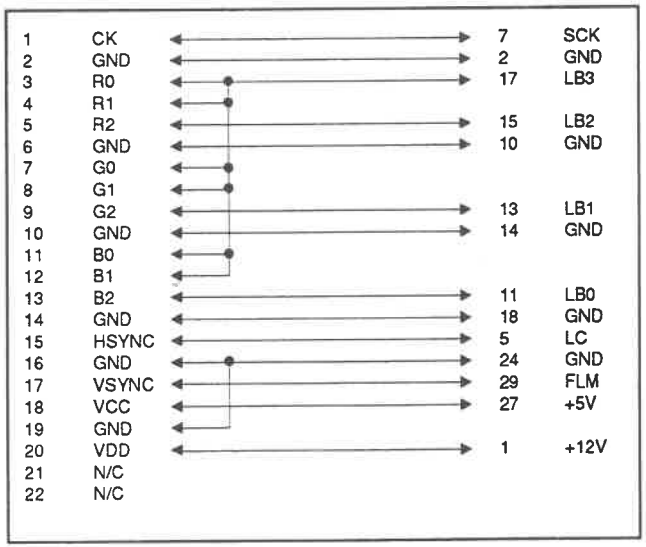
Panel Bank W2



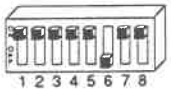
Shorted

SHARP COLOR LCD

640X480 (16 Color) *Display Master* **VGA**
LQ10D011



DIP Switch 1

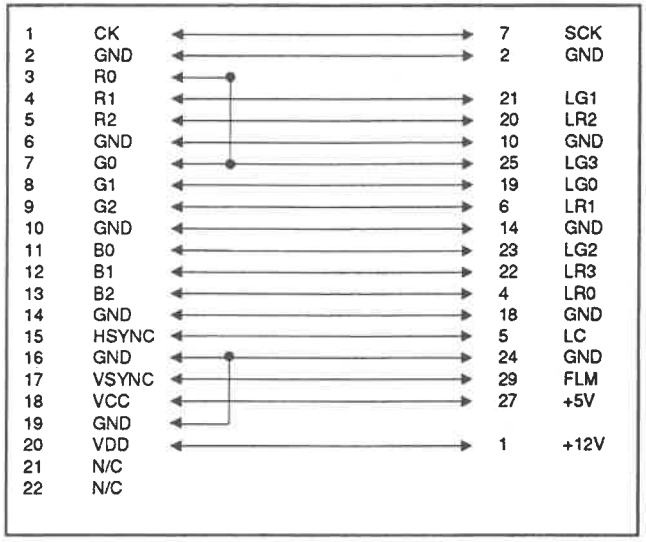


Panel Bank W2

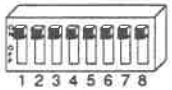
Shorted

SHARP COLOR LCD (Continued)

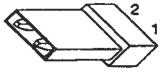
640X480 (256 Color) *Display Master* **VGA**
LQ10D011



DIP Switch 1



Panel Bank W2



Shorted

NOTE: Please contact YAMAHA Technical Support for special BIOS and circuit changes necessary to support 256 colors.

640X400 LJ640U26 — *Display Master* VGA

A1	DIN	→	17	LB3
B1	N/C			
A2	CKD	→	12	BNCLK
B2	GND	→	2	GND
A3	HID	→	5	LC
B3	GND	→	10	GND
A4	VID	→	29	FLM
B4	N/C			
A5	GND	→	14	GND
B5	GND	→	18	GND
A6	VM			
B6	VM			
A7	VL	→	27	+5V
B7	VL			
A8	VD			
B8	VD			

DIP Switch 1

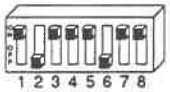
Panel Bank W2

Open

640X400 LJ640U27 — *Display Master* VGA

A1	DIN	→	17	LB3
B1	N/C			
A2	CKD	→	12	BNCLK
B2	GND	→	2	GND
A3	HID	→	5	LC
B3	GND	→	10	GND
A4	VID	→	29	FLM
B4	N/C			
A5	GND	→	14	GND
B5	GND	→	18	GND
A6	N/C			
B6	N/C			
A7	VL	→	27	+5V
B7	VL			
A8	VD			
B8	VD			

DIP Switch 1



Panel Bank W2

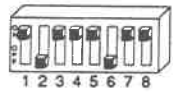
Open

640X400 LJ640U31 — *Display Master* VGA

A1	DIN0	→	11	LB3
B1	DIN1	→	7	SCK
A2	CKD	→	5	LC
B2	GND			
A3	HID			
B3	GND	→	2	GND
A4	VID	→	29	FLM
B4	N/C			
A5	GND	→	10	GND
B5	GND	→	14	GND
A6	VD	→		+24V
B6	VD			
A7	VL	→	27	+5V
B7	VL			
A8	N/C			
B8	N/C			

Circuit

DIP Switch 1



Panel Bank W2

Open

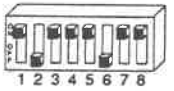
NOTE: See schematic on page 54.

640X400 LJ640U32 — *Display Master* VGA

A1	DIN0	→	11	LB3
B1	DIN1	→	7	SCK
A2	CKD	→	5	LC
B2	GND			
A3	HID			
B3	GND	→	2	GND
A4	VID	→	29	FLM
B4	N/C			
A5	GND	→	10	GND
B5	GND	→	14	GND
A6	N/C			
B6	N/C			
A7	VL	→	27	+5V
B7	VL			
A8	VD	→	1	+12V
B8	VD			

Circuit

DIP Switch 1

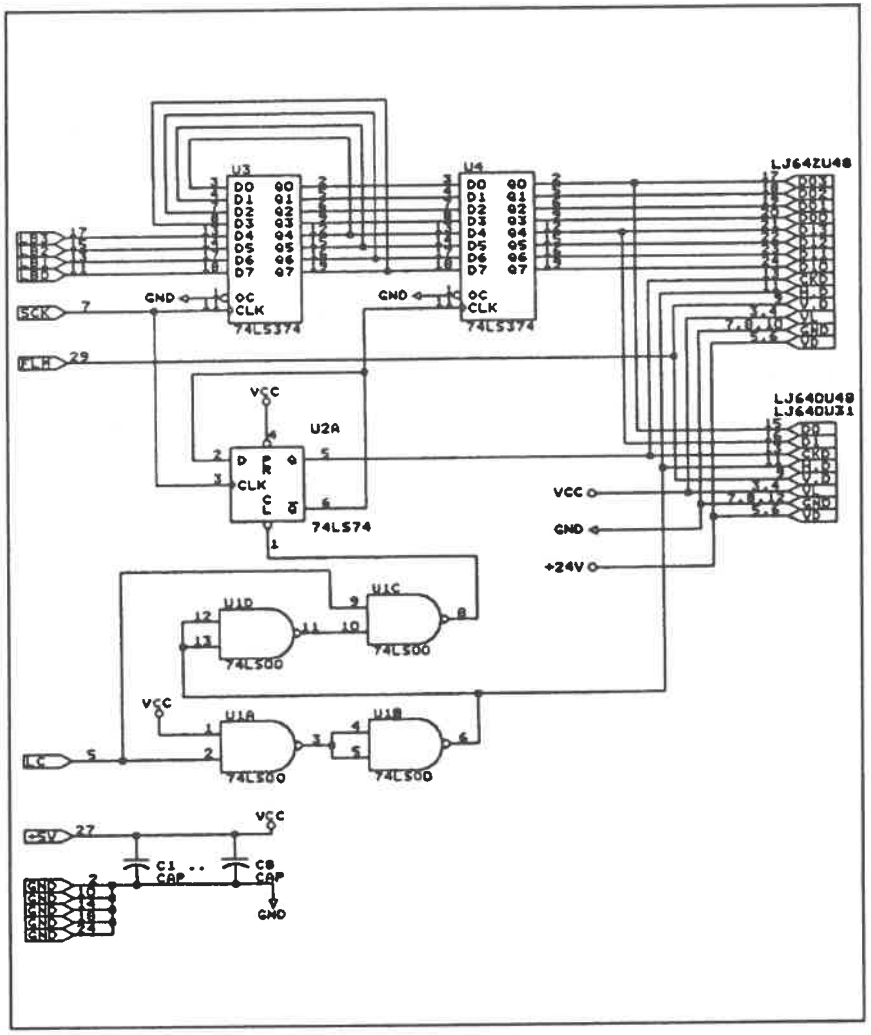


Panel Bank W2

Open

NOTE: See schematic page 54.

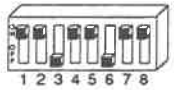
Sharp Data Latch Circuit



640X400X16 *Display Master* **VGA**
LJ64ZU26/LJ64ZU31

A1	D1	→	13	LB1
B1	D0	→	11	LB0
A2	D3	→	17	LB3
B2	D2	→	15	LB2
A3	N/C			
B3	N/C			
A4	CKD	→	12	BNCLK
B4	GND	→	2	GND
A5	HD	→	5	LC
B5	GND			
A6	VD	→	29	FLM
B6	GND	→	10	GND
A7	GND	→	14	GND
B7	GND	→	18	GND
A8	VD	→		+24V
B8	VD			
A9	VL	→	27	+5V
B9	VL			
A10	N/C			
B10	N/C			

DIP Switch 1



Panel Bank W2

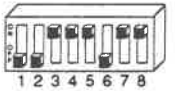
Open

640X480 *Display Master* **VGA**
LJ640U48

A1	DIN0	→	11	LB3
B1	DIN1	→	7	SCK
A2	CKD	→	5	LC
B2	GND			
A3	HID			
B3	GND	→	2	GND
A4	VID	→	29	FLM
B4	N/C			
A5	GND	→	10	GND
B5	GND	→	14	GND
A6	VD	→		+24V
B6	VD			
A7	VL	→	27	+5V
B7	VL			
A8	N/C			
B8	N/C			

Circuit

DIP Switch 1



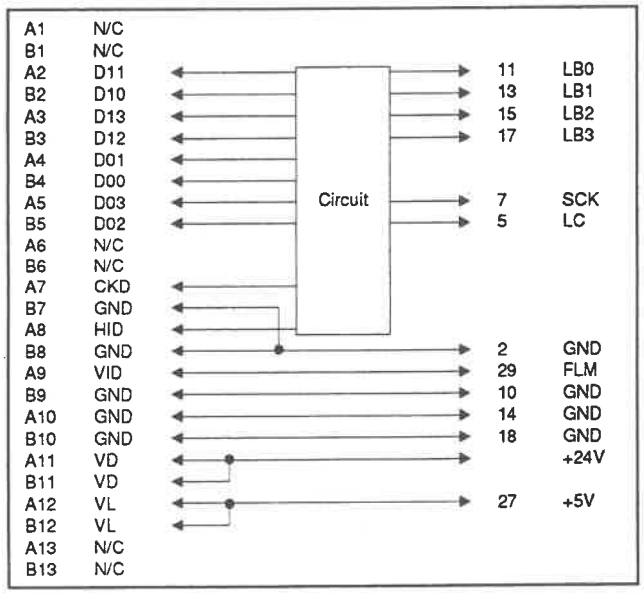
Panel Bank W2

Open

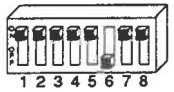
NOTE: See schematic on page 54.

640X480X16
LJ64ZU48/49

***Display Master* VGA**



DIP Switch 1



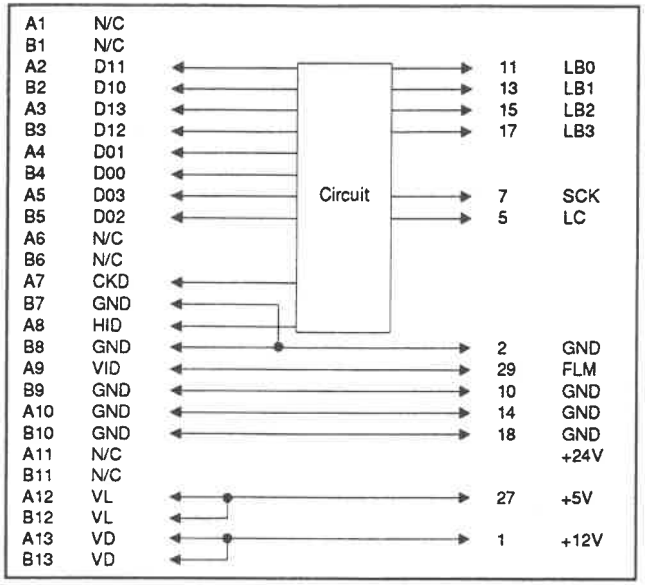
Panel Bank W2

Open

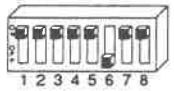
NOTE: See schematic on page 54.

640X480X16
LJ64ZU50

***Display Master* VGA**



DIP Switch 1



Panel Bank W2

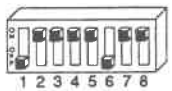
Open

NOTE: See schematic on page 54.

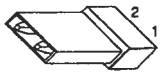
640X400 TLX1193/TLX1251 — *Display Master* VGA

1	FGND			
2	N/C			
3	FP	⟷	29	FLM
4	LP	⟷	5	LC
5	SCP	⟷	7	SCK
6	GND	⟷	2	GND
7	UD0	⟷	11	LB0
8	UD1	⟷	13	LB1
9	UD2	⟷	15	LB2
10	UD3	⟷	17	LB3
11	GND	⟷	10	GND
12	VDD	⟷	27	+5V
13	VO	⟷ 10K Ohm POT		
14	VEE	⟷	33	-VLCD
15	GND	⟷	14	GND
16	LD0	⟷	19	LG0
17	LD1	⟷	21	LG1
18	LD2	⟷	23	LG2
19	LD3	⟷	25	LG3
20	GND	⟷	18	GND
			24	GND
	10K Ohm POT		34	-VLCD ADJ
			N/C	

DIP Switch 1



Panel Bank W2

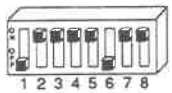


Shorted

640X400 TLX1501 — *Display Master* VGA

1	FP	⟷	29	FLM
2	LP	⟷	5	LC
3	SCP	⟷	7	SCK
4	N/C			
5	N/C			
6	VDD	⟷	27	+5V
7	GND	⟷	2, 10	GND
8	VE	⟷	33	-VLCD
9	UD0	⟷	11	LB0
10	UD1	⟷	13	LB1
11	UD2	⟷	15	LB2
12	UD3	⟷	17	LB3
13	LD0	⟷	19	LG0
14	LD1	⟷	21	LG1
15	LD2	⟷	23	LG2
16	LD3	⟷	25	LG3
			24	GND
	10K Ohm POT		34	-VLCD ADJ
			N/C	

DIP Switch 1



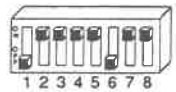
Panel Bank W2

Shorted

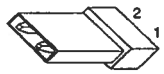
640X400 TLX1641 — *Display Master* VGA

1	FG			
2	N/C			
3	FP	⟷	29	FLM
4	LP	⟷	5	LC
5	SCP	⟷	7	SCK
6	GND	⟷	2	GND
7	UD0	⟷	11	LB0
8	UD1	⟷	13	LB1
9	UD2	⟷	15	LB2
10	UD3	⟷	17	LB3
11	GND	⟷	10	GND
12	VDD	⟷	27	+5V
1	VO	⟷ 10K Ohm POT		
2	VEE	⟷	33	-VLCD
3	N/C			
4	LD0	⟷	19	LG0
5	LD1	⟷	21	LG1
6	LD2	⟷	23	LG2
7	LD3	⟷	25	LG3
8	GND	⟷	14	GND
			24	GND
	10K Ohm POT		34	-VLCD ADJ
			N/C	

DIP Switch 1



Panel Bank W2

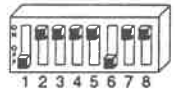


Shorted

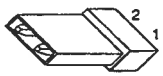
640X480 TLX1181/TLX1371, TLX1541/TLX1551 — *Display Master* VGA

1	FGND			
2	N/C			
3	FP	⟷	29	FLM
4	LP	⟷	5	LC
5	SCP	⟷	7	SCK
6	GND	⟷	2	GND
7	VD0	⟷	11	LB0
8	VD1	⟷	13	LB1
9	VD2	⟷	15	LB2
10	VD3	⟷	17	LB3
11	GND	⟷	10	GND
12	VDD	⟷	27	+5V
13	VO	⟷ 10K Ohm POT		
14	VEE	⟷	33	-VLCD
15	GND	⟷	14	GND
16	LD0	⟷	19	LG0
17	LD1	⟷	21	LG1
18	LD2	⟷	23	LG2
19	LD3	⟷	25	LG3
20	GND	⟷	18	GND
			24	GND
	10K Ohm POT		34	-VLCD ADJ
			N/C	

DIP Switch 1



Panel Bank W2



Shorted

APPENDICES

A. Connector Pinouts

B. General Panel Configurations

C. Standard VGA Modes

D. Troubleshooting

E. YAMAHA Tech Support

A. Connector Pinouts

The following figure details the 34-pin header connector (J1) on the *Display Master* VGA card.

Pin	Description	Pin	Description
1	+12V (from PC board)	2	Ground (VSS)
3	M (AC drive pulse for LCD)	4	LR0 (red data bit 0)
5	LC (Hsync)	6	LR1 (red data bit 1)
7	SCK	8	BDSCLK (delayed SCK of 30–50 nS)
9	N/C	10	Ground (VSS)
11	LB0 * (blue data bit 0)	12	BNCLK (negative SCK)
13	LB1 * (blue data bit 1)	14	Ground (VSS)
15	LB2 * (blue data bit 2)	16	N/C
17	LB3 *[1] (blue data bit 3)	18	Ground (VSS)
19	LG0 † (green data bit 0)	20	LR2 (red data bit 2)
21	LG1 † (green data bit 1)	22	LR3 (red data bit 3)
23	LG2 † (green data bit 2)	24	Ground (VSS)
25	LG3 † (green data bit 3)	26	EXT-ON (panel ON)
27	+5V (Max. 50 mA) (VCC, from PC board)	28	Reserved
29	FLM (Vsync, S, Frame)	30	-12V (Max. 50 mA) (from PC board)
31	-24V (VEE) *(Max. 30 mA when combined with Pin 33)*	32	Reserved
33	-VLCD (output to LCD) *(Max. 30 mA when combined with Pin 31)*	34	-VLCD ADJ (external adjust)

* Drives upper half of dual LCD screens † Drives lower half of dual LCD screens
[1] Drives single bit panel data line

NOTE: Pins 27, 30, 31, and 33 have a maximum combined current of 30 mA

You may use any standard "IDC" 34-pin mating connector (female) with the *Display Master* VGA header connector.

The following figure details the 26-pin feature connector (J2) on the *Display Master* VGA card.

Pin	Signal	Pin	Signal
1	P0	2	P1
3	P2	4	P3
5	P4	6	P5
7	P6	8	P7
9	CLK2	10	BLANK
11	HSY	12	VSY
13	GROUND	14	GROUND
15	GROUND	16	GROUND
17	EVID	18	ESYNC
19	ECLK	20	NO CONNECT
21	GROUND	22	GROUND
23	GROUND	24	GROUND
25	NO CONNECT	26	NO CONNECT

You may use any standard "IDC" 26-pin mating connector (female) with the *Display Master* VGA feature connector.

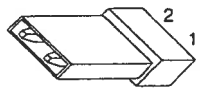
B. General Panel Configuration

The following figures provide general panel configurations. If your panel is not listed below, you may choose to configure the cabling yourself. We suggest you use panel pinouts and panel specifications (supplied by the manufacturer), and the switch setting below which best matches your panel type. YAMAHA cannot guarantee that the switch settings below will work with your particular panel.

Should you need help configuring your panel, refer to Appendix E, YAMAHA Tech Support, in this manual.

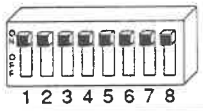
DISPLAY MASTER VGA

Panel Bank Jumper W2

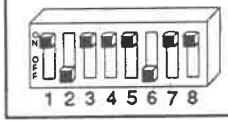


Shorted

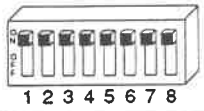
Analog Monitor
640X480



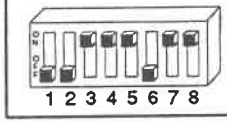
LCD Panel
640X400
Dual Screen/4 Bit Data



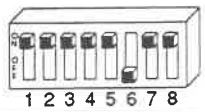
Digital Monitor
Multisync



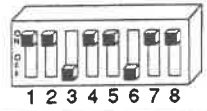
LCD Panel
640X480
Dual Screen/8 Bit Data



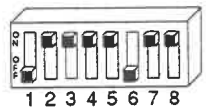
Color LCD Panel
640X480



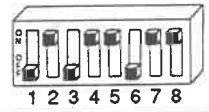
Reserved



LCD Panel
640X400
Dual Screen/8 Bit Data

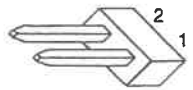


Plasma Panel
640X480
1 Bit Data



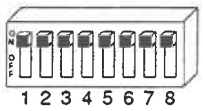
DISPLAY MASTER VGA

Panel Bank Jumper W2

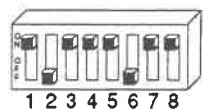


Open

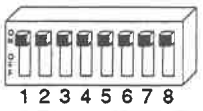
Analog Monitor
640X480



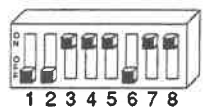
EL Panel
640X400
1 Bit Data



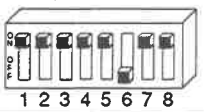
Digital Monitor
Multisync



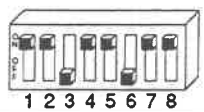
EL Panel
640X480
2 Bit Data



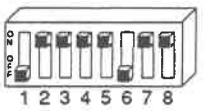
EL Panel
640X480
(Sharp)



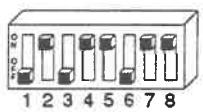
EL Panel
640X400
4 Bit Data



EL Panel
640X480
(Planar)



Reserved



C. Standard VGA Modes

This section describes how to access the enhanced modes of the *Display Master* VGA card. The information in this section is intended for users familiar with assembly language programming. The VGA standard supports a variety of video modes. These video modes can be accessed through video BIOS calls from assembly language as well as high level language routines. The following figure lists the standard VGA video modes available with the *Display Master* VGA card.

Mode (hex)	Type	Resolution	Colors *	Memory Buffer Start Address	Char. Size
0, 1	Text	320x200	16	B8000	8x8
0*, 1*	Text	320x350	16	B8000	8x14
0+, 1+	Text	360x400	16	B8000	9x16
2, 3	Text	640x200	16	B8000	8x8
2*, 3*	Text	640x350	16	B8000	8x14
2+, 3+	Text	720x400	16	B8000	9x16
4, 5	Graphics	320x200	4	B8000	8x8
6	Graphics	640x200	2	B8000	8x8
D	Graphics	320x200	16	A0000	8x8
E	Graphics	640x200	16	A0000	8x8
10	Graphics	640x350	16	A0000	8x14
11	Graphics	640x480	2	A0000	8x16
12	Graphics	640x480	16	A0000	8x16
13	Graphics	320x200	256	A0000	8x8
* The number of colors on a panel are dependent on the panel type					

D. Troubleshooting

Bus Clock Speed

The *Display Master* line of cards must be run on a 10MHz or slower PC bus. This is normal on XT and AT class computers. Some 80386 or 80486 computers allow the bus clock speed to be set to a higher speed. When this occurs, the *Display Master* VGA may not function properly. Most of these computers have a CMOS RAM setup option that will set the bus speed to 8MHz, and the setting for the clock speed is normally labeled ATCLK or ATCLOCK. This setting will place the bus at the standard AT bus speed.

Jumper E5

Jumper E5 is used to select the RAMDAC chip used on the *Display Master* VGA card. It is set at the factory and under normal circumstances should not be changed. If you should have trouble running the *Display Master* VGA, you might want to verify that this jumper has been set correctly at the factory: If the RAMDAC chip number is BT475, short pins 2 and 3 on Jumper E5. If the RAMDAC chip number is BT471, short pins 1 and 2 on Jumper E5.

The following are typical symptoms and solutions when troubleshooting your *Display Master* VGA card.

Troubleshooting

Symptom	Solution
System gives an Error Beep on Power-up	Verify that the edge connector is inserted all the way in the expansion slot. Verify that the *Display Master* VGA is properly aligned with the motherboard. Verify that the motherboard switch settings are set properly. Verify that the *Display Master* VGA switch settings are set properly. Verify that no peripheral adapters are occupying the same I/O or memory address as the *Display Master* VGA.
No display	Make sure cables are connected to the monitor or panel. Verify that the proper cable has been used and that it is the proper length. Make sure that the monitor is turned on. Make sure the brightness and/or contrast controls are turned up far enough. Verify that the motherboard switch settings are set properly. Verify that the *Display Master* VGA switch settings are set properly. Verify that Jumper E5 is set properly (see the section entitled "Jumper E5" on page 69).

Troubleshooting (Continued)

Symptom	Solution
Display loses synchronization or outputs garbage	Verify that the edge connector is inserted all the way in the expansion slot. Verify that the *Display Master* VGA is properly aligned with the motherboard. Verify that the motherboard switch settings are set properly. Verify that the *Display Master* VGA switch settings are set properly. Verify that no peripheral adapters are occupying the same I/O or memory address as the *Display Master* VGA. Make sure the bus clock speed is set at 8 MHz or ATCLK. Verify that the cables are the proper length. Verify that there are no blown buffers.
No -24V supply properly.	Verify that the system's -12V is working

E. YAMAHA Tech Support

Before contacting YAMAHA Systems Technology Division for technical support, please have the following information available:

- Type of *Display Master* card (ie. CGA, EGA, VGA)
- *Display Master* part number

  This is located on the bottom right corner of the *Display Master* VGA card.
- *Display Master* revision number

  This is located on the bottom right corner of the *Display Master* VGA card.
- *Display Master* BIOS revision number
- *Display Master* controller chip number
- *Display Master* DIP switch and jumper settings.
- Panel or Display type

This information will speed up the technical support process. You may contact YAMAHA technical support at:

(408) 437-3133

You may also Fax any support questions you have to the following number:

(408) 437-8791

For your convenience, we have included a "Tech Support Form" on the following page. This form is an easy way to document information that is necessary for technical support.

Display Master™ VGA Tech Support Form

DIRECTIONS: Fill out this form before contacting YAMAHA Systems Technology Division for technical support. You may either call YAMAHA Systems Technology Division Tech Support at (408) 437-3133, or you may copy and fax this form to (408) 437-8791. This form will speed up the technical support process.

Panel Information

❑ EL ❑ Plasma ❑ LCD

Manuf: _____ Resolution: ___X___ Part #: _____

Display Master Information

Part/Revision #: _____ BIOS Version #: _____

Controller Chip #: _____ RAMDAC Chip #: _____

Description of Problem: _____

_____

_____

_____

_____

Customer Name: _____

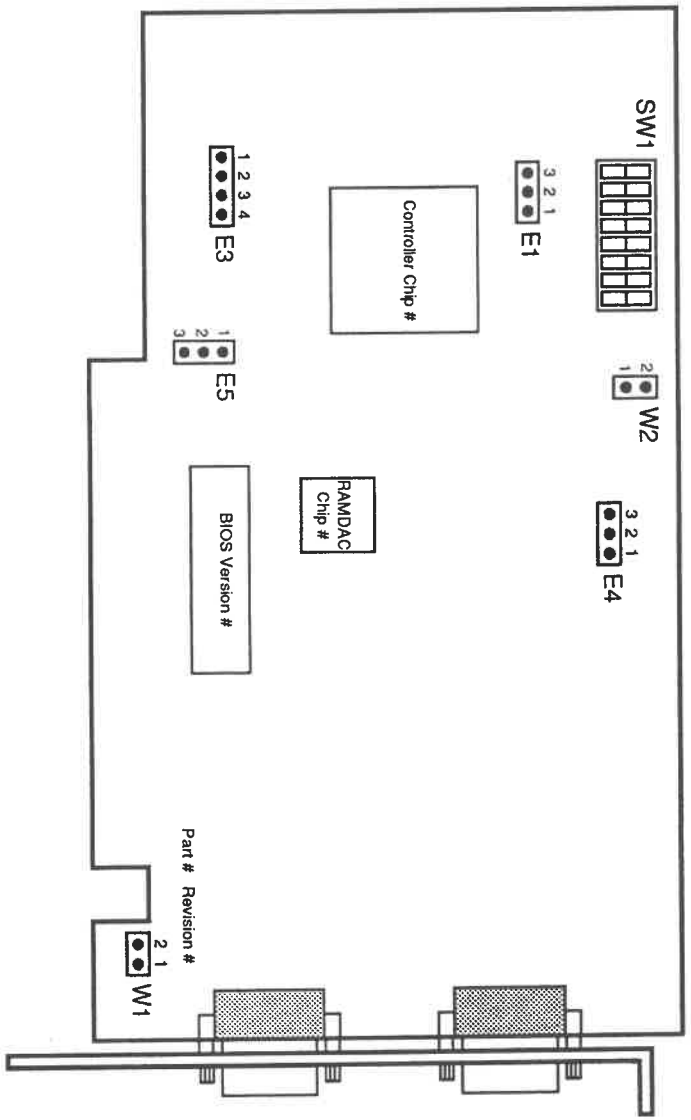
Company: _____

Telephone/FAX #: _____

(continued)

(continued)

DIRECTIONS: Use the following illustration to jot down the switch and jumper configurations of your Display Master *VGA card. The YAMAHA tech support representative will ask you to read back your switch and jumper configurations.*



Warranty Information

YAMAHA *Display Master*™ VGA Limited Warranty

One Year Parts and Labor

YAMAHA Corporation of America, Systems Technology Division (hereafter referred to as YAMAHA) warrants to the original consumer/purchaser of YAMAHA *Display Master* VGA, that this product will be free of defects in material and/or workmanship for one (1) year after the date of purchase.

During the warranty period, YAMAHA will at its option, repair or replace any nonconforming board without charge for parts or labor.

This warranty is provided for the benefit of the original consumer/purchaser and is valid only if YAMAHA *Display Master* VGA was purchased from YAMAHA or a distributor authorized by YAMAHA to sell such products. Contact YAMAHA directly if you have any questions in this area.

YAMAHA reserves the right to utilize reconditioned parts in the repair of the product or to use reconditioned units (carrying the remainder of the original warranty or ninety (90) days, whichever is greater). INBOUND SHIPPING AND INSURANCE CHARGES ARE THE CONSUMER/PURCHASER'S RESPONSIBILITY. Charges incurred for the return of the product to the consumer will be paid by YAMAHA. Please be prepared to provide proof of purchase date (warranty registration, sales receipt, or other reasonably acceptable method) when requesting service under warranty.

THIS WARRANTY IS THE ONLY WARRANTY WHICH YAMAHA MAKES IN CONNECTION WITH THIS PRODUCT. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. ANY IMPLIED WARRANTY APPLICABLE TO THIS PRODUCT, INCLUDING THE WARRANTY OF MERCHANTABILITY IS LIMITED TO THE DURATION OF THE EXPRESS WARRANTY. YAMAHA EXCLUDES AND SHALL NOT BE LIABLE IN ANY EVENT FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OTHER THAN THOSE TO DISPLAY MASTER VGA.

Some states do not allow limitations on how long an implied warranty may last; therefore, these limitations and exclusions may not apply to you.

This warranty gives you specific legal rights. You may also have other rights which vary from state to state.

In the event that any of the provisions of this warranty are found by stature or by applicable administrative judicial entities to be unenforceable, the remaining provisions shall remain in force.

Owner's Responsibilities

In order for YAMAHA to provide warranty service, it is necessary that the consumer assume certain responsibilities:

Contact your distributor promptly upon discovery of any point of concern relating to the operation of *Display Master* VGA. If your points of concern have not been resolved within thirty (30) days following notification, contact YAMAHA directly. If you have moved, contact YAMAHA for the name of an authorized distributor in your new location. When returning merchandise to YAMAHA, a Return Authorization is required.

Exclusions

YAMAHA's warranty does not apply to the following:

1. Products purchased from sources not authorized by YAMAHA to sell YAMAHA *Display Master* products.
2. Products whose trademark, name, or identification numbers have been altered or removed.
3. Failures that are the result of improper operation, maintenance, and/or repair.
4. Failures that result from abnormal strain, neglect, abuse, modifications, accidental damage, exposure to extremes in temperatures, or relative humidity.
5. Radio frequency interferences resulting from the connection of equipment not designated by YAMAHA as compatible.
6. Software, regardless of the media involved.
7. Loss of program material (data), and/or peripheral failures, regardless of cause.

Distributors authorized by YAMAHA to sell YAMAHA *Display Master* products, periodically receive sales, service, support materials and training that are not readily available to non-authorized distributors. This being the case, your local authorized YAMAHA *Display Master* VGA distributor is uniquely equipped to respond to any YAMAHA *Display Master* type needs you might have. In the event a local authorized YAMAHA *Display Master* VGA distributor is not available, please do not hesitate to contact YAMAHA directly.

YAMAHA Corporation of America
Systems Technology Division
981 Ridder Park Drive, San Jose CA 95131