MiniModule™/VFP-III
Technical Manual

P/N 5001421 Revision B

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Notice

REVISION HISTORY

Revision	Reason for Change	Date
1	Advanced Production Release	1/99
A	Production Release	4/99
B	Tech Support Update	8/00

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Preface

Introduction

This manual is for integrators and programmers of systems that use the Ampro MiniModule™/VFP-III controller, a PC-compatible flat panel display controller module. It contains information on hardware requirements and interconnection, and details of how to program the board and integrate it with other modules and boards in an embedded system.

There are three chapters in this manual, organized as follows:

- **Chapter 1—Introduction**. General information pertaining to the MiniModule/VFP-III controller, including its features and specifications.
- **Chapter 2—Configuration and Installation**. A description of how to configure and connect the MiniModule/VFP-III controller for use with an Ampro CPU board and a CRT or flat panel display. Included are tables listing the pinouts of each of the board's connectors, and switch settings.
- **Chapter 3—Operation**. A software-oriented overview of the MiniModule/VFP-III controller features, configuration options, and utilities that are available under MS-DOS. It describes how to reprogram the onboard flash VGA video BIOS to support standard flat panels.

Technical Support

Ampro technical support for this product is available from 8:00 AM to 5:00 PM, Pacific Time, Monday through Friday. When you call, please have the product's technical manual and the product available.

Table i lists contact information for Ampro technical support.

Table i. USA Technical Support Contact Information

Telephone	800-966-5200 (USA), or 408 360-0200
FAX	408 360-0250
Email	techsupport@ampro.com
Web Site	http://www.ampro.com
Virtual Technician	http://www.ampro.com/scripts/virtual_technician.exe?faq
FTP	ftp://ftp.ampro.com
Surface Mail	Ampro Computers, Incorporated, 4757 Hellyer Avenue, San Jose, CA 95138, USA

Chapter 1
Introduction

General Description

The MiniModule/VFP-III (VGA Flat Panel) controller is a compact, low power, high-resolution multimode display controller module. It offers full software compatibility with current popular PC video standards, VGA, SVGA, and emulation of “legacy” standards, EGA, CGA, and MDA. This device features hardware acceleration circuitry, allowing BitBlt, ROPs, and hardware cursor for increased GUI performance. It provides this functionality in a compact module designed to stack directly with Ampro's Little Board™ and CoreModule™ family products, and other PC/104-*Plus*-compliant expansion modules. It is ideal for embedded applications, where low power consumption, small size, high reliability, and IBM PC and PC/ AT software compatibility are critical. The module can stack directly with the “stackthrough” bus headers of CoreModule, other MiniModule products, and PC/104-*Plus* compatible expansion modules without additional adapters or accessories.

The module interfaces with external devices through three separate connectors: a 10-pin CRT monitor connector, a 80-pin ribbon-cable connector for interfacing with various flat panels, and a 26-pin connector for interfacing with Zoom Video compliant external video systems.

The MiniModule/VFP-III controller can control a wide range of color and monochrome LCD, plasma, and electroluminescent (EL) flat panels. Simultaneous display on both a CRT and a flat panel is supported on certain panels. In addition, its analog video output supports standard multifrequency analog VGA CRT monitors.

Because of its compatibility with standard PC video modes, virtually all operating systems, utilities, and applications for text and graphics display support the MiniModule/VFP-III controller.

You can reprogram the board's video BIOS to support a particular flat panel display in an embedded system. On flat panel displays, features such as stretching, vertical compensation, vertical centering, double scanning, and a variety of other special effects can be activated to match video content to the display. Refer to Chapter 3 for a description of the various utilities supplied with the board that set display modes and otherwise take advantage of the board's special display features. In some cases, the video BIOS must be modified to take advantage of a particular feature. A MiniModule/VFP-III controller video BIOS Development Kit is available for this purpose.

The MiniModule/VFP-III controller is shipped with a standard VGA video BIOS that supports an analog VGA CRT and a wide range of LCD flat panels. The BIOS is stored in an onboard Flash EPROM and is easily upgradable using supplied utilities. 16 different flat panels are supported by the standard BIOS, and Ampro can supply BIOS images for other flat panels. In addition, Ampro can supply upon request a Flat-Panel BIOS Development Kit. Using the software provided in this kit, developers can create a custom VGA BIOS for virtually any current display panel. Contact your Ampro sales representative or technical support for details.

Optional Ampro Development Platform

Ampro provides an optional bench top platform with IDE and floppy disk drives, 140W power supply, two PC expansion bus slots, two PCI expansion slots, and cables. It is a convenient way to quickly set up an Ampro system for product development or test. The development platform, together with an Ampro CPU module, the MiniModule/VFP-III controller, and your flat-panel assembly make up a complete development environment. Contact your Ampro sales representative for details.

Features

The MiniModule/VFP-III controller provides a number of unique features that enhance and simplify the use of flat-panel displays in embedded systems:

- **Programmable video BIOS**—The module supports CRT, LCD, and EL displays, using the Chips & Technologies (C&T) 69000 High Performance Flat Panel/CRT VGA Controller. To support the diverse signal timing and interface requirements of different flat panels, the video BIOS resides in an onboard flash EPROM. The standard video BIOS supports up to 16 popular flat panels, selectable by a utility program. OEMs can independently develop additional flat-panel video BIOSes.
- **High Performance—**The C&T 69000 Flat-panel/CRT VGA Controller incorporates a graphical user interface (GUI) accelerator for enhanced performance under Windows®, Windows® 95, Windows NT™, OS/2, and display-intensive applications.
- **Video Memory—**The MiniModule/VFP-III controller comes with 2 M bytes of DRAM, enough to support all standard VGA modes as well as a number of high-resolution VESA SVGA modes integrated directly inside the C&T 69000.
- **Color Flat-Panel Support—**The full range of colors can be displayed on color TFT LCD and STN LCD panels. The theoretical limit of available colors exceeds what current color flat panels can display. The module supports 24-bit True Color modes.
- **Color Simulation and Reduction—**Color is automatically converted to gray-scale for monochrome LCD panels, using a Frame Rate Modulation (FRM) technique that provides up to 16 levels of gray. A pulse width modulation technique (PWM) is used on EL panels.
- **Composite Video Output—**An NTSC/PAL compatible video signal is available, capable of driving a standard television.
- **Flat Panel Differential Signaling—**A PanelLink™ compatible transmitter option is available for interfacing panels at greater distances with less noise.
- **APM Power Management—**The MiniModule/VFP-III controller supports Advanced Power Management features, such as “panel off” mode and a “standby” mode. Panel off mode allows the powering-down of the display interface while maintaining the system interface to display memory and internal registers. Standby mode allows both the display and system interface to be powered-down. The board also supports the VESA DPMS standard, for displays that are compliant with this standard. These features are particularly valuable for battery-operated embedded systems.

- **Vee Bias Supply (option)—**You can install an external voltage converter board to provide an adjustable ±15V to ±35V at 30 mA for the Vee supply required by some LCD flat panels. The voltage adjustment control (which can be implemented with an external potentiometer) can be used as a contrast adjustment for LCD panels.
- **Power Sequencing Logic—**Some LCD flat-panel displays are extremely sensitive to the sequence in which power and control signals are applied at power up. Erroneous sequencing can reduce the life span or directly damage some panels. The MiniModule/VFP-III controller provides power-sequencing circuits for safe panel operation. It can switch the +5V and +12V supplies to the panel under control of the video controller. It also properly sequences application of the Vee bias supply voltage.
- **PC/104-*Plus* compliant 32-Bit Interface to the PCI Bus**—The MiniModule/VFP-III controller has a 32-bit PCI Bus interface, compliant with the PC/104-*Plus* specification.

Enhanced Reliability

Reliability is especially important in embedded computer systems. Ampro, specializing in embedded system computers and peripherals, knows that embedded systems must be able to run reliably in rugged, hostile, and mission-critical environments without operator intervention. Over the years, Ampro has evolved system designs and a comprehensive testing program to ensure a reliable and stable system for harsh and demanding applications. These include:

ISO 9001 Manufacturing. Ampro is a certified ISO 9001 vendor.

Regulatory testing. Knowing that many embedded systems must qualify under EMC emissions and susceptibility testing, Ampro designs boards with careful attention to EMI issues. Boards are tested in standard enclosures to ensure that they can pass such emissions tests. Tests include European Union Directives EN55022 and EN55011 (for EMC), EN61000-4-2 (for ESD), ENV50140 (for RF Susceptibility), and EN61000-4-4 (for EFT). Conducted Emissions testing is also performed at US voltages per FCC Part 15, Subpart J (the European Union Directives are otherwise compatible with Part 15 testing).

Wide-range temperature testing. Ampro Engineering qualifies all of its designs by extensive thermal and voltage margin testing.

Shock and Vibration Testing. Boards intended for use in harsh environments are tested for shock and vibration durability to MIL-STD 202F, Method 213-I, Condition A (three 50G shocks in each axis) and MIL-STD 202F, Method 214A, Table 214-I, Condition D (11.95B random vibration, 100 Hz to 1000 Hz). (Contact your Ampro sales representative to obtain *Shock and Random Vibration Test Report for the Little Board/P5x CPU* for details.)

Operating Modes

The MiniModule/VFP-III provides full VGA, EGA, CGA, and MDA video BIOS compatibility. All of the standard PC video software (emulation) modes are supported. In addition, a set of VESA SuperVGA modes is provided. See Table 1-1 for a summary of supported display modes. A more detailed table is provided in the Specifications section later in this chapter.

Table 1-1. Video Mode Summary

Video Standard	Resolution	Colors
CGA Graphics	320 x 200	4
	640 x 200	2
CGA Text	640 x 200	16
MDA	720 x 350	Mono
EGA	640 x 350	16
VGA	320 x 200	256
	640 x 480	16
VESA (Standard SuperVGA)	640 x 480	256
	640 x 480	32K
	640 x 480	64K (High color)
	640 x 480	16M (True Color)
	800 x 600	256
	800 x 600	32K
	800 x 600	64K (High color)
	800 x 600	16M (True Color)
	1024 x 768	16
	1024 x 768	256
	1024 x 768	32K
	1024 x 768	64K (High Color)
	1280 x 1024	16
	1280 x 1024	256
	1600 x 1200	16
	1600 x 1200	256

Specifications

This section lists the technical specifications of the MiniModule/VFP-III controller.

Display Support

CRT Displays

The MiniModule/VFP-III controller supports high resolution fixed frequency and variable frequency analog monitors in either interlaced or non-interlaced modes. Monitors supplied with either 9-pin or 15-pin D-Sub connectors can be used (with an appropriate "transition" cable).

Support for digital monitors (such as EGA and CGA) is not provided.

Flat-Panel Displays

The MiniModule/VFP-III display controller supports all flat-panel display technologies including plasma, electroluminescent (EL), and LCD. LCD panel types include single panel-single drive (SS), and dual panel-dual drive (DD) configurations. The file **PNL-SUPP.TXT** on the Utility disk describes all supported panels.

Note

Panel technology is changing rapidly. Flat-panel support will change from time to time to maintain compatibility with current panel technology. Contact the Ampro web site in the Technical Support Section (www.ampro.com/support) for a list of the currently supported panels for the VFP-III.

Physical Specifications

- Size 3.6 x 3.8 x 0.6 inches (90 x 97 x 15 mm)
  (Compatible with the PC/104-*Plus* specification.)
- Weight 3.0 oz. (84 gm)

Power Specifications

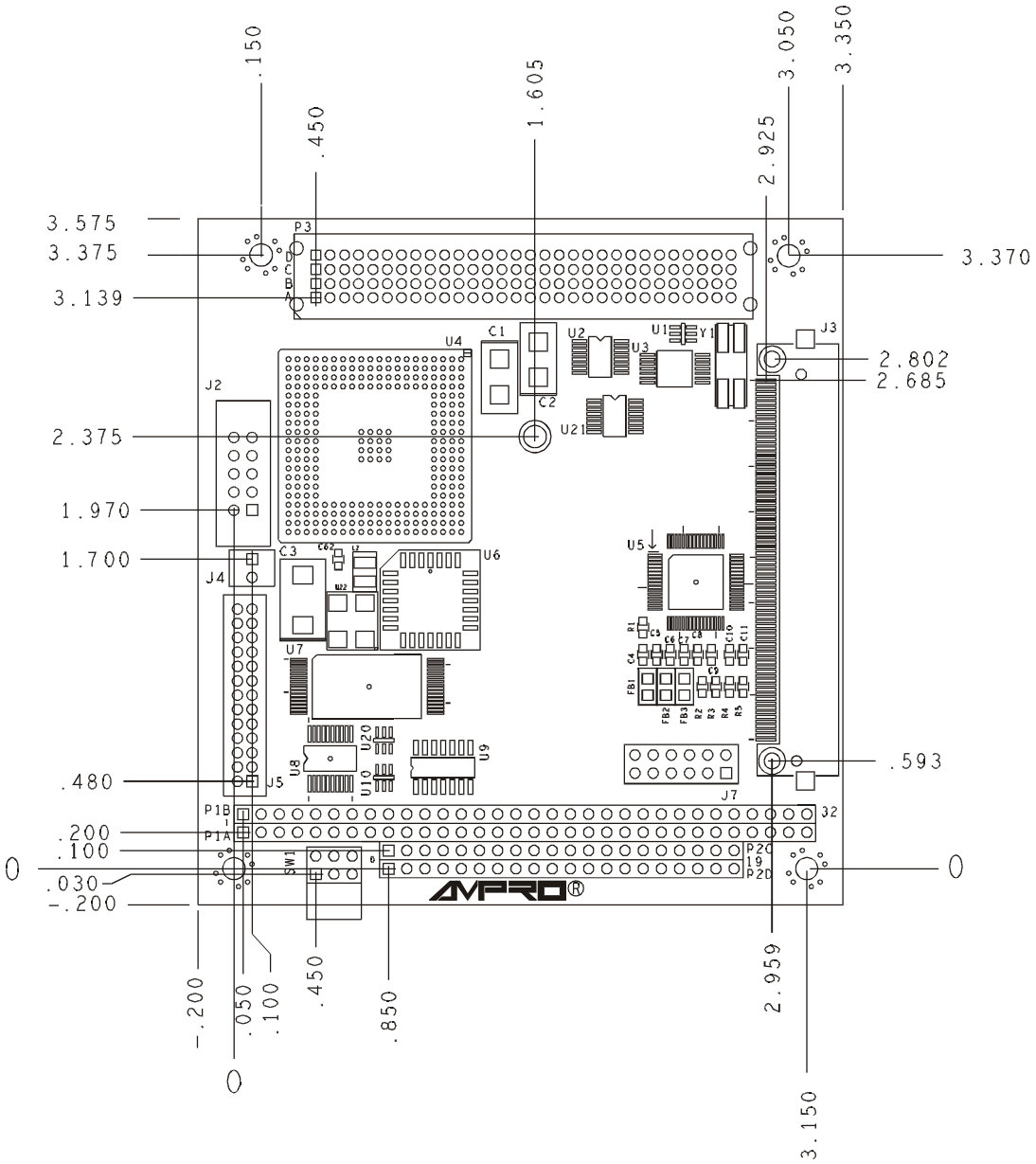
- Power consumption 1.7 w, typical @ 5 VDC ±5%
- Power consumption, Standby Mode 0.3 w, typical @ 5 VDC ±5%

Operating Environment

- Operating Temperature Range: 0° to 70° C; extended temperature range can be tested by special order
- Humidity: 5 to 95% relative humidity (non-condensing)
- Storage temperature: -55° to +85° C

Caution

Most flat panels have a maximum operating temperature of +55°C or less.



All dimensions are in inches.

Figure 1-1. Mechanical Dimensions

Chapter 2

Configuration and Installation

Introduction

This chapter describes how to configure, connect, and install the MiniModule/VFP-III controller. The information is presented in sections, in the following order:

- Board configuration—How to set the slot position switch.
- CRT interfacing—How to connect a CRT monitor to the MiniModule/VFP-III controller.
- Flat-panel interfacing—How to connect flat panels to the MiniModule/VFP-III controller.
- Installation—How to install a MiniModule/VFP-III controller in a Little Board- or CoreModule-based embedded system.

Board Configuration

Use the rotary switch SW1 to configure the module's PCI slot position in the module stack. Each PCI peripheral card must have a unique address. Table 2-1 summarizes the settings of the Rotary switch SW1.

Table 2-1. SW1 Settings

Switch Position	Module Slot	REQ	GNT	CLK	IDSEL	ID Address	INT0	INT1	INT2	INT3
0 or 4	1	REQ0	GNT0	CLK0	IDSEL0	AD20	INTA	INTB	INTC	INTD
1 or 5	2	REQ1	GNT1	CLK1	IDSEL1	AD21	INTB	INTC	INTD	INTA
2 or 6	3	REQ2[1]	GNT2[1]	CLK2	IDSEL2	AD22	INTC	INTD	INTA	INTB
3 or 7	4	REQ2[1]	GNT2[1]	CLK3	IDSEL3	AD23	INTD	INTA	INTB	INTC

Note 1

Because module slots 3 and 4 share REQ2/GNT2, they cannot both be bus master devices.

The switch setting indicates the PCI slot occupied by this module. It must be unique with respect to the setting of any other PCI module in the stack.

CRT Interfacing

The MiniModule/VFP-III controller provides analog output for a CRT monitor at the dual row 10-pin connector, J2. Only analog monitors are supported. Older TTL-type monitors cannot be used.

Analog monitors with either 15-pin or 9-pin interfaces can be used. J2 accepts a 10-wire flat ribbon cable made with an IDC (Insulation Displacement) connector on one end and either a DB9S D-Sub connector or a DB15S D-Sub connector on the other. A DB15S version, compatible with most VGA monitor pinouts, is supplied with the MiniModule/VFP-III controller Development Kit. It functions as a “transition connector” between J2 and the standard 15-pin CRT cable connector supplied with most VGA monitors.

VGA CRT Connector (J2)

A DB9S connector's signal pinout is compatible with some multifrequency CRT monitors equipped with male DB9S cables. The cable is simple to make because the wires on J2 are arranged to allow a straight-through connection to an IDC DB9S connector. Table 2-2 shows the signals available at J2, and shows the standard wiring for DB9S and DB15S video cables.

A 17-inch version of the DB15S cable is available from Ampro. Contact your Ampro sales representative for details.

Table 2-2. VGA CRT Connector (J2)

J2 Pin	Signal	DB9S Pin	DB15S Pin
1	Red	1	1
2	Analog Ground	6	6
3	Green	2	2
4	Analog Ground	7	7
5	Blue	3	3
6	Analog Ground	8	8
7	Hsync	4	13
8	Analog Ground	9	10
9	Vsync	5	14
10	Key Pin	-	4,5,9,11,12,15

Note

Keep the ribbon cable as short as possible. An unshielded ribbon cable longer than 24 inches may result in blurred video, especially in high-resolution modes.

The VGA output signals are conditioned with ferrite beads on the board to minimize EMI (electromagnetic interference) emissions. Still, care should be taken to shield the embedded system and the video output cables to keep emissions as low as possible. Regulatory agency (such as the FCC in the U.S.) regulations may apply to systems built with the MiniModule/VFP-III controller. It is the responsibility of the OEM to make their systems compliant with emissions regulations in their locale.

Flat-Panel Interfacing

All the signals needed for a wide variety of flat panels, monochrome, STN color, TFT color, and others are provided on J3. It is an 80-pin connector designed to accept a dual 40-pin ribbon cable.

The flat-panel interface signals appear at the connector as shown in the two tables below. Signal names vary from panel to panel, as there is no generally agreed upon standard among flat-panel manufacturers. Examples of some typical names used by various panel manufacturers are shown in the right-hand column. Together they should provide enough information to connect any flat panel.

Flat Panel Interface Connector (J3)

Table 2-3 lists the signals available on the flat panel interface connector, J3. Table 2-4 shows examples of mating connectors for J3.

Caution

Although flat panels of a similar type use similar sets of signals from the video controller, they do not share a standardized interface connector pin configuration. Read the description of each signal carefully to determine how each signal is to be used for the display you choose. Refer to the panel manufacturer's technical literature to determine how to wire a cable for the panel you choose for your application.

Table 2-3. Flat Panel Video Connector (J3)

PIN	Signal Name	Description
A1	FLM	First Line Market. Flat panel equivalent to VSYNC
A2	SHFCLK	Shift Clock. Pixel clock for flat panel data.
A3	M	Signal for panel AC drive control. Can also be configured as Display Enable (DE) for TFT panels.
A4	LP	Latch Pulse. Flat panel equivalent to HSYNC.
A5-A28	FP0-23	Flat panel video data 0 though 23, in order.
A29	VDDSAFE	Switched V_LCD supply for panel power.
A30	+12SAFE	Switched +12 Volt supply for panel power.
A31	VEE	Switched VEE supply to panel (from LCD bias supply option board).
A32	ECON	External contract adjustment. This signal is input to the LCD bias supply option board, to allow for adjustment of the Vee voltage with an external potentiometer.
B1-12	FP24-35	Flat panel video data 24 though 35, in order.
B13	EBKL-OC	Enable backlight control. Active low, open collector.
B14	ENABKL	Enable backlight control. Active high.
B15	ENAVEE	Enable Vee control. Active high.
B16	ENAVDD	Enable Vdd control. Active high.
B29,31	V_LCD	Unswitched supply for panel power.
B33,34	TXP0,TXN0	PanelLink™ twisted pair, channel 0.
B35,36	TXP1,TXN1	PanelLink™ twisted pair, channel 1.
B37,38	TXP2,TXN2	PanelLink™ twisted pair, channel 2.
B30,40	TXPC,TXNC	PanelLink™ twisted pair, clock.
B17,18	+5	+5 Volt supply.
B25,27	+12	+12 Volt supply.
A33-40 B19-24, B26,28 B30,32	GND	Ground.

Table 2-4. J3 Mating Connectors

Connector Type	Mating Connector
RIBBON	HIROSE FX2BA-80S-1.27R

Power Sequencing

IMPORTANT: Some LCD flat panel displays can be damaged when the Vee bias supply is applied to the LCD substrate without first enabling the control and data lines. This can damage the panel or reduce its operational life. The video controller provides signals for sequencing the power in the proper order to protect the panel from these effects. The MiniModule/VFP-III supports automatic sequencing of Vdd (+3.3V), VEE, and +12V (for an external backlight power inverter). If you use an external Vee supply, you must enable the power using the sequencing signal ENAVEE. Similarly, use ENAVDD, and ENABKL to switch Vdd and the backlight power supply.

Advanced Power Management

The same signals that support power sequencing are also used to provide advanced power management features. In “panel off mode” both the CRT and flat-panel interface are turned off, but the VGA subsystem (registers and display memory) remains powered. In “standby mode”, the CRT and flat-panel interfaces are turned off, and in addition, the VGA subsystem is turned off. The controller is placed in a low-power mode in which only the DRAM is refreshed. To take advantage of the power savings modes, you must control the panel’s power supplies with the power sequencing signals on connector J3, or use the "switched" power signals provided on this connector.

LCD Bias Supply Option (J7)

The LCD Bias Supply option is a small circuit board that supplies Vee power to a LCD display. The board converts the +5V from the MM/VFP-III to the Vee voltage (between 15V and 35V, negative or positive) required by some LCD panels, and makes this voltage available on the flat-panel connector J3. It uses the signal, ENAVEE, to apply Vee power to the panel in the proper sequence with other signals. In addition, the board provides a contrast control as well as a way of providing and external contrast control.

The Ampro LCD Bias Supply option mounts parallel to the MM/VFP-III, connected to the board via a 12-pin connector, J7. You secure the board to the MM/VFP-III using a 0.3-inch standoff.

Table 2-5 shows the connector pinout for J7 with a description of each signal. Some of its output signals also appear on the flat panel connector, J3.

Table 2-5 LCD Bias Supply Option Connector (J7)

J7 Pin	Description
1	Ground.
2	+5V to the Vee Supply Option board.
3, 10	Key Pin
4	Ground.
6	Enable Vee—TTL control Signal, driven by the VGA controller chip.
8	Ground.
11	Vee Output, to panel.
12	External contrast adjustment Input.

Selecting Vee Polarity

Most LCD displays require a Vee supply of between 15V and 35V. Some panels need a negative supply, and some a positive supply. The LCD Bias Supply Option provides a jumper for selecting the Vee output polarity. To select the polarity for the panel you will be using, set the jumper on W1 as follows:

- Negative Vee W1=1/2
- Positive Vee W1=2/3

Note

Incorrect Vee polarity or voltage can damage a LCD panel. Set the polarity and voltage on the Vee supply before connecting the LCD panel.

Attaching an External Contrast Control

Vee controls the contrast of the LCD display. (Do not confuse this with a backlight, which illuminates the screen using one or more fluorescent tubes. Backlights generally require a high voltage AC supply.)

The LCD Bias Supply board control (R1) allows you to set the precise Vee voltage for the contrast you require. However, you may want to provide a more accessible Vee control so that users can set the display contrast to accommodate various ambient lighting conditions. The board provides a jumper and control signal to allow the attachment of a remote potentiometer for this purpose.

- To use the contrast potentiometer on the LCD Bias Supply board, install a jumper on W2.
- To use an external potentiometer, remove the jumper from W2, and attach the circuit shown in Figure 2-1 between J3-A32 and ground.

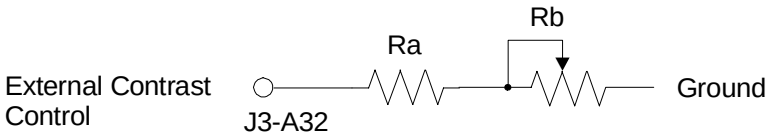


Figure 2-1. External Contrast Adjustment for LCD panels

Select **Ra** and **Rb** to provide the appropriate voltage range adjustment for the LCD panel you are using. Consult your panel's technical literature for the range of voltages you need to supply for the contrast adjustment. Use the following formulae to calculate the resistor values (in K Ohms).

$$R_a = \frac{270}{(V_{ee}\min / 1.5) - 1} - 12$$

$$R_b = \frac{270}{(V_{ee}\ \min / 1.5) - 1} - 12 - R_a$$

Example:

Suppose the following values are shown in the panel's data sheet:

Vee Max = 24 V

Vee min = 20 V

Calculate the required resistor values as follows:

Ra = (270 / ((24 / 1.5) - 1)) -12

Ra = 6K Ω

Rb = (270 / ((20 / 1.5) - 1)) -12 - 6

Rb = 3.9K Ω

Zoom Video Port Interface (J5)

The Zoom Video Port is a PCMCIA standard for video input. The ZV port can receive video data in either RGB or YUV format. the input data can be scaled, positioned, and can overlay the VGA data stream. It can use color keying for non-rectangular windowing, or X-Y keying.

For more information about the ZV port and its uses, read the application notes for the Chips and Technologies 69000 video controller, available at their Web site, www.chips.com.

J5 is a high density latching connector. Table 2-6 lists the signals and pin numbers for J5 and Table 2-7 lists a compatible mating connector.

Table 2-6. ZV Port Connector (J5)

J5 Pin	Name	Function
1 - 16	VP0 - VP15	Video Data Inputs
18	VREF	Vertical Reference Input
20	HREF	Horizontal Reference Input
22	VCLK	Video Click Input
24	VRDY	Video System Ready Input
26	PCLK	Video Port Clock Output
17, 19, 21, 23, 25	Ground	

Table 2-7. J5 Mating Connector

Mating Connector
Molex 51110-2651

TV Composite Video Interface (J4)

As a option, the MM/VFP-III can provide a composite video output that is capable of driving a standard television (NTSC or PAL). The Friction Lock Header (J4) allows connection of a transition cable that interfaces to the standard video connector of a TV.

A utility program on the utility diskette allows the TV out mode to be enabled. Table 2-8 lists the connector pinout and Table 2-9 lists a compatible mating connector.

Table 2-8. Transition Cable Pinout

Pin	Function
1	Composite Video
2	Ground

Table 2-9. J4 Mating Connector

Connector Type
MOLEX 10-11-2023

Board Installation

The MiniModule/VFP-III controller can be assembled with other compatible components in a variety of ways.

- It can be a part of a CoreModule and MiniModule stack.
- It can plug onto the PC/104-*Plus* Bus connector of an Ampro Little Board CPU.
- It can plug onto a custom carrier board designed and built by an OEM. (Such a carrier board could also support an Ampro CPU module and other MiniModule expansion boards, as well as other PC/104 expansion boards.)

The module is supplied with P1, P2, and P3 *stackthrough* connectors, so it can easily occupy any position in a stack of boards used in a PC/104-*Plus* compliant embedded system.

Use the appropriate spacers to secure the module to its parent or companion boards. Typically, 0.6 inch spacers are used. This conforms with the PC/104 mounting specifications.

To install the display controller:

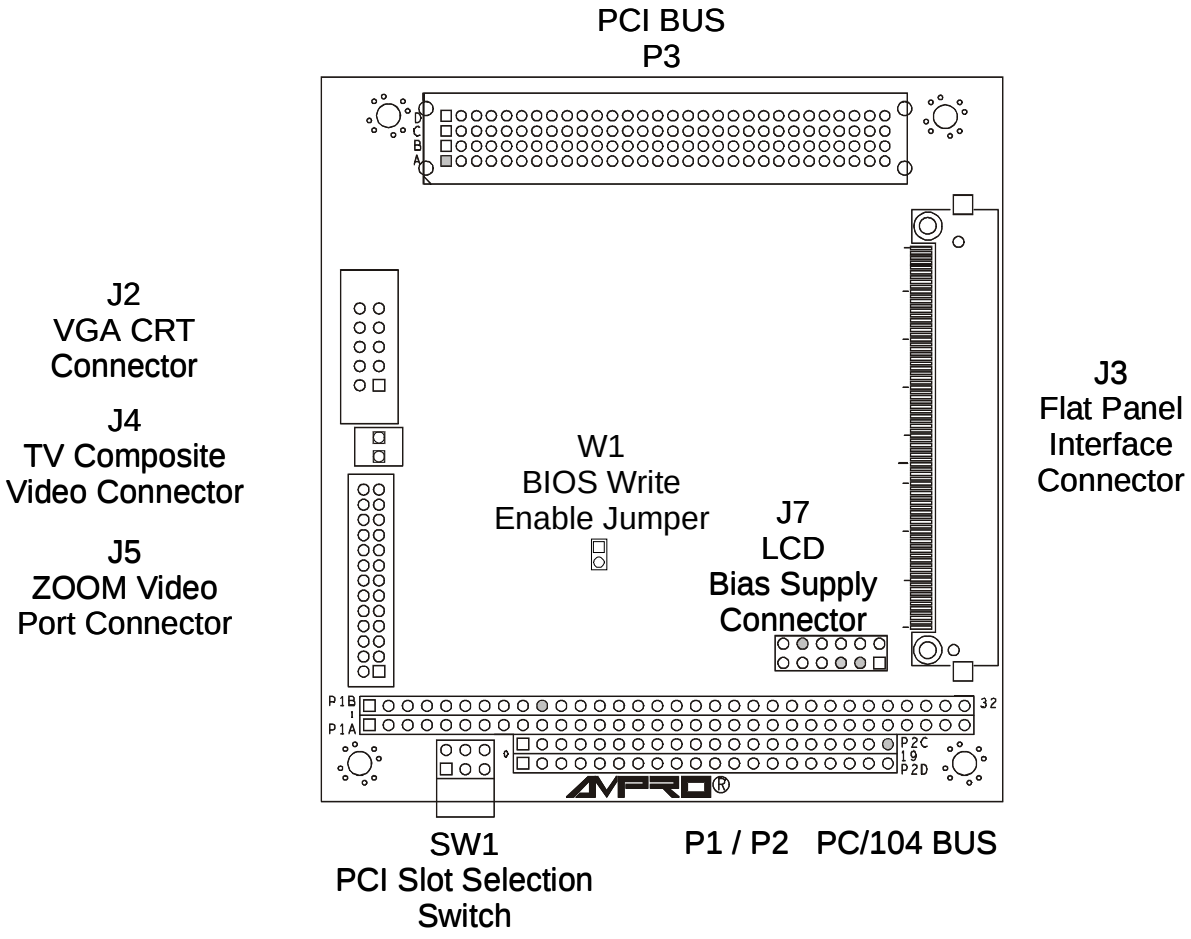
1. Set any jumpers, as described earlier in this chapter, see Figure 2-2.
2. Plug the MiniModule/VFP-III controller bus headers P1, P2, and P3 onto the corresponding host connectors, see Figure 2-2.

Note

Be sure to align the module's bus connectors to the host's bus connectors correctly. If misaligned, damage to the system could occur when power is applied.

3. Use the spacers and associated hardware provided with the module to secure the module to the host board.
4. Connect the cables between the MiniModule/VFP-III controller and the display. In some space-limited applications, it may be necessary to connect cables before installing the board on the host. Note that most connectors on the board provide a “key pin” position, where a male pin is removed and its corresponding receptacle is blocked. Cables and board connectors supplied by Ampro use this feature to help prevent connector misalignment during installation.
5. In flat-panel systems, be sure to provide all the appropriate voltages for the flat panel. “Safe” supplies, where the supplies are fused, are preferred.

Initially you may want to connect a CRT to the MiniModule/VFP-III controller and then modify the video BIOS for the flat panel you will be using. BIOS modification is discussed in Chapter 3.



Gray pins indicate key pins.

Square pin is Pin One.

Figure 2-2. Connector and Jumper Locations

Chapter 3

Operation

Introduction

This chapter discusses operation of the MiniModule/VFP-III controller from a software point of view. It describes:

- How to reprogram the video BIOS to select a flat-panel BIOS.
- How to use the display controller in high-resolution SuperVGA modes.
- How to use the programs provided on the Utility Disk.

Installing a Flat-Panel BIOS

The MiniModule/VFP-III controller comes with a standard VGA video BIOS programmed for an analog multifrequency CRT display and up to 16 flat panel displays. The default flat panel display selection is the Sharp LM64K101 monochrome VGA LCD flat panel. (Read the **PNL-SUPP.TXT** file for a description of flat panel displays supported by the BIOS.)

When the board is initialized during POST (Power On Self Test), both the CRT and the LCD panel become the display console for the computer. They display the same information simultaneously. Either or both displays can be left disconnected, since the display controller does not sense whether or not a display is attached.

All the standard VGA video modes are supported in the standard video BIOS. In addition, standard SuperVGA and VESA modes are supported by proprietary Chips and Technologies video drivers. The VESA video driver is built into the standard video BIOS. The VESA modes work with both the CRT and flat-panel BIOS's and is described later in this chapter.

The standard video BIOS supports power sequencing and power management functions. Power sequencing, essential for LCD displays, is implemented by control signals ENAVEE, ENABKL, and ENAVDD. These signals control the onboard power switches that condition the Vee supply, the +12V backlight supply, and the VDD supply. You can use these signals to control external power switches as well. The signals are set at POST when the board is being initialized.

If you plan to use a panel other than the default monochrome LCD panel, you can select one of the BIOS-supported panels using the PNL-SEL3 utility and reprogram the onboard Flash device with a reconfigured BIOS image.

You can also create a custom BIOS for a new panel using the MiniModule/VFP-III controller video BIOS Development Kit, supplied by Ampro. (Contact your sales representative for details.)

BIOS Programming Procedure

The following procedure describes how to select a particular flat panel from those supported by the standard BIOS's.

1. Select the video BIOS file you will program into the onboard Flash device. Select also the particular panel you will use in your system that is supported in that BIOS file. Use the information found in the file **PNL-SUPP.TXT**, on the Utility disk to make your selections. Note the *panel number* for the panel you choose. Video BIOS files are named *filename*.dat on the disk.
2. Remove EMM386, HIMEM, and other extended memory managers from your CONFIG.SYS or AUTOEXEC.BAT files. No extended memory managers can be loaded. (You must reboot the system for any changes to take effect.)

Note

Make a backup copy of your utility disk, especially the filename.dat files. The PNL-SEL3 utility modifies the filename.dat file.

3 Run the panel selection utility by entering the following command at the DOS command line:

PNL-SEL3

The program prompts you for the BIOS filename and panel number. For example, to select the Sharp LQ12S08 panel, use the file A000-101.DAT and panel number 8 (as indicated in the **PNL-SUPP.TXT** file).

PNL-SEL3 will write a modified version of A000-101.DAT, replacing the original version.

4 Using the CPU's SETUP facility, verify that the D000 memory segment is available. BIOS programming will not work if some other device is occupying this memory.

5 To reprogram the video BIOS, enter the following command at the DOS prompt:

VFP3PGM *filename*.**dat**

where *filename*.dat is the name of the video BIOS image file you modified with the PNL-SEL3 utility.

It should only take a few seconds to program the video BIOS. At completion, the system speaker beeps and the system reboots. During the programming cycle, the video BIOS cannot function, so VFP3PGM.COM does not write informative messages to the screen.

Troubleshooting a Video BIOS Installation

It should become obvious immediately whether or not a new video BIOS is functioning properly by observing the display (assuming the display is connected properly). Of course, there is always a slight chance that something will happen when reprogramming the video BIOS that leaves the board in a non-functional state. Here are a few suggestions to help recover from a programming error:

- As a precaution, it is helpful to have a bootable diskette prepared that has VFP3PGM.COM, the standard video BIOS, and an AUTOEXEC.BAT to automatically reprogram the video BIOS at boot time. Then, should programming fail, the system could be reset and the standard BIOS would be automatically reinstalled by booting from the special diskette.
- Ampro CPU's provide a SETUP option that lets you use a CRT terminal as a “serial console”. This could provide a useful means of controlling the computer system during flat-panel installation. Details about using the serial console option are provided in the CPU's Technical Manual.

External Video Overlay (Zoom Video)

The video controller supports up to 16 bits of external RGB or YUV video data that can be input and merged with the internal VGA data stream through the Zoom Video port (J5). This PCMCIA standard interface allows you to display “live” video on flat panel displays.

The controller supports two forms of video windowing:

1 Color key input

2 X-Y window keying

Color key input is the familiar video overlay technique in which a particular color is designated as a “key” for switching between two video sources. The Zoom Video interface provides for an externally generated color key signal input, which switches between the external video source and internally generated video.

X-Y window key input can be used to position the live video window coordinates.

Controlling the Display

The MiniModule/VFP-III controller provides all standard VGA functions. Software should work properly with all standard modes. The module also has enhancements to operate in SuperVGA modes in the same manner as normal modes. Access to SuperVGA modes should be made through the VESA video BIOS extension, a TSR program. The VESA driver is described in a following section. In addition, there are flat-panel-specific controls that can be used to optimize the display. These are managed by utilities supplied on the Utility Disk.

The MiniModule/VFP-III controller does not require any jumpering changes to switch display modes, nor are there jumpers to indicate what kind of display is connected. There is no monitor sensing circuitry on the board, as this tends to get in the way when configuring for embedded applications. All mode switching and configuration are either set by defaults programmed into the video BIOS or switched by utility programs. The initial display mode, set in the video BIOS, defaults to VGA mode 03, 80 column x 25 row text unless set up otherwise. The resolution you see on the display is a function of the mode you select and the resolution of the display device.

Using Third Party Graphics Products

Another way to control the screen display is to use third-party products. Third party software often includes source code or a portable run-time library of graphics functions that the OEM can use to produce a wide range of visual effects.

The following graphic libraries may be used with the MiniModule/VFP-III controller when using resolutions up to 1024 X 768. They are compatible with Borland's *Turbo C* and *Turbo Pascal*, and with Microsoft *C* and *Pascal*. (These popular languages also have some graphic support software included in their packages.)

- *Essential Graphics, Version 4.0,* South Mountain Software. Phone: 201-762-6965
- GX Graphics, PCX Programmer's Toolkit, PCX Effect, GENUS Microprogramming. Phone: 713-870-0737
- *HALO Professional*, Media Cybernetics. Phone: 800-992-4256
- *MetaWINDOW/PLUS*, Metagraphics. Phone: 408-438-1550

The software landscape changes continually. You may find these two software product catalog/buyer's guides helpful in locating additional graphic libraries and products:

- *The Connection*, published quarterly by Programmer's Connection Inc. 7249 Whipple Ave. NW, North Canton, Ohio 44720-7143. Phone: 800-336-1166.
- *The Programmer's Shop*, published quarterly by SDC Communications 90 Industrial Park, Hingham, MA 02043. Phone: 800-447-8041.

Using Ampro-Supplied Utilities

The following programs are supplied on the Utility disk:

CT.COM, **FP.COM**, and **SM.COM**—These are three simple utilities that switch between displays. They are useful when you have both a CRT and flat panel connected to the MiniModule/VFP-III. CT switches to the CRT and disables the flat panel. FP switches to the flat panel and disables the CRT. SM displays on both the CRT and flat panel simultaneously.

PNL-SEL3.COM—This utility modifies a video BIOS file (*filename*.dat) to select for one of the several supported flat panels. Use of this program is described earlier in this chapter.

VFP3PGM.COM—This is the Flash programming utility used to write a video BIOS file (*filename*.dat) into the onboard Flash device. Use of this program is described earlier in this chapter.

DEBUGVGA.EXE—This is a general-purpose video utility that can be used to test and troubleshoot your video subsystem. For a description of the various command parameters you can use, refer to the file DEBUGVGA.TXT on the Utility disk.

Using Standard Video BIOS Functions

To program the graphics controller you may use the built-in low level functions in the video BIOS. Using this programming interface, you can control the video display modes, the cursor position, set the colors in the color palette, and read and set a number of other controller characteristics. All calls to the video BIOS are made through software INT 10h. When you make the call, the contents of CPU register AH determines the primary function and the contents of the AL register determines a secondary function.

Table 3-1 provides an overview of the INT 10h functions. The table shows the AH register value paired with the primary function it selects.

Table 3-1. Video BIOS Function Calls

AH Value	Function
00	Mode set
01	Set cursor type
02	Set cursor position
03	Read cursor position
04	Read light pen position (not supported)
05	Select active display page
06	Scroll active page up
07	Scroll active page down
08	Read character at current cursor position
09	Write characters at current cursor position
0Ah	Write characters only at current cursor position
0Bh	Set color palette
0Ch	Write dot
0Dh	Read dot
0Eh	Write teletypewriter to active page
0Fh	Return current video state
10h	Set palette registers
11h	Character generator routine
12h	Alternate select
13h	Write string
1Ah	Display combination code
1Bh	Return functionality/state information
1Ch	Save/restore
14h-19h	Reserved

Using the VESA Video Modes

VESA video modes are supported in the video BIOS supplied with the board. No external VESA driver is required. VESA support is a part of the standard video BIOS interrupt, INT 10h. To select a VESA mode, you always supply a 4Fh function code in the AH register and a subfunction code in the AL register when executing an INT 10h call. When the function returns status information is in register AX. The format of the return status is:

AL = 4Fh — If the function is supported by the VESA BIOS

AH = 0 — Indicates success

AH > 0 — Indicates the function call failed. Typically:

AH = 1 is returned for a failure

Values 2 through FFh are considered *reserved*.

The following list summarizes the VESA functions provided in the VESA portion of the video BIOS. For complete details, obtain a copy of the actual VESA specification at the address specified at the end of this chapter. VESA display modes are listed in Table 1-1.

Function 00 — Return super VGA information

Function 01 — Return super VGA mode information

Function 02 — Set the super VGA display mode, where

BL = display mode number

BH bit 0: 1 = Not VESA mode, 0 = VESA mode true

BH bit 7: 1 = preserve display memory, 0 = clear memory

Function 03 — Return current display mode

BX returns the current display mode

Function 04 — Save/restore super VGA video state

DL = 0: Return state buffer size

DL = 1: Save super VGA video state

DL = 2: Restore super VGA video state

Function 05 — Display memory window control

BH = 0: Select display memory page

BL = 0: Window A, BL = 1: Window B

DX = Starting page boundary address

BH = 1: Return current display memory page

BL = 0: Window A, BL = 1: Window B

DX returns page boundary address

Video Controller Hardware Resources

This section describes the hardware resources used by the MiniModule/VFP-III controller. This section contains a memory map of the MiniModule/VFP-III controller and the I/O addresses you may need when assembling an embedded system. The information in this section is a summary. For complete details of memory and I/O port usage, you will need to consult the technical information supplied in the Chips® 69000 Data Sheet. You can obtain the data sheet from Chips & Technology, Inc; their web site is at www.chips.com.

OEMs should consider the long-term implications of using *unique* registers and functions in the graphics controller chip. The market and technology for graphics controllers and other PC-related technology changes rapidly. There is always a chance that the particular graphics chip used on the MiniModule/VFP-III controller will change. Embedded systems tend to be long lasting and stable environments, and changes in technology are often disruptive. The VGA standard is quite stable, and the *standard* VGA hardware registers and video BIOS specifications are quite stable and are not likely to change. Whenever possible, it is better to write software to a *virtual interface* such as the VGA video BIOS or the VESA BIOS extension, since these insulate the software from the underlying hardware. If you need to make changes to the controller chip registers, incorporate the changes into the BIOS using the MiniModule/VFP-III controller Video BIOS Development Kit. (Contact your Ampro sales representative to obtain a MiniModule/VFP-III controller video BIOS Development Kit.)

Memory Map

Table 3-2 shows a typical memory map for a system composed of an Ampro CPU module and the MiniModule/ VFP-III.

Table 3-2. Typical System Memory Map

Memory Address	Function
F0000-FFFFFh	PC CPU ROM-BIOS
D0000-EFFFFh	SSD Sockets and expansion boards (on Ampro products, if enabled)
CA000-CFFFFh	Empty
C0000-CBFFFh	44K video BIOS
A0000-BFFFFh	Video Screen RAM
00000-9FFFFh	640K bytes onboard DRAM for programs

I/O Map

Table 3-3 lists the I/O port addresses used on the MiniModule/VFP-III display controller.

Table 3-3. I/O Port Address

Function	I/O Port Address (Hex)
Ampro Reserved	276h, 277h
General Registers	3BAh or 3DAh, 3CAh, 3C2h, 3CCh
Reserved Registers	3C6h to 3C9h
Sequencer Registers	3C4h and 3C5h
CRTC Registers	3B4h to 3B5h or 3D4h to 3D5h
Graphics Registers	3CEh to 3CFh
Attribute Registers	3C0h to 3C1h
Extension Registers	3D6h, 3D7h

The I/O addresses 276h and 277h are unique to the MiniModule/VFP-III controller. They are used for internal control only and should not be used by OEMs.

Useful Names And Addresses

The following names and addresses are provided to help you obtain additional technical information:

Video Electronics Standards Association (VESA)
1330 South Bascom Avenue, Suite D
San Jose, CA 95128
Phone: 408 971-7525

Chips & Technologies
2950 Zanker Road
San Jose, CA 95134

69000 Data Sheet
Publication: DB181.2
Stock number: 010-181-002

PC/104 Consortium
849 Independence Avenue, Suite B
Mountain View, CA 94043
Telephone: 415 903-8304
FAX: 415 967-0995

For more detailed information about using the VGA video BIOS, get one of the many popular books on the subject such as:

Advanced Programmer's Guide to SuperVGAs
by George Sutty and Steve Blair
Brady publication, Simon & Schuster, New York.

Tricks of the Graphics Gurus
Sams Publishing
Division of Prentice Hall, Carmel, Indiana

The C Graphics Handbook
Roger T. Stevens
Academic Press, San Diego, California

Bitmapped Graphics Programming in C++
Mark Luse
Addison Wesley, Menlo Park, California

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