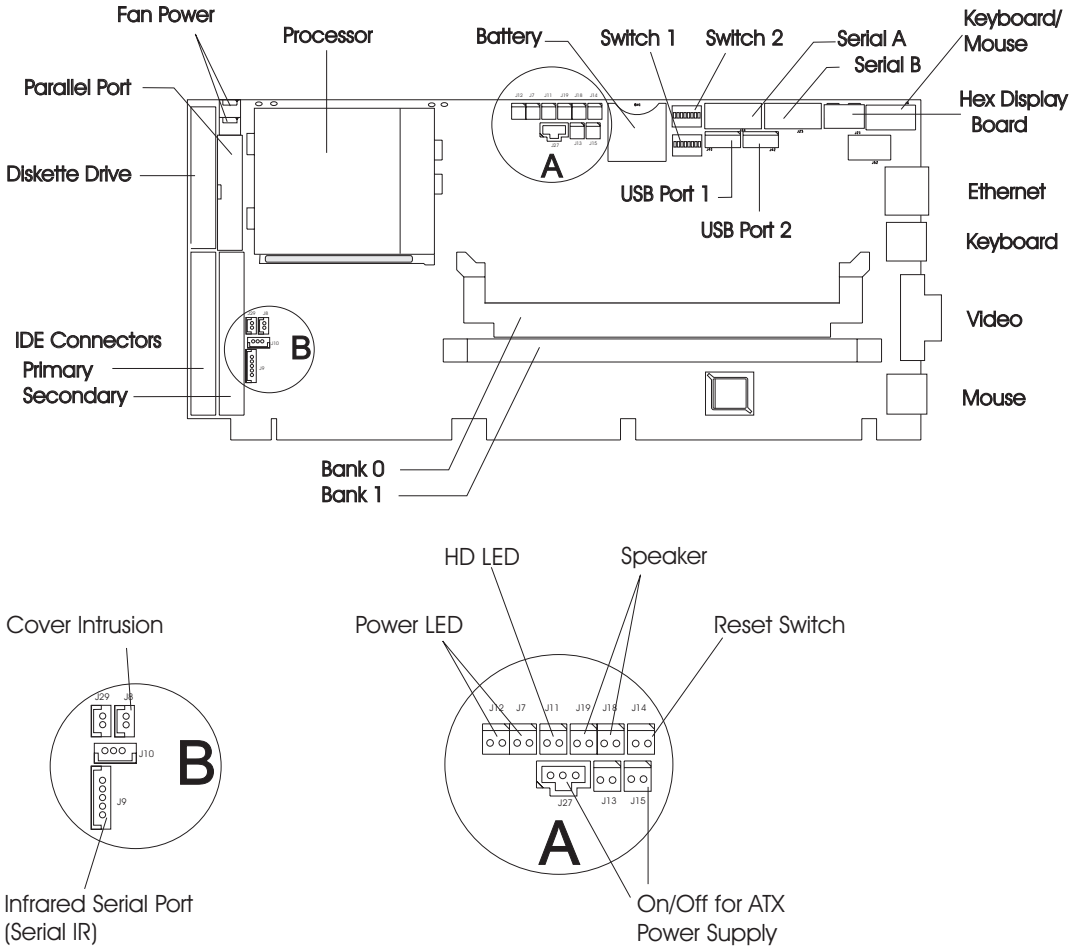
Chapter 6. IBM 586VE Single-Board Computer

The IBM 586VE Single-Board Computer (SBC) is a 586-class single-board computer designed for use in ruggedized applications, such as the embedded products and complete systems offered by IBM.

The following are the features of the SBC.

- Processors—the SBC automatically adjusts the processor core-voltage during POST
  - Pentium® processors up to 200 MHz
  - Pentium processors with MMX up to 233 MHz
  - AMD K6-2 or K6-3 processors up to 500 MHz
- 512 KB level 2 cache
- 32 MB to 384 MB of synchronous DRAM
- Selectable processor, memory-bus, and PCI-bus clocks
  - Processor-input clock: 60, 66, 75, 83 MHz
  - Memory-bus (host-bus) clock: 60, 66, 75, 83 MHz
  - PCI-bus clock: 30, 32, 33 MHz
- Connectors for standard I/O devices:
  - Two integrated PCI IDE controllers that support:
    - IDE modes 0, 1, 2, and 3, or PIO mode 4
    - ATA multi-word DMA modes 0, 1, and 2
  - Two NS16550A-compatible serial ports
  - Infrared serial port (configured as serial IR)
  - Parallel port with extended-capabilities port (ECP) and enhanced-parallel port (EPP) support
  - Diskette drive controller (1.44 MB and 2.88 MB support)
  - Keyboard port
  - Mouse port
  - Two USB ports
  - PCI 10 BaseT/100 BaseTX Ethernet
- Thermal sensing of ambient and processor temperatures
- Watchdog timer
- Real-time clock
- BIOS (can be upgraded with software)
- External PCI expansion connectors (2.1 revision)
- PCI Industry Computer Manufacturers Group (PICMG) edge connector, which supports external ISA and PCI adapters
- Integrated video/graphics
  - Host-bus interface
  - Configurable video memory size (from 512 KB to 4 MB)
  - Supports up to 1280 by 1024 resolution and 24-bit color

SBC Component Layout



The function of connectors J13 (A), J10 (B), and J29 (B) is reserved.

Figure 6-1. SBC Component Layout

Memory Subsystem

DIMMs

The SBC has two 168-pin DIMM sockets (bank 0 and bank 1). Each socket can accept gold-tabbed, non-parity, synchronous-DRAM DIMMs. The DIMMs can be 32 MB, 64 MB, 128 MB, or 256 MB. The DIMMs do not have to be the same size; the SBC will optimize for the maximum performance of each DIMM.

Note: Use only IBM-approved memory. To increase memory, contact your IBM representative. To replace defective modules, see page 8-3 for the FRU part numbers.

Cache

The SBC has a 512 KB level-2 (L2) cache, which cannot be upgraded. The L2 cache gives increased performance in almost all applications. The amount of performance increase depends on the application.

Video Graphics Subsystem

The video/graphics accelerator (*video*) is a high-performance video function that is integrated onto the SBC. It has the following features:

- High-performance SiS video chip set
- Host-bus interface (up to 83 MHz)
- Up to 4 MB of video memory with 64-bit interface
- Unified memory architecture
- Support for the following video modes:
  - 640 by 480 up to 85 Hz with over 16 million colors (24-bit)
  - 800 by 600 up to 85 Hz with over 16 million colors (24-bit)
  - 1024 by 768 up to 85 Hz (60 Hz interlaced) with over 16 million colors (24-bit)
  - 1280 by 1024 up to 75 Hz (45 Hz interlaced) with approximately 64 000 colors
- Display Power Management Signaling (DPMS) energy management

The SBC uses a unified memory architecture, which uses part of system memory for video. This architecture provides flexibility in configuring the video memory to meet your requirements for color and resolution.

During configuration, 512 KB to 4 MB of system memory is allocated to the video subsystem as video memory. The default value is 4 MB.

Indicators

Hex Displays

The SBC provides a two-digit hex display, viewable from the top of the SBC. This display gives codes indicating the progress of POST. When the SBC has completed POST successfully, the display shows a 00, and the operating system starts loading. If an error is detected during POST, the error code is indicated in the hex display, as follows:

1. The start code of ***EE***
2. The first two digits of the error code
3. The second two digits of the error code
4. The end code of ***EE***

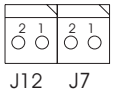
For example, if a 162 configuration error occurred at power-on, you would see **EE 01 62 EE** in the hex display. This will repeat until you press a key.

Note: The 162 error will not display when the SBC is set to auto-configure mode. In auto-configure mode, the SBC automatically reconfigures itself and reboots.

Power-On LED

The power-LED connector turns on the system power-on indicator (the green LED) whenever 5 volts is applied to the SBC. It consists of two 2-pin connectors operating as a single connector. The connector pair supports the 2-pin LED connector in IBM systems and the 3-pin LED connector in industry-standard covers.

The 2-pin power LED can be connected to J12 or J7. The 3-pin power LED can be connected across J12-1 and J7-1, or across J12-2 and J7-2.



Pin	Description
J12-2	–
J12-1	+
J7-2	+
J7-1	–

HD Access LED

This connector will drive a hard-drive-access LED. It will light the LED whenever there is activity to either of the IDE ports.

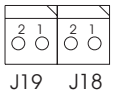
The connector is a 2-pin header that connects through a cable to the HD-access LED (yellow).

Pin	Description
1	+
2	–

Speaker

The speaker connector consists of two 2-pin connectors. The connectors are used to drive a speaker or a speaker LED (in noisy environments). A standard 8-ohm speaker can be connected to give normal system audio outputs.

The two connectors act as a single header and support the 2-pin speaker connector in IBM systems or the industry-standard 4-pin connector. The 2-pin speaker cable can be connected to either J19 or J18. The 4-pin cable can be connected across both J18 and J19 (the two outer-most pins are used).



Pin	Description
J19-2	Vcc
J19-1	Data out
J18-2	Vcc
J18-1	Data out

I/O Connectors

Diskette Drive Connectors

The SBC provides for attaching a diskette drive through a single 34-pin connector. The controller supports two diskette drives through a 34-pin ribbon cable; however, the cable provides a connector for only one drive.

This connector is a 2-by-17 header.

Pin	Description	Pin	Description
1	Ground	2	Density Sel
3	Key	4	N/C
5	Ground	6	DRate 0
7	Ground	8	-Index
9	Ground	10	-Motor 0
11	Ground	12	-FDSel 1
13	Ground	14	-FDSel 0
15	Ground	16	-Motor 1
17	Ground	18	Dir
19	Ground	20	-Step
21	Ground	22	-WData
23	Ground	24	-WGate
25	Ground	26	-Track 0
27	Ground	28	-WrProt
29	Ground	30	-RData
31	Ground	32	HD Select
33	DRata 1	34	DskChange

IDE Connectors

The SBC has two IDE connectors: one to the primary controller and the other to the secondary controller. Each controller supports two drives and can operate in PIO modes 0 through 4 and DMA modes 0 through 2. These interfaces support transfer rates of up to 16.7 MB per second, depending on the hard drive installed. The mode for each drive (PIO or DMA) is selected through the Configuration/Setup Utility program.

Each connector is a standard 2-by-20 header that provides a signal path to the IDE controller. Each interface supports two standard, 3.5-inch drives through a 40-pin, flat-ribbon cable.

Pin	Description	Pin	Description
1	-Reset	2	Ground
3	Data 7	4	Data 8
5	Data 6	6	Data 9
7	Data 5	8	Data 10
9	Data 4	10	Data 11
11	Data 3	12	Data 12
13	Data 2	14	Data 13
15	Data 1	16	Data 14
17	Data 0	18	Data 15
19	Ground	20	Key
21	DRQy	22	Ground
23	-IOW	24	Ground
25	-IOR	26	Ground
27	IOChRdy	28	NC
29	-DACKy	30	Ground
31	-IRQ 14	32	-IO CS 16
33	HA1	34	Ground
35	HA 0	36	HA 2
37	-CS 0(1F0h)	38	-CS 1 (3F0h)
39	-IDEACT	40	Ground

Keyboard/Mouse

The SBC provides two 6-pin, miniature-DIN connectors for the keyboard and mouse (DIN stands for Deutsches Institut fur Normung–German Institute for Standardization). The SBC also has an 8-position header that provides an alternative method of connecting the keyboard and mouse. Any IBM-compatible mouse or keyboard will work with these ports.

The keyboard/mouse connector is a 2-by-4 header. It can be attached through a cable to two standard DIN connectors.

Pin	Description	Pin	Description
1	Keyboard Data	2	Ground
3	5 Volts	4	Keyboard Clock
5	Mouse Data	6	Ground
7	5 Volts	8	Mouse Clock

Parallel Port

The SBC has a 26-pin connector that provides a full-function, bidirectional parallel port. This port supports the Extended Capability Port (ECP) and the Enhanced Parallel Port (EPP) modes. The Configuration/Setup Utility program configures these modes in the BIOS. This connector is designed to be interfaced to the standard system parallel port connector through a cable.

This connector is a 2-by-13 header attached through a 26-pin ribbon cable to a 25-pin, D-shell connector fastened to the chassis.

Pin	Description		Pin	Description	
	ECP	EPP		ECP	EPP
1	-Strobe	-Write	2	-Auto FD	-Dstrobe
3	Data 0	Data 0	4	-Error	-Error
5	Data 1	Data 1	6	-Init	-Init
7	Data 2	Data 2	8	-Select In	-AStrobe
9	Data 3	Data 3	10	Ground	Ground
11	Data 4	Data 4	12	Ground	Ground
13	Data 5	Data 5	14	Ground	Ground
15	Data 6	Data 6	16	Ground	Ground
17	Data 7	Data 7	18	Ground	Ground
19	-ACK	-ACK	20	Ground	Ground
21	Busy	-Wait	22	Ground	Ground
23	PE	PE	24	Ground	Ground
25	Select	Select	26	Reserved	Reserved

Serial Ports

The SBC has two standard serial ports and one infrared port, which is configured as a serial port.

The connectors for the standard serial ports are on two 10-pin headers. Both ports are NS16550A-compatible and designed to be connected to the system unit through cables. The Configuration/Setup Utility program controls the software setup for these ports.

Serial Port A

Serial Port A is usually configured as COM1 and has an RS-232 physical interface.

The connector is a 2-by-5 header attached through a 10-pin cable to a connector fastened to the chassis.

Table 6-1. Serial Port A (RS-232 only)

Pin	Description	Pin	Description
1	Carrier Detect	2	Data Set Ready
3	Receive Data	4	Request to Send
5	Transmit Data	6	Clear to Send
7	Data Terminal Ready	8	Ring Indicator
9	Ground	10	Key

Serial Port B

Serial Port B is usually configured as COM2 and can have one of two physical interfaces: RS-232 or RS-422/485. A configuration switch controls the physical interface used (see “Configuration Switches” on page 6-12).

The connector is a 2-by-5 header attached through a 10-pin cable to a connector fastened to the chassis.

Table 6-2. Serial Port B (RS-232 or RS-422/485)

Pin	Description		Pin	Description	
	RS-232	**RS-422/485**		**RS-232**	**RS-422/485**
1	Carrier Detect	TD–	2	Data Set Ready	NC
3	Receive Data	RD–	4	Request to Send	NC
5	Transmit Data	TD+	6	Clear to Send	NC
7	Data Terminal Ready	RD+	8	Ring Indicator	NC
9	Ground	Ground	10	Key	Key

Infrared

The infrared connector is a 5-pin, 2-millimeter, center-line connector. The infrared port is configured as a serial port and supports slow IR (SIR) and amplitude-shift keying IR (ASKIR) standards.

To use this port, you need to construct the cabling with an external connector or external infrared device.

Pin	Description
1	+5 V
2	Reserved
3	Infrared receive
4	Ground
5	Infrared transmit

USB Port

The SBC has two USB ports on two 5-pin headers. The Configuration/Setup Utility program controls the setup for these ports.

Each connector is a 1-by-5 header attached through a cable to a standard USB-port connector that is fastened to the chassis.

Pin	Description
1	+5 V
2	D–
3	D+
4	Ground
5	Shield Ground

Video

The video connector is a standard 15-pin D-shell connector. The output is standard SVGA. The video device driver controls the actual resolutions available to the user. For the location of the video device drivers included with the 7563 Passive Backplane System, see page 2-5.

Pin	Description		
1	Red	9	Key
2	Green	10	Ground
3	Blue	11	Not connected
4	Not connected	12	Not connected
5	Ground	13	Hsync
6	Red Return	14	Vsync
7	Green Return	15	Not connected
8	Blue Return		

Ethernet

The SBC has an optional 10 BaseT/100 BaseTX Ethernet port. This port is available to the user through a standard RJ45 connector on the rear of the card. The Ethernet port requires 100-ohm, category-5, twisted-pair cabling. For the location of the Ethernet device drivers, see page 2-5.

The connector is a single RJ45 connector.

Pin	Description	Pin	Description
1	TD+	2	TD–
3	RD+	4	NC
5	NC	6	RD–
7	NC	8	NC

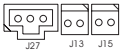
Miscellaneous Connectors

ATX Power Supply

The SBC provides two connectors to be used with the soft on/off control of an ATX power supply. The soft on/off control uses a momentary-make on/off switch connected to the SBC instead of the standard two-pole switch connected to the power supply. As a result, the SBC controls the on/off state of the power supply.

When using the soft on/off control, connect the on/off switch to the 2-pin connector (J15), and connect the 3-pin auxiliary power-supply cable to the 3-pin connector (J27).

Note: Use only a momentary-make switch and a properly-wired power supply.



Pin	Description
J15-1	On/off switch
J15-2	Ground

Pin	Description
J27-1	5 V stand-by
J27-2	/ONCTL- soft on/off
J27-3	Ground

Cover Intrusion

This connector is a standard 2-pin, 2-millimeter, center-line connector. The two pins are routed to the cover intrusion detector (see page 4-3 for a description of the detector).

Pin	Description
1	Voltage out
2	Voltage detect

The logic on the SBC works as follows:

The two connector pins on the SBC are routed to the detector circuitry. When the pins are shorted, an event is latched in the detector. The event is latched even if the computer is turned off or the power cord is unplugged. Bit 6 at I/O address 0158h contains the status of the latch. If bit 6 is 1, the latch has been tripped. The latch is reset by setting bit 6 at I/O address 0157h to 1.

To use the logic to detect a cover being removed, the user must connect a switch that is closed when the cover is removed, and open when the cover is installed.

12 V dc Fan Power Connector

The SBC provides two fan connectors. Each connector is a 3-pin header.

Pin	Description
1	Ground
2	+12 V
3	Tachometer input

Reset Switch

This connector is used with a system reset switch. When the two pins are shorted together, the SBC performs a hardware reset.

The connector is a 2-pin header attached through a cable to the backplane. When used in stand-alone mode, this connector can be attached to a system reset switch.

Pin	Description
1	-Reset
2	Ground

BIOS Flash ROM

The BIOS for the SBC is contained in Flash ROM. This lets the BIOS be updated through software. BIOS updates can be downloaded from the Web site (see “Downloading System Support Programs and BIOS Updates” on page 7-2 for more information).

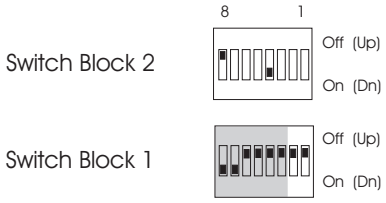
Memory-Retention Battery

This battery is used to maintain the information stored in the CMOS (complementary metal oxide semiconductor) memory. It also is used to power the time-of-day clock when the system unit is powered off. If a password is lost or forgotten, you must remove the battery for 10 minutes, and then replace it. This removes all the contents of the CMOS memory, and the password. You will have to run the Configuration/Setup Utility program after you replace the battery.

Configuration Switches

The SBC has two switch blocks. Switch block 2 (upper switch block) selects the multiplier and bus frequency for the microprocessor. Other switches on both switch blocks enable various functions on the SBC.

The following shows the default switch settings.



The empty switch positions are processor dependent.
The switches in the shaded area are reserved and should be set as shown.

Figure 6-2. Default Switch Settings

The following tables show the function of each switch on configuration switch blocks 2 and 1. For information on specific-processor settings and an example, see “Switch Setting Example” on page B-8.

Table 6-3. Configuration Switch Block 2

Switch	Description
1	Clock multiplier 0
2	Clock multiplier 1
3	Clock multiplier 2
4	RS-422/485 or RS-232
5	CPU/PCI clock 0
6	CPU/PCI clock 1
7	CPU/PCI clock 2
8	Enable auto boot

Table 6-4. Configuration Switch Block 1

Switch	Description
1	Disable keyboard/mouse port
2	Disable video
3-8	Reserved (set as shown in Figure 6-2)

Processor Speed Selection Switches

Switch block 2 is used to configure the SBC to the speed of the microprocessor. Switches 1 through 3 select the internal clock multiplier for the microprocessor. Switches 5 through 7 select the input frequency and external bus speed.

The following table shows the settings for the clock multiplier and the resulting internal processor clock for each CPU-input frequencies.

Table 6-5. Processor Clock Multiplier

Switches			Multiplier	Processor Speed by CPU Input Clock				Special Notes
3	2	1		60	66	75	83	
Dn	Dn	Dn	1.5	90	100	na	na	Pentium only
Dn	Dn	Up	2.0	120	133	na	na	Pentium MMX only
Dn	Up	Up	2.5	150	166	188	208	
Dn	Up	Dn	3.0	180	200	225	250	
Dn	Dn	Dn	3.5	210	233	263	291	
Up	Dn	Up	4.0	240	266	300	333	
Up	Up	Up	4.5	270	300	337	375	
Up	Up	Dn	5.0	300	333	375	416	
Up	Dn	Dn	5.5	330	366	412	458	
Dn	Dn	Up	6.0	360	400	450	500	AMD K6-2 and K6-3 only

The following table shows the switch settings for the input clocks to the CPU, PCI bus, and host bus. The table shows only the optimal settings for each CPU-input frequency.

Table 6-6. Processor/Bus Clocking

Switches			Clocking		
7	6	5	CPU	PCI Bus	Host Bus
Up	Up	Up	60	30	60
Up	Up	Dn	66	33	66
Dn	Up	Up	75	32	75
Dn	Up	Dn	83	32	83

Processor Voltage Selection

When the system is turned on, the SBC automatically selects the correct core voltage. The following shows the processors and the core voltages that are set.

Table 6-7. Processor Voltages

Microprocessor	Voltages Detected
AMD K6-2	2.2 V
AMD K6-3	2.4 V
Pentium MMX	2.8 V
Pentium	3.3 V

Enable Auto Boot

Switch 8 on switch block 2 controls the SBC auto-boot feature at power-on. When the switch is down (on), auto boot is enabled. With auto boot enabled, BIOS detects configuration errors at power-on and automatically alters the CMOS settings to match the hardware so that the computer can complete the boot process without operator intervention. This feature is useful in situations where an operator or keyboard and display are not available to clear the configuration error.

Use this feature carefully because it can mask hardware problems. Hardware errors could cause the computer to change configuration and possibly lead to inconsistencies in the operation of hardware and applications running on the computer. The default position is auto boot disabled (off).

RS-422/485 or RS-232

Switch 4 on switch block 2 controls the electrical interface of serial port B. If the switch is up (off), the port is a standard RS-422/485 interface. If the switch is down (on), the port is a standard RS-232 interface. The default position is RS-232 (on).

Disable Video

Switch 2 on switch block 1 lets you disable the video function on the SBC. When this switch is down (on), the SBC disables all video drivers on the SBC. The default position is video enabled (off).

Disable Keyboard/Mouse

Switch 1 on switch block 1 is used to disable the keyboard and mouse ports, preventing anyone from using the keyboard or mouse. The default position is keyboard and mouse ports enabled (off).