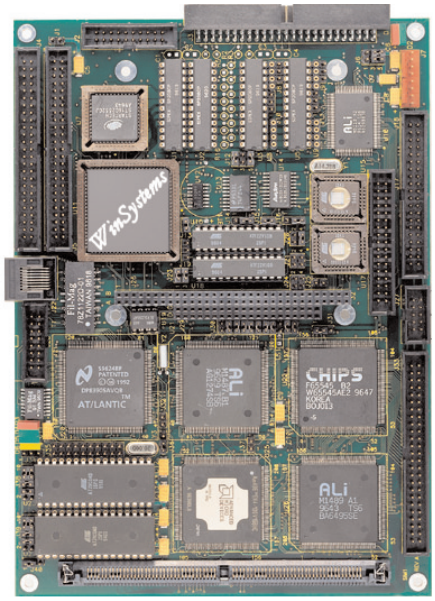
WinSystems®
EMBEDDED COMPUTERS

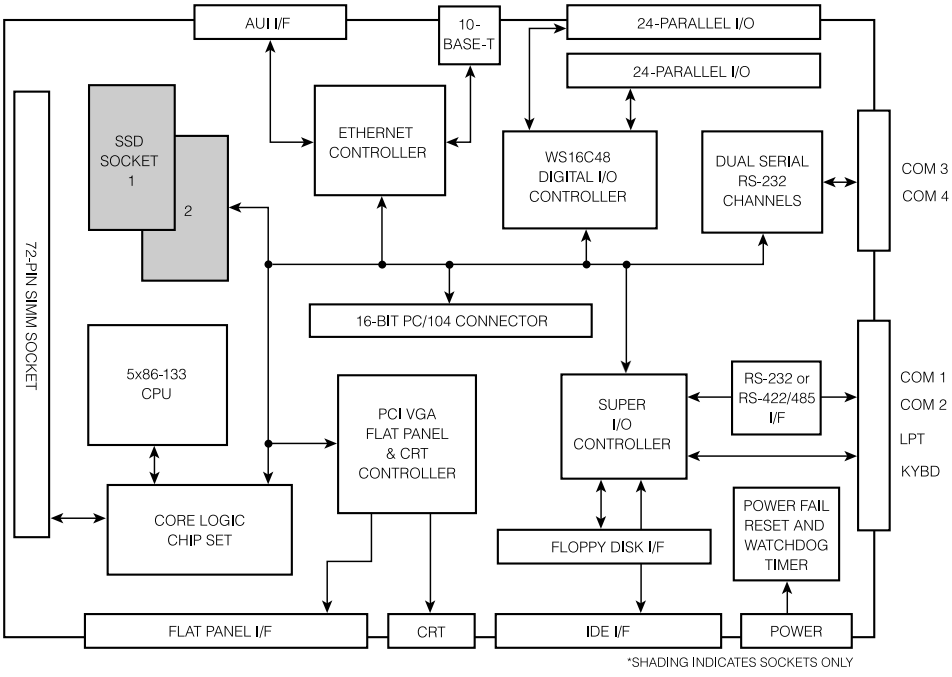
LBC-586Plus-133 Single Board Computer with Video and Ethernet

FEATURES

- 133MHz 5x86 CPU
- PC-AT software compatible
- Up to 64 Mbytes of installable system DRAM with either EDO or Fast Page SIMM supported
- 256KB Level 2 cache
- Two solid state disk sockets support onboard bootable DIP Flash, SRAM or (EP)ROM
- Up to 288MB Flash Disk with Flash File System
- High-resolution, SVGA video controller supports:
  - Color STN, TFT and Dual-Scan Color STN panels with 8, 9, 12, 15, 16, 18, and 24-bit interfaces
  - Supports panel resolutions including 640 x 480, 800 x 600 and 1024 x 768
  - Supports simultaneous CRT and LCD operation
  - PCI local bus for high speed operation
- IEEE 802.3, 10Mbps NE2000 compatible Ethernet controller with integrated AUI and 10BASE-T I/F
- 4 RS-232 serial ports with FIFOs; COM1 & COM2 with optional onboard RS-422/485/J1708 support
- Bidirectional LPT port that supports EPP/ECP
- 48 bidirectional TTL digital I/O lines with 24 capable of event sense interrupt generation
- Onboard PCI EIDE hard disk interface
- Onboard floppy disk controller
- Two interrupt controllers and 7 DMA channels
- Three 16-bit counter/timers
- AT keyboard controller
- 16-bit PC/104 expansion connector



- SMM/SMI supported
- Watchdog timer and power-fail reset
- Real-time clock with battery backup
- Status, hard disk and Ethernet activity LEDs
- Speaker port and onboard piezo transducer
- Upgrade for WinSystems' LBC-486
- Small size: 5.75 x 8.0 inches (146mm x 203mm)
- +5 volt only operation



OVERVIEW

The LBC-586Plus combines a CPU with Ethernet, video, solid state disks, floppy, IDE, serial and digital I/O. Its feature-rich onboard I/O controllers makes the LBC-586Plus ideal for embedded control industrial applications requiring operator interface or as a network computer. Plus its PC software compatibility assures easy program development and checkout.

FUNCTIONAL CAPABILITY

Processor - The LBC-586Plus incorporates a surface mounted 133 MHz 5x86 CPU. Benchmarks show the 5x86-133 to be equal or exceed the performance of a 75 MHz Pentium. The chipset provides the core logic that makes the board PC/AT software compatible. It includes the DRAM controller, bus interface and integrated peripheral controllers (8237 DMA, 82C54 timer, 82C59 PIC, RTC, KYBD controller, and CMOS memory) plus an internal PCI bus for high-speed operation.

Memory - Up to 64Mbytes of Dynamic RAM can be populated on the board with a 72-pin SIMM. The BIOS can detect and automatically support either Fast Page or EDO memories. The board is shipped with no memory installed which permits the user to install and upgrade the memory in the field. The LBC-586PLUS supports both a SRAM and M-Systems' DiskOnChip® 2000 simultaneously.

Direct Memory Access (DMA) - Seven DMA channels are supported with Channel 2 dedicated to the floppy disk controller. The LPT is jumper selectable for ECP operation. The other DMA channels are wired to the PC/104 connector.

3.5" and 5.25" Floppy Disk Support - Up to two floppy disk drives from 360KB through 1.44MB formats are supported by the board. The output buffers are capable of sinking 48mA and are accessed via a standard 34-pin connector.

EIDE Hard Disk Interface - The LBC-586Plus incorporates a PCI EIDE local bus interface for high-performance data transfers for up to 2 devices. A 40-pin header connector handles all command, data, and status I/O lines to an industry standard IDE interface. A LED blinks during data transfer to provide visual status information.

Solid State Disks (SSD) - Two 32-pin sockets support Flash, EPROM or SRAM. A user can substitute onboard semiconductor devices for applications where the environment is too harsh for mechanical hard disks or floppy disk drives while offering significant speed advantages. Supported memory devices are 512K x 8 EPROMs, SRAMs, Flash (PEROMs) or 1M x 8 EPROMs. WinSystems provides an installable device driver for these devices called USSD.SYS for use with MS-DOS and ROM-DOS operating systems. It supports disk sizes up to 1MB onboard and up to 16MB off board when using WinSystems' PCM-SSD PC/104 modules.

Flash Disk - Also a 32-pin DiskOnChip® Flash disk is supported but not populated. It is a 32-pin device that offers 8 to 288Mbyte capacity and includes TrueFFS™, an embedded Flash File System. The file system provides hard disk read/write compatibility, automatic bad block management, and wear leveling. More SSD capacity is available with WinSystems' PCM-DOC or PCM-IDE-FLASH PC/104 modules.

Ethernet Controller - The board is hardware compatible with one of the most popular Ethernet Adapter architectures, Novell's NE2000. This means that most PC-compatible drivers, utilities and Ethernet supported operating systems will work directly with the LBC-586Plus.

It conforms to the IEEE 802.3 and Ethernet standards for a 10 Mbps Carrier Sense Multiple Access/Collision Detection (CSMA/CD) local area network. The LBC-586Plus provides connectivity for both an AUI and 10BASE-T twisted-pair on a single board.

The configuration information describing the device's architecture, address, interrupt, etc. can either be loaded from jumpers or an EEPROM. LEDs provide status information of Rx, Tx, Link and Collision.

Video Controller - A Chips and Technologies' 65545 high-performance PCI flat panel/CRT controller provides a sophisticated graphics hardware engine for Bit Block Transfer (BITBLT), line drawing, hardware cursor control, and other functions intensively used in Graphical User Interfaces (GUIs). An onboard PCI interface assures maximum video performance.

Video Memory - Onboard 256K x 16 DRAMs provide 1Mbyte of video memory, which is sufficient to support the screen resolutions and maximum number of colors displayed required by most applications.

CRT Video Interface - The CRT video output signals are wired to a 10-pin dual-in-line connector at the edge of the board. A CBL-207-1 interface cable adapts it to a standard female 15-pin "D-Sub" type connector commonly used for VGA. Simultaneous operation of the CRT and LCD is shown in the chart on the next page.

Flat Panel Display Support - The LBC-586Plus supports all flat panel display technologies including plasma, electroluminescent (EL), and liquid crystal (LCD). It

Modes Supported During LCD Display

CRT Mode Resolution	CRT Mode Color [4]	Mono LCD Gray Scales [4]	DD STN LCD Colors [2,3,4]	9-Bit TFT LCD Colors [1,2,3,4]	Video Memory	Simultaneous Display
320x200	256/256K†	61/61	256/226,981	256/185,193	512KB	Yes
640x480	16/256K†	16/61	16/226,981	16/185,193	512KB	Yes
640x480	256/256K†	61/61	256/226,981	256/185,193	512KB	Yes
800x600	16/256K†	16/61	16/226,981	16/185,193	512KB	Yes with 1MB
800x600	256/256K†	61/61	256/226,981	256/185,193	512KB	Yes with 1MB
1024x768	16/256K†	16/61	16/226,981	16/185,193	512KB	Yes with 1MB

NOTES

1. Larger color palettes and simultaneous color can be displayed on 12-bit, 8-bit and 24-bit TFT panels via the 65545 video input port.
2. Includes dithering.
3. Includes frame rate control.
4. Colors are described as number of simultaneous on-screen colors and number of unique colors available in the palette.

† 256K colors assumes DAC output mode is set to 6 bits of R, G, and B. If DAC is set to 8-bit output mode, the number of available colors is 16M.

will support mono and color displays. The board properly sequences the driver electronics logic voltage and the backlight voltage to provide intelligent power sequencing to the panel.

FP-50 Interface - Since there isn't an electrical or mechanical interface standard for flat panels, WinSystems has developed a flat panel interface system configuration to work with the different interface signals, timing requirements, and connectors that vary between panel technologies and suppliers. This solution consists of a standard 50-pin panel interface called the FP-50, a panel personality module, and cables.

The FP-50 video bus supports panels that require from 3- to 24-bits per pixel. It has power, timing and control signals for various panel types. Also, 4 lines are assigned to allow the LBC-586Plus to read an ID jumper setting on the personality module to auto configure the BIOS for the correct panel type. A BIOS extension in the onboard EPROM provides PC video compatibility for the various modes of operation for the different panels.

Software - Software drivers are available with high-resolution drivers for various software packages including Windows and DOS applications. Video BIOS modifications can be made for custom panel types.

Serial Communications - Four independent, double-buffered, full-duplex, serial asynchronous channels are supported. Each transmit and receive channel has a 16-byte FIFO. This device is a dual 16550 compatible UART that offers software compatibility with PC-type driver programs.

Independent control of transmit, receive, line status and data set interrupts are on all channels. Each channel is setup to provide internal diagnostics such as loopback and echo mode on the data stream. Independent on-chip software programmable baud rate generator selectable from 50 through 115.2 K bits per second. Individual modem handshake control signals are supported for both channels.

All serial channels are configured as Data Terminal Equipment (DTE). COM1 and COM2 are wired to a 50-pin connector at the edge of the board. WinSystems offers the optional CBL-247-1 which adapts each serial channel to 9-pin male "D" connectors with PC-AT compatibility.

COM3 and COM4 are wired to a 20-pin connector. WinSystems offers the optional CBL-173-1 which adapts each serial channel to 9-pin male "D" connectors.

COM1 through COM4 RS-232 Pin-Out

Pin	Flow	Signal
1	IN	Data Carrier Detect (DCD)
2	IN	Receive Data (RxD)
3	OUT	Transmit Data (TxD)
4	OUT	Data Terminal Ready (DTR)
5	—	Signal Ground (GND)
6	IN	Data Set Ready (DSR)
7	OUT	Request To Send (RTS)
8	IN	Clear To Send (CTS)
9	IN	Ring Indicator (RI)

RS-232 interface levels are supported on all channels. The RS-232 drivers have an on-chip charge pump to generate the plus and minus voltages so that the LBC-586Plus only requires +5 volts to operate.

Either RS-422 or RS-485 electrical levels can be supported on COM1 and COM2 by removing the RS-232 transceivers and installing the optional CK-75176 chip kit per channel.

Parallel I/O - The LBC-586Plus contains a highly versatile WS16C48, 48-line digital I/O controller. Each I/O line is individually programmable for input, output, or output with read-back operation. Each output channel is latched and has an open collector driver (with a pull-up resistor) capable of sinking 12mA of current.

The major feature of this controller is its ability to monitor 24 of the lines for both rising and falling digital edge transitions, latch them and then interrupt the host processor notifying that a change-of-input status has occurred. Transition polarity is programmable and enabled on a bit-by-bit basis. Each lines' transition is latched by the event so that even short duration pulses will be recognized. An interrupt ID register is maintained for each line for writing more efficient Interrupt Service Routines. This is an efficient way of signaling the CPU of real-time events without the burden of polling the digital I/O points.

The WS16C48 has its I/O lines connected to two, 50-pin connectors. Twenty-four data lines are alternated with 24 ground lines for reduced noise and crosstalk. Also +5 volts and ground are included in the cable. The pinout is compatible with the industry standard 4 to 24 position I/O module mounting racks (Opto-22, etc.) for use with high-level AC and DC opto-isolated solid state relays. An optional CBL-115-4, 50-pin conductor ribbon cable connects the LBC-586Plus to one I/O rack.

Line Printer Port - The LBC-586Plus has a parallel port that may be operated in standard and bidirectional as well as Extended Capabilities Port (ECP) and Enhanced Parallel Port (EPP) modes. The controller chip is designed to provide enhanced ESD and Latch-Up protection of up to 4KV/300mA.

Alternatively, it can be used as two additional general purpose I/O ports if a printer is not required. The first port is configured as 8 input or output only lines. The other port is configured as 5 input and 3 output lines.

Real-Time Clock/Calendar - A MC146818A compatible clock supports a number of features including periodic and alarm interrupt capabilities. In addition to the time and date keeping functions, the system configuration is kept in CMOS RAM contained within the clock section.

Keyboard Controller - An 80C42 equivalent controller supports a PC/AT-type keyboard. It is accessed via the optional CBL-247-1 Multi-I/O adapter cable.

Interrupts - Two 82C59A compatible interrupt controllers accept inputs from the onboard peripherals (including the 16C48) and the PC/104 Bus for a total of twelve selectable interrupt sources.

CBL-247-1 Keyboard Female Connector Pin-Out

Pin	Signal
1	Keyboard Clock
2	Keyboard Data
3	N/C
4	Ground
5	+5 volts

Status LEDs - A red status LED is also available to monitor system activity. Under a user's program control, it can indicate error conditions or blink different patterns to provide a visual indication of status.

Timers - Three, independent 82C54 compatible 16-bit timers are supported. Channel 0 is wired to interrupt Channel 0, Channel 1 generates the DRAM refresh using DMA Channel 0, and Channel 2 is used by the speaker port.

Watchdog Timer - A software/hardware enabled, retriggerable watchdog timer is provided. This timer must be updated at least once every 1.5 seconds otherwise a failure is assumed and the board will be reset. This circuit is important for use in remote and unattended applications.

Reset - A precision voltage comparator monitors the +5 volt status. Upon detection of an out-of-tolerance condition, the board is reset. This action is critically important in order to detect brown-out or power fail conditions. The reset circuit also ensures that the power is nominal before executing a power-on reset. This circuit also inhibits the processor's memory write line, preventing invalid data from being written to the SSD memory devices during power fluctuations.

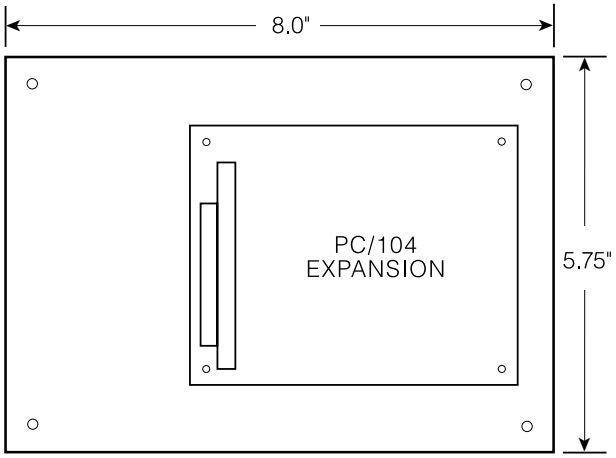
Battery - A 350 mAH battery supplies the LBC-586Plus with standby power for either or both SRAM memory sockets, the real time clock and CMOS setup RAM.

Speaker - An onboard piezo transducer is available for sound generation. A beep code is generated that corresponds to any BIOS error codes (if required) during the power up or reset sequence.

Power - Power is input via an 8-pin connector. For most applications, the board only requires +5 volts. The +12 volts is required by most FP50 flat panel interfaces and Ethernet AUI transceivers. Also, +12 volts is wired directly to the PC/104 connector.

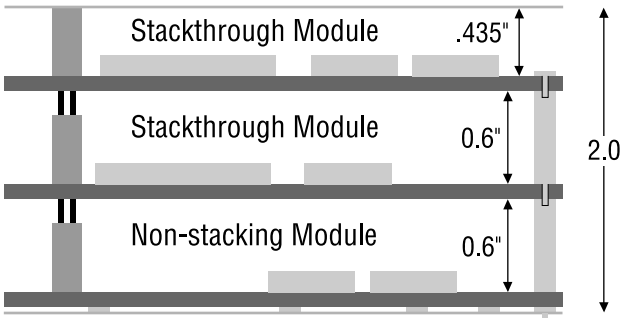
Standalone Operation - The board can be used as a simple, complete, standalone embedded controller

mounted on a flat surface using a set of standoffs. The LBC-586Plus measures 5.75 x 8.0 inches (146mm x 203mm).



Outline/dimensions of board

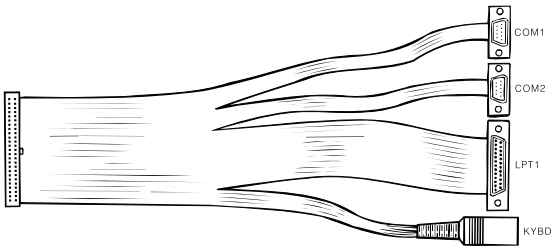
PC/104 Expansion - The LBC-586Plus provides a common computer core from which engineers can add off-the-shelf or user-designed, application specific PC/104 modules to match their exact configuration. It has a 16-bit, non-stackthrough, PC/104 interface and connector. PC/104 modules are self-stacking and plug together in a "piggy back" configuration to serve as a mezzanine expansion bus.



PC/104 Module Stack

PC/104 modules are very compact, measuring only 3.6 x 3.8 inches, and are offered by WinSystems and a number of third party companies worldwide. Module functions include serial I/O, digital I/O, SSD, PCMCIA, GPS, modem, speech/sound, SCSI-2, etc.

I/O Connector - WinSystems offers the optional CBL-247-1, Multi-I/O cable adapter for the COM1, COM2, LPT1 and keyboard. These four ports are combined into one 50-pin header at the edge of the board. The CBL-247-1 is a 1 foot adapter cable that offers a more convenient termination. COM1 and COM2 are 9-pin male "D" connectors with strain relief. LPT1 is a 25-pin "D" female socket with strain relief. The keyboard is a standard 5-pin DIN connector.



Drawing of CBL-247-1

SOFTWARE SUPPORT

BIOS - The LBC-586Plus is designed to support both full PC-AT DOS compatible and embedded systems applications. An Award BIOS is supplied with each board to provide configuration flexibility, performance and AT compatibility.

Software - Since the LBC-586Plus is software compatible with the PC-AT, it will run the latest versions of DOS, Windows, and OS/2. It will support other operating systems such as QNX and real-time executives that require a "PC-AT" hardware environment.

Networking - The LBC-586Plus supports remote booting with an onboard EPROM socket for use as a diskless network computer. Its NE2000 and PC-AT compatibility support numerous network OS's and kernels.

Software Developers Kit - WinSystems offers the SDK2-LBC-104 software developers kit to supply the necessary hardware, software and cables to begin program development with the LBC-586Plus board. It consists of DOS 7.x, CBL-247-1 Multi-I/O cable, a 2GB

SDK2-LBC-104 Software Developers Kit

or larger hard disk plus controller cable, an 1.44 MB high density 3.5 inch floppy disk plus controller cable and triple output power supply housed in an enclosure.

The power supply is an 80 Watt universal switcher that will accept input voltages from 85 VAC to 264 VAC. Output voltages are +5 volts at 5A, +12 volts at 2A, and -12 volts at 0.5A. The power supply, floppy disk and hard disk are mounted in a black anodized enclosure. The packaging permits easy access to the board, PC/104 modules and peripherals during program development.

ROM-DOS Developers Kit (RDK) - WinSystems also offers several different Flash-based developers kits for those applications that do not need rotational media during development. When you order a LBC-586Plus along with the RDK of your choice, WinSystems will jumper the CPU, program and install the Flash part to your LBC-586Plus. The RDK includes a PS-80W-1, PCM-POST, Flash, ROM-DOS, cables and utility software.

SPECIFICATIONS

Electrical

LBC-586Plus CPU Clock: 133 MHz
PC/104 Interface: 16-bit, non-stackthrough
Ethernet data rate: 10 megabits per second
Serial Interface: 4 Serial channels with RS-232 levels
RS-422/485 optional using the CK-75176 kit on COM1 and COM2 only
LPT Interface: Bidirectional LPT with ECP/EPP
Parallel Interface: 48 I/O lines, TTL compatible
Output: I_{OL} = 12mA at 0.6 volts
Input: 10K nominal pull-up resistor
EIDE interface: Supports 2 drives
Floppy Disk Interface: BIOS supports one or two 360K/720K/1.2M/1.44M drives
Vcc = = +5V ±5% at 2A typ: LBC-586Plus-133

Note: An AUI interface transceiver and flat panel adapter usually requires +12V to operate, refer to the manufacturer's specification for their current requirements.

System Memory

Addressing: 64 Megabytes
Capacity: 72-pin EDO or Fast Page SIMM supplied and installed by user.
Cache: 256K bytes

Solid State Disk

Capacity: Two, 32-pin memory sockets support up to 1MB SRAM or Atmel Flash, 2MB of EPROM or up to 288MB DiskOnChip®

Mechanical

Dimensions: 5.75" x 8.0" (146mm x 203mm)
Jumpers: 0.025" square posts

Connectors

Serial, Parallel, Keyboard: 50-pin on 0.100" grid
Floppy Disk Interface: 34-pin 0.100" grid
IDE Interface: 40-pin 0.100" grid
Parallel I/O: 26-pin 0.100" grid
CRT: 10-pin dual on 0.100" grid
Panel: 50-pin dual on 0.100" grid
Twisted Pair: RJ-45
AUI: 16-pin dual on 0.100" grid
PC/104 Bus: 64-pin 0.100" socket
40-pin 0.100" socket
Power: 8-pin in-line Molex

Environmental

Operating Temperature: -40°C to +70°C
Non-condensing relative humidity: 5% to 95%

ORDERING INFORMATION

LBC-586Plus-133-0	586DX SBC with 256KB cache

For OEM applications, the LBC-586Plus can be ordered with the video and/or Ethernet circuitry depopulated. Contact a factory applications engineer for configuration, price, and delivery information.

PCM-CFlash-2	PC/104 Flash card with onboard Flash file system
PCM-IDEFLASH	IDE Flash module
PCM-SSD	PC/104 solid state disk module
RDK-LBC-259-xxF	ROM-DOS Developers Kit, 2MB
SDK2-LBC-104	Software Developers Kit
FLASH-MD2000-Dxx	32-pin DiskOnChip® where xx = 8 to 288MB memory storage
SIMM72-xxM	72-pin SIMM, where xx = 8, 16, 32, or 64MB
CBL-115-4	4 foot, Opto rack interface cable
CBL-147-1	16-pin ribbon to 15-pin D-Sub AUI adapter cable
CBL-173-1	20-pin ribbon to two 9-pin male D connector adapter cable
CBL-174-1	Power cable for the board
CBL-207-1	10-pin ribbon to 15-pin CRT D-sub adapter cable
CBL-247-1	1 foot, Multi-I/O adapter cable
CK-75176-2	RS-422/485 chip kit for 1 channel
PS-80W-1	80 watt power supply

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