

**OPERATIONS MANUAL**  
**LBC-486Plus**  
**LBC-586Plus**

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## **REVISION HISTORY**

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# 1 General Information

## 1.1 Features

- 486DX4 at 100MHz or 5X86 at 133 MHz
- 100% PC-AT Compatible
- Up to 32 Mbytes of user installable FPM or EDO DRAM
- Optional 256K L2 Cache
- Solid State Disk Support of up to 12MB
- PCI High-Resolution VGA controller for CRT or Flat Panel usage
- PCI IDE Controller
- NE2000 Compatible 10BaseT, AUI, Ethernet Controller
- Four 16550 Compatible Serial ports with optional RS422, RS485, J1708 interfaces
- Bi-directional Parallel printer port supports EPP and ECP modes
- 48 Digital I/O lines with 24 line event sense capability
- Dual Floppy Disk interface
- 16-Bit PC/104 Expansion Bus
- Watchdog Timer with Power-fail reset

## 1.2 General Description

The LBC-486/586Plus is a small, high-performance, embeddable computer system on a single board. It integrates a number of popular I/O options including VGA, Ethernet, Solid-State Disk, and High-Density Parallel I/O. Four PC compatible serial ports are standard, as are the floppy, hard disk, and parallel printer interfaces. The LBC-Plus is populated with either a 100 MHz AMD DX4 processor or the AMD 5x85 133 MHz processor. Up to 32Mbytes of user installable SIMM memory is supported. An optional 256KB level two cache is also available. A full 16-bit PC/104 expansion bus is provided for further expansion to an entire industry of add-on peripherals including sound and speech modules, SCSI controllers, Analog I/O modules, and literally hundreds of other options available from WinSystems and a variety of vendors supporting the PC/104 standard. An onboard silicon disk array supports disks up to 2 megabytes in size and can utilize SRAM, PEROM or EPROM as the disk media. Boot capability is provided onboard and a set of utilities and drivers are provided to make the silicon disk based system very user friendly. Alternately, the M-Systems DiskOnChip FLASH modules may be populated, supporting disk sizes ranging from 1 Megabyte to 12 Megabytes.

## **1.3 Specifications**

### **1.3.1 Electrical**

|                 |                                                                                                                                |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------|
| Bus Interface : | PC/104 8-Bit or 16-Bit expansion bus                                                                                           |
| System Clock :  | Jumper programmable from 4MHz to 50MHz                                                                                         |
| Interrupts :    | TTL Level input                                                                                                                |
| VCC :           | +5V +/- 5% at 2.0A typical with a 133MHz 5X86 processor with 16M DRAM<br>1.8A typical with a 100MHz DX4 processor and 16M DRAM |
| VCC1 :          | +12V +/-5% (Not required. PC/104 Expansion, Flat-Panel, or AUI use only)                                                       |
| VCC2 :          | -12V +/-5% (Not required. PC/104 Expansion or FFlat-Panel use only)                                                            |

### **1.3.2 Memory**

|                      |                                                                                                                                                   |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Addressing :         | 32 Megabyte addressing                                                                                                                            |
| BIOS ROM :           | 128K OTPROM                                                                                                                                       |
| Memory SIMM Socket : | 72-pin Fast Page Mode or EDO DRAM in sizes from 1M to 32M                                                                                         |
| SSD Memory :         | Two 32-pin JEDEC standard sockets support 4-Mbit SRAM, 4-Mbit PEROM, 4-Mbit EPROM, 8-Mbit EPROM, or one M-Systems 32-Pin DOC (DiskOnChip) module. |

### **1.3.3 Mechanical**

|              |                                                                                                                                                                                                                               |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dimensions : | 5.75 X 8.0 X 0.60 inches (without PC/104 modules or cables)                                                                                                                                                                   |
| PC-Board :   | FR4 Epoxy Glass with 4 signal layers and 2 power planes with screened component legend, and plated through holes.                                                                                                             |
| Jumpers :    | 0.025" square posts on 0.10" centers                                                                                                                                                                                          |
| Connectors : | Multi I/O : 50 pin RN type IDH-50LP<br>COM3/COM4 : 20-pin RN type IDH-20LP<br>Floppy Disk : 34 pin RN type IDH-34-LP<br>Fixed Disk : 40 pin RN type IDH-40-LP<br>Digital I/O : Two 50 pin RN type IDH-50-LP<br>10BaseT : RJ45 |

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|                |                                                                        |
|----------------|------------------------------------------------------------------------|
| Ethernet AUI : | 16 pin RN type IDH-16-LP                                               |
| CRT :          | 10 pin RN type IDH-10-LP                                               |
| Flat Panel :   | 50 pin RN type IDH-50-LP                                               |
| Power/Reset :  | 8 pin in-line Molex                                                    |
| PC/104 Bus :   | 64 Pin SAMTEC type ESQ-132-12-G-D<br>40 Pin SAMTEC type ESQ-120-12-G-D |

**1.3.4** Environmental :

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

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## 2

# LBC-PLUS Technical Reference

## 2.1 Introduction

This section of the manual is intended to provide sufficient information regarding the configuration and usage of the LBC-Plus board. WinSystems maintains a Technical Support group to help answer questions regarding configuration, usage, or programming of the board. For answers to questions not adequately addressed in this manual, contact Technical Support at (817) 274-7553 between 8AM and 5PM Central Time.

## 2.2 ALI 1487/1489 Chipset

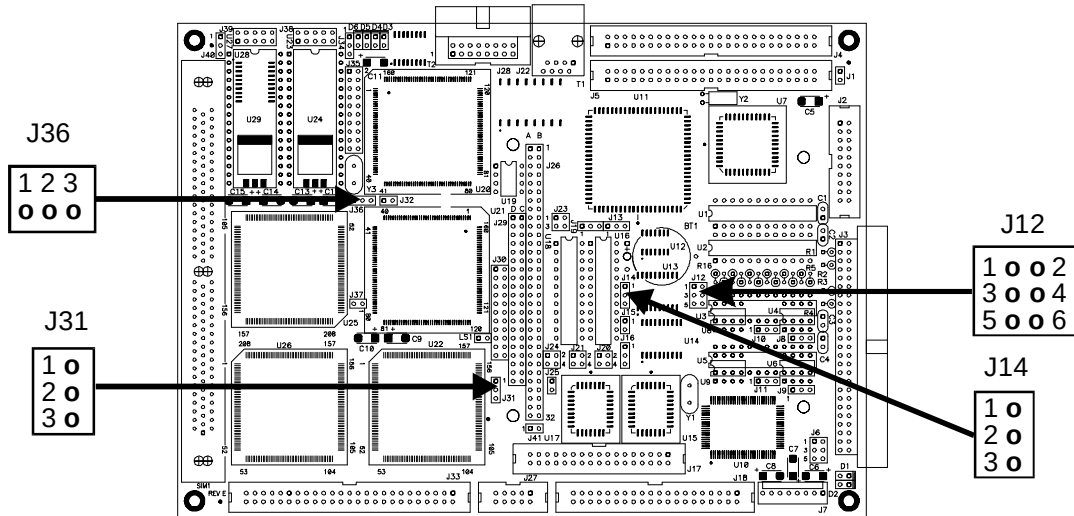
The LBC-Plus utilizes the ALI FINALI-486 Chipset which provides a highly-integrated, high-performance backbone for full PC/AT compatibility. The Chipset contains the logic for DRAM and bus state control as well as the standard complement of 'AT' class peripherals, including :

- 8 DMA Channels compatible with PC/AT 8237A DMA controllers
- 15 interrupt inputs compatible with master/slaved 8259 interrupt controllers
- Three 8254 compatible timer/counter channels
- A PC-AT compatible real time clock/calendar with CMOS RAM
- A PCI BUS IDE interface
- A PC/AT compatible keyboard interface

These functional units are 100% PC/AT compatible and are supported by the AWARD BIOS and setup. Users desiring to access these internal peripherals directly should refer to any manufacturers generic literature on the equivalent discrete component.

There are a number of internal registers within the Finali-486 chipset that are used by the BIOS for control and configuration. Refer to the I/O map in Appendix A for port usage to avoid conflicts when adding external I/O devices.

## 2.3 CPU Speed Selection



The LBC-Plus uses a Crystal controlled frequency synthesizer to control the CPU clock rate. The jumper block at J12 allows for the selection of any of 8 CPU base clock frequencies ranging from 8 MHz to 100 MHz.

The table below gives all of the possible CPU clock speeds available by jumpering J12.

| CPU Speed | J12<br>1-2 | J12<br>3-4 | J12<br>5-6 |
|-----------|------------|------------|------------|
| 8 Mhz     | ON         | ON         | ON         |
| 16 MHz    | ON         | ON         | OFF        |
| 33 MHz    | ON         | OFF        | ON         |
| 40 MHz    | ON         | OFF        | OFF        |
| 50 MHz    | OFF        | ON         | ON         |
| 66 MHz    | OFF        | ON         | OFF        |
| 80 MHz    | OFF        | OFF        | ON         |
| 100 MHz   | OFF        | OFF        | OFF        |

**NOTE :** The LBC-Plus board will be jumpered at the factory for the rated speed of the installed processor. Jumpering J12 to any speed in excess of the rated speed may result in CPU overheating, misoperation, and possible destruction of the CPU. Failures of CPUs which have been operated above their rated speed or temperature are not covered under the WinSystems standard product warranty.

### 2.3.1 Clock Multiplier Select

486DX4 and 5X86 processors actually run at a multiple of the base oscillator frequency. The jumper block at J36 allows selection of the multiplier as shown here :



## 2.4 PCI Clock Select

The PCI bus clock source must be selected using jumper blocks at J14 and J31. The CPUCLK source may be selected any time the CPU base frequency is less than or equal to 33MHz. For any CPU base frequency in excess of 33MHz the CPUCLK/2 selection must be made.

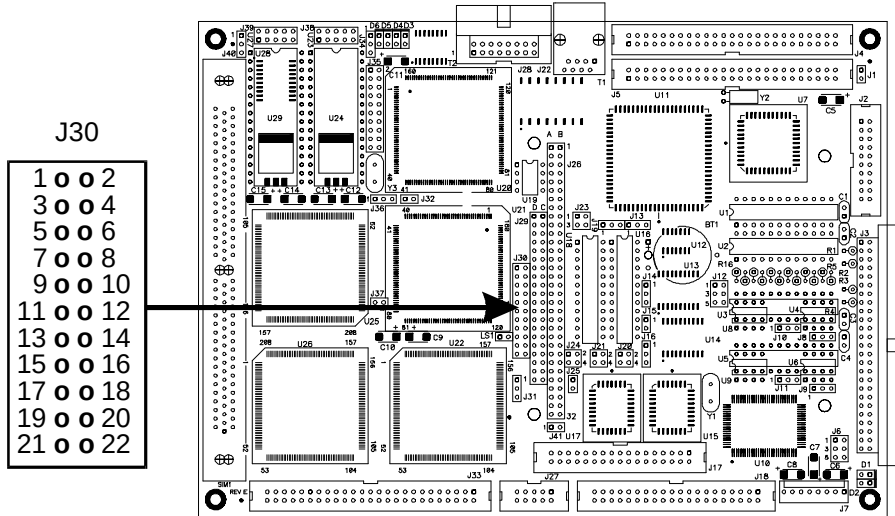


## 2.5 Memory Installation

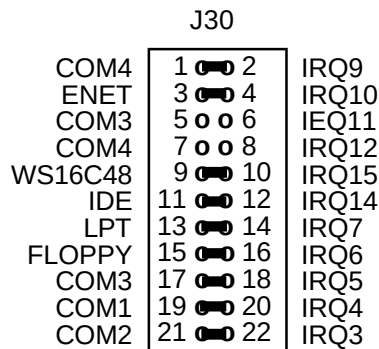
The LBC-Plus utilizes user installable 72-pin standard SIMMs. SIMM modules should be a minimum speed of 70nS and X32 architecture is preferred as there is no support for the parity bits provided by X36 bit modules. A single SIMM socket is provided which can support DRAM sizes from 1MB to 32MB.

Installation is accomplished with power off by angling the SIMM module approximately 30 degrees from vertical and inserting the fingers into the connector (It may be necessary to remove any device installed in the U27 socket. ). The SIMM module is keyed slightly off-center and cannot be inserted backwards without extreme force. Once the fingers are in the socket, the module is then rotated to the vertical until the retaining clips snap into place. Removal is the reverse process. Pull the retaining clips outward and the SIMM module, once released, should rotate back to an appropriate removal angle.

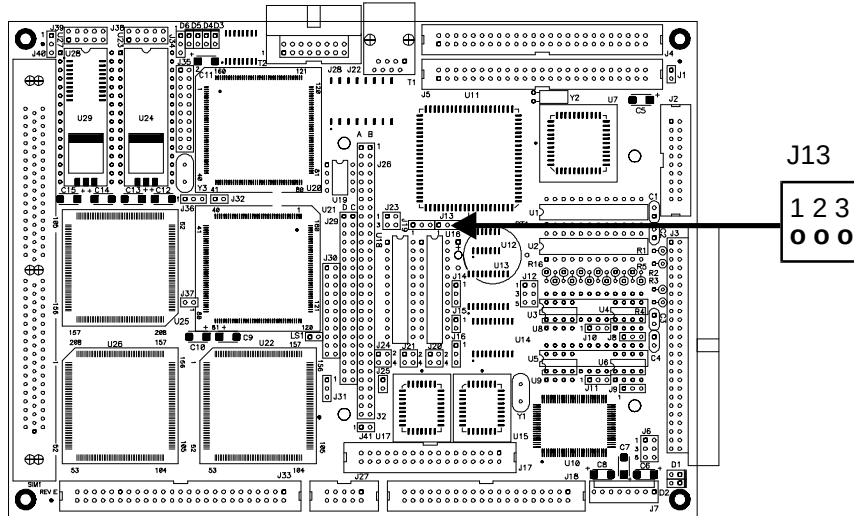
## 2.6 Interrupt routing



All interrupts on the LBC-Plus are routed to their respective PC/104 bus pins. Onboard peripherals, serial, parallel, and disk are routed to their typical usage interrupts using the jumper block at J30. This block allows disconnecting or rerouting of the onboard interrupts. The layout for the J30 header and the default jumper settings are shown here.



## 2.7 Real Time Clock/Calendar



The LBC-Plus contains an onboard Clock/Calendar within the ALI1487 chip. This clock is fully compatible with the MC146818A used in the original PC-AT computers. This clock has a number of features including periodic and alarm interrupt capabilities. In addition to the time and date keeping functions, the system configuration is kept within the CMOS RAM contained in the clock section. This RAM holds all of the setup information regarding hard and floppy disk types, video type, shadowing, wait states, etc. Refer to the section on the AWARD BIOS Setup for what is configured via the CMOS RAM.

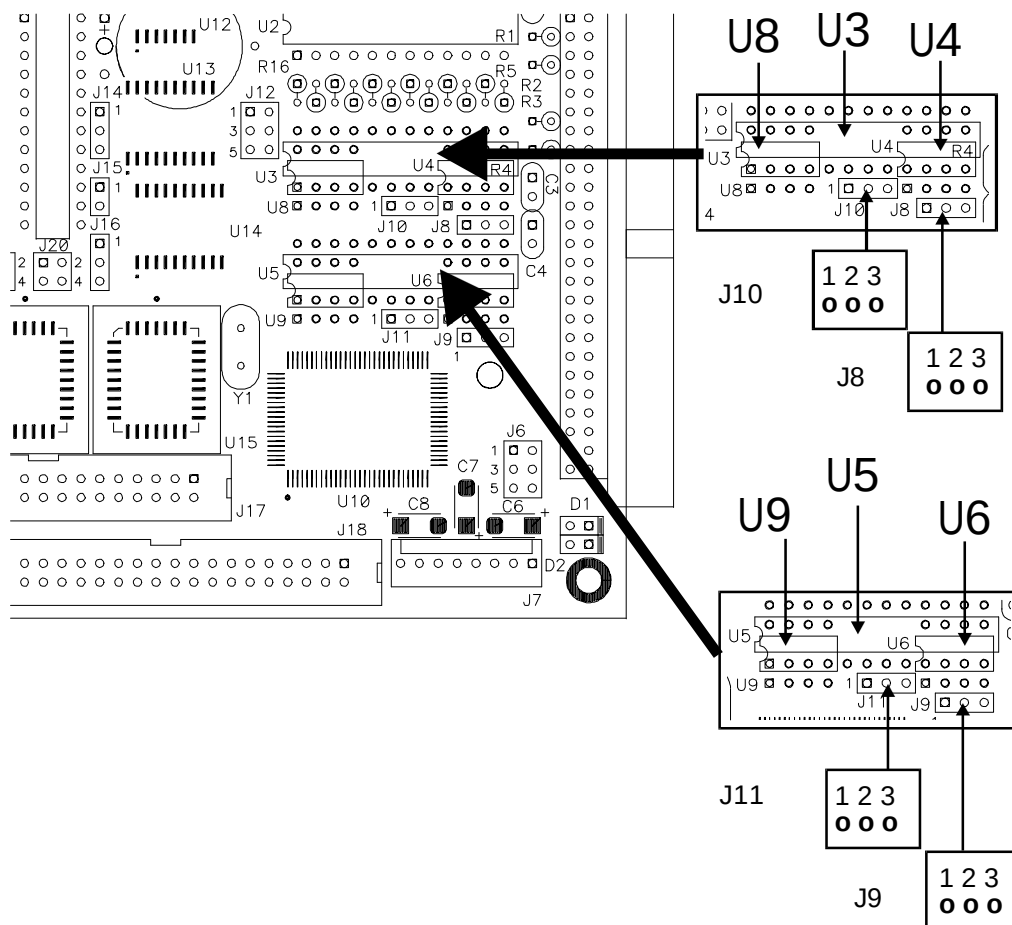
It may become necessary at some time to make the CMOS RAM forget its current configuration and to start fresh with factory defaults. This may be accomplished by removing power from the board. Then remove the jumper from pins 1-2 on J13 and place on pins 2-3 for 30 seconds. Replace the jumper on J13 pins 1-2, power-up, and reconfigure the CMOS settings as desired.

**NOTE :** J13 is the master battery enable jumper. Removing the jumper removes battery power from the entire board including the SSD array. Be sure that any data contained in battery backed SRAM is backed up before removing the battery jumper. J13 must be jumpered 2-3 in the clear position if a battery is not installed.

## 2.8 Keyboard Interface

The LBC-Plus contains an onboard PC-AT style keyboard controller. Keyboard connection is made through the Multi-I/O connector at J3. An adapter cable P/N CBL-162-1 is available from WinSystems to make ready access to all of the devices terminated at the Multi-I/O connector. Users desiring custom connections should refer to the Multi-I/O connector pin definitions given later in this manual.

## 2.9 Serial Interface



The LBC-Plus provides four 16550 compatible RS-232 serial ports at the following addresses :

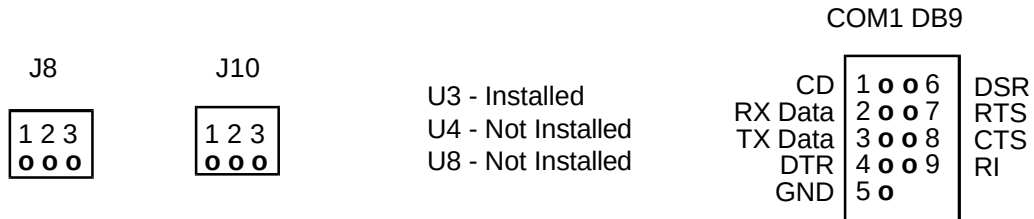
|      |       |            |
|------|-------|------------|
| COM1 | 3F8H  | at IRQ 4   |
| COM2 | 2F8H  | at IRQ 3   |
| COM3 | 3E8H* | at IRQ 5** |
| COM4 | 2E8H* | at IRQ 9** |

\*COM ports 3 and 4 can be enabled or disabled individually via the jumper block at J23. When J23 pins 1-2 are jumpered, COM3 is enabled. When J23 pins 3-4 are jumpered, COM4 is enabled.

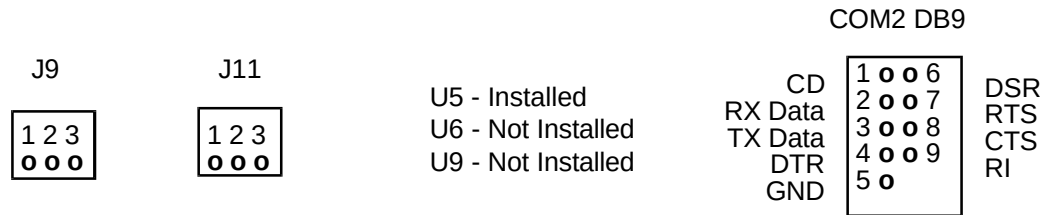
\*\*The interrupts are not disconnected when COM3 or COM4 are disabled. Use the interrupt routing block described earlier to disconnect the default interrupts if desired.

The two primary serial ports, COM1 and COM2 are configurable for RS-422, RS-485 or J1708, with the addition of optional driver ICs. The configuration options for each of the supported modes are shown on the following pages.

### COM1 - RS-232

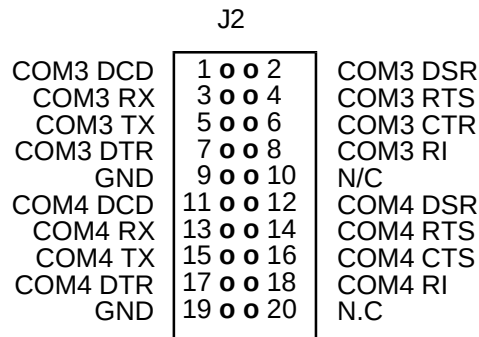


### COM2 - RS-232



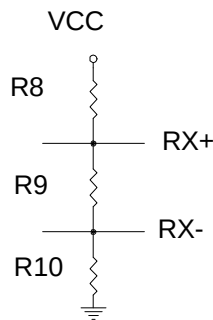
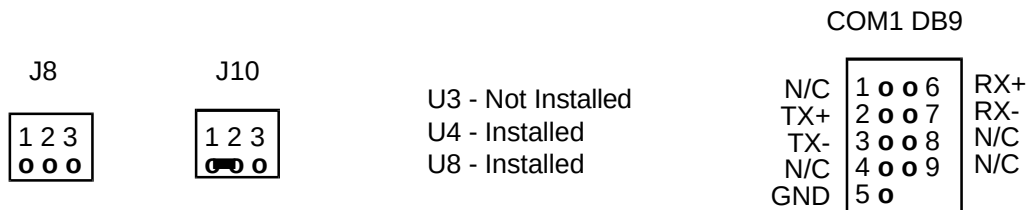
### COM3/COM4 - RS-232

COM3 and COM4 are RS-232 only and are terminated at J2. An adapter cable is available from WinSystems ( P/N CBL- 173-1), which adapts J2 to two standard DB9M connectors. The pin definitions for J2 are shown here :

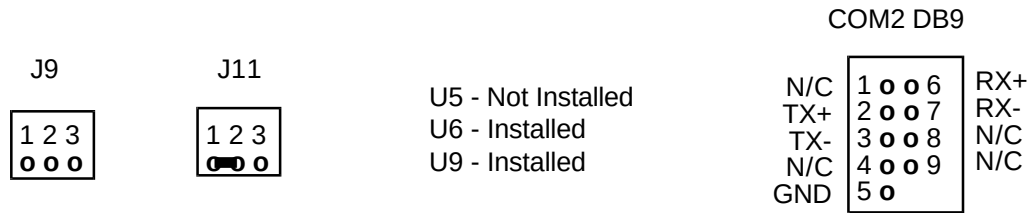


**2.9.1** RS-422 Mode Configuration

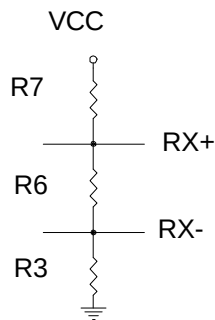
RS-422 levels are supported on both COM1 and COM2 with the installation of the optional "Chip Kit", WinSystems part number CK-75176-2. This kit provides the driver ICs necessary for a single channel of RS-422. If two channels of RS-422 are required then two kits will be needed. RS-422 is a 4-wire point-to-point full-duplex interface allowing much longer cable runs than are possible with RS-232. The differential transmitter and receiver twisted pairs offer a high degree of noise immunity. RS-422 usually requires the lines be terminated at both ends. This termination can be accomplished either on the cable or by installing resistors on the board in locations reserved for them. The method for determining the correct resistor values is beyond the scope of this document but it is recommended that trial values of 100 ohms be used in all three locations at the receiver end. The following illustration shows the correct mode jumpering, driver IC installation, I/O connector pin definitions, and termination resistor locations for each of the channels when used in RS-422 mode.

**COM1 - RS-422**

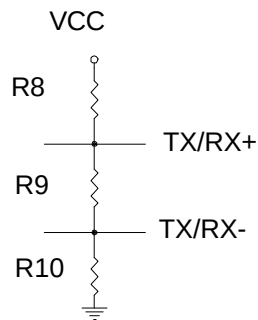
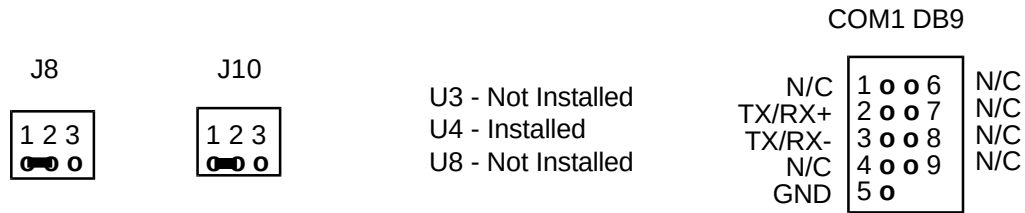
**RS-422 NOTE :** When used in RS-422 mode, the transmitter must be enabled by setting the RTS bit in the Modem Control Register (Bit1).

**COM2 - RS-422**

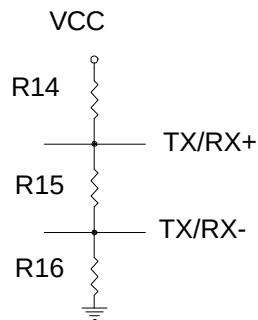
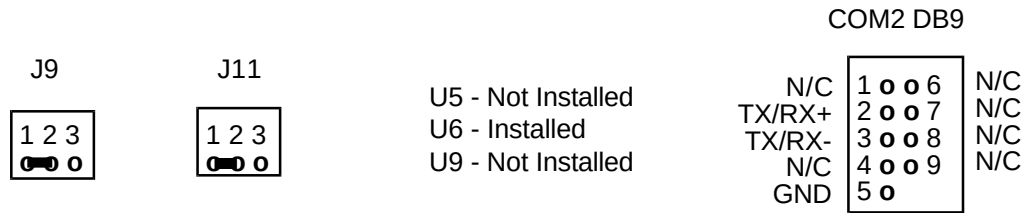
**RS-422 NOTE :** When used in RS-422 mode, the transmitter must be enabled by setting the RTS bit in the Modem Control Register (Bit1).

**2.9.2** RS-485 Mode Configuration

The RS-485 Multi-drop interface is supported on both channels with the installation of the optional "Chip Kit", WinSystems part number CK-75176-2. A single kit is sufficient to configure both channels for RS-485. RS-485 is a 2-wire multi-drop interface where only one station at a time talks (transmits) while all others listen (receive). RS-485 usually requires the twisted pair be terminated at each end of the run. The required termination values are dependent upon a number of factors including: line impedance, line length, etc. A good trial value is 100 ohms in all three resistor locations. The following illustrations show the correct jumpering, driver IC installation, I/O connector pinout, and termination resistor locations for each of the channels when used in RS-485 mode.

**COM1 - RS-485**

**RS-485 NOTE :** Because RS-485 uses a single twisted-pair, all transmitters are connected in parallel. Only one station at a time may transmit or have its transmitter enabled. The transmitter Enable/Disable is controlled in software using bit 1 in the Modem Control Register (RTS). When RTS is set, the transmitter is enabled, and when cleared (the normal state) the transmitter is disabled and the receiver is enabled. Note that it is necessary to allow some minimal settling time after enabling the transmitter before transmitting the first character. Likewise, following a transmission, it is necessary to be sure that all characters have been completely shifted out of the UART (Check Bit 6 in the Line Status Register) before disabling the transmitter to avoid chopping off the last character.

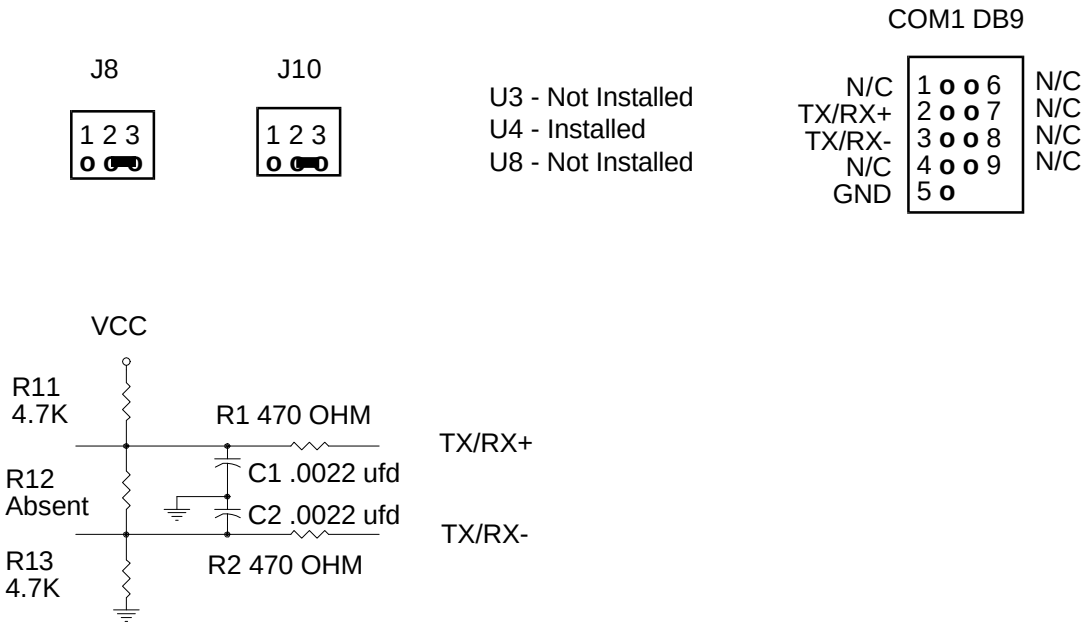
**COM2 - RS-485**

**RS-485 NOTE :** Because RS-485 uses a single twisted-pair, all transmitters are connected in parallel. Only one station at a time may transmit or have its transmitter enabled. The transmitter Enable/Disable is controlled in software using bit 1 in the Modem Control Register (RTS). When RTS is set, the transmitter is enabled, and when cleared (the normal state) the transmitter is disabled and the receiver is enabled. Note that it is necessary to allow some minimal settling time after enabling the transmitter before transmitting the first character. Likewise, following a transmission, it is necessary to be sure that all characters have been completely shifted out of the UART (Check Bit 6 in the Line Status Register) before disabling the transmitter to avoid chopping off the last character.

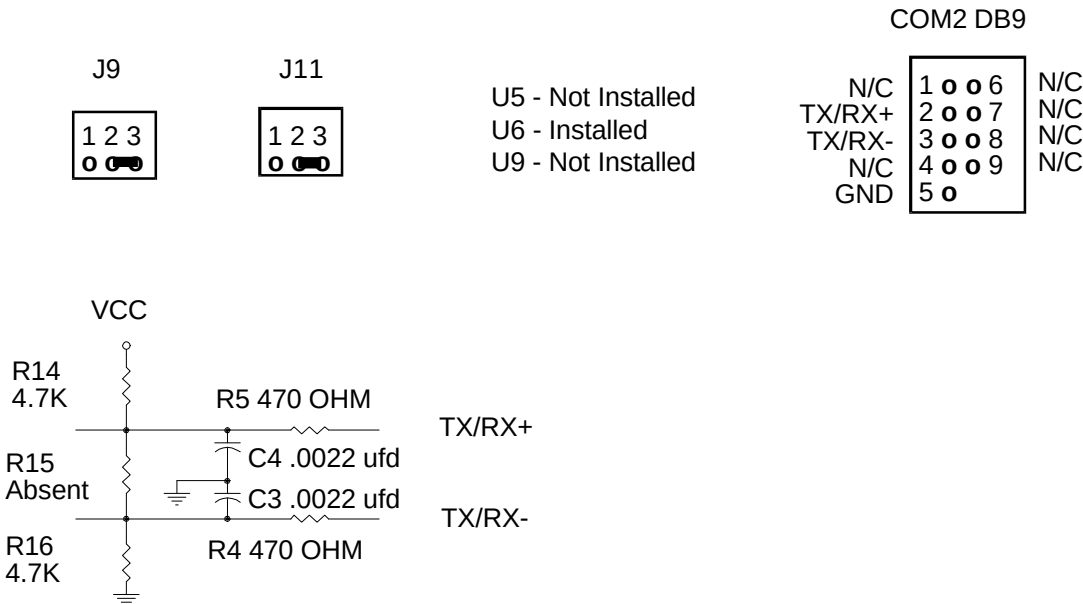
**2.9.3 SAE J1708 Configuration**

The Society of Automotive Engineers (SAE) J1708 interface is a variation of the RS-485 interface which is used for "Serial Data Communications between Microcomputer Systems in Heavy Duty Vehicle Applications". It is beyond the scope of this document to go into detail on the J1708 specification. The LBC-Plus may be user configured for J1708 by the addition of the CK-75176-2 "Chip Kit". One "Chip Kit" is sufficient to configure both channels for J1708. The illustrations that follow show the correct jumpering, driver IC installation, I/O connector pin definitions, and the termination network details for each of the channels when used in J1708 mode.

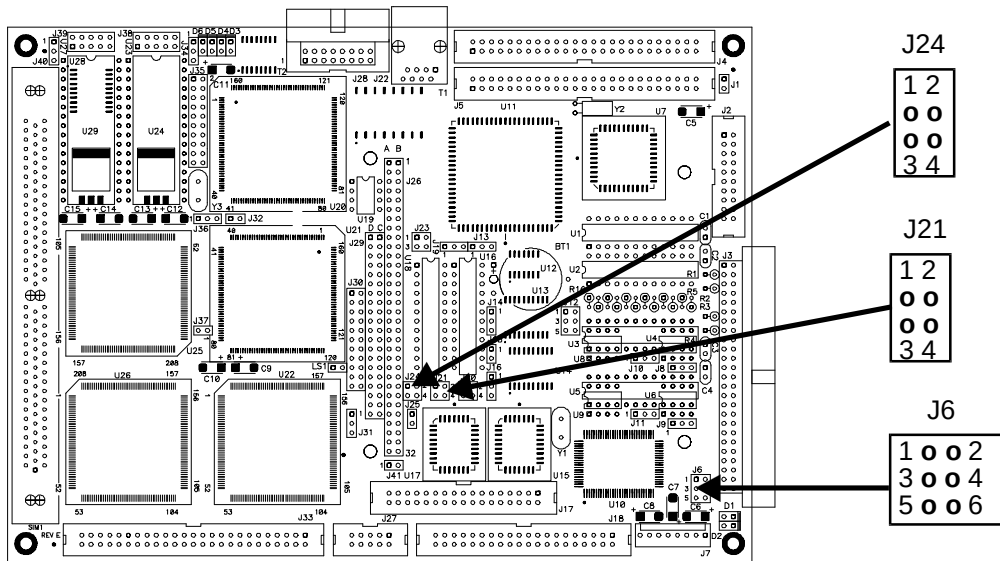
**COM1 - J1708**



**COM2 - J1708**



2.10 Parallel Printer Port



The LBC-Plus supports a fully bi-directional parallel printer port capable of EPP and ECP operations. The parallel port is mapped at 278H and is terminated at the Multi-I/O connector J3. The pin definitions for the parallel port DB25 connector when using the CBL-162-1 cable are shown below :

|        |    |    |    |    |    |    |    |    |    |    |    |    |    |    |        |
|--------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--------|
| STROBE | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | AUTOFD |
| PD0    | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | ERROR  |
| PD1    | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | INIT   |
| PD2    | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | SLIN   |
| PD3    | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | GND    |
| PD4    | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | GND    |
| PD5    | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | GND    |
| PD6    | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | GND    |
| PD7    | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | GND    |
| ACK    | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | GND    |
| BUSY   | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | GND    |
| PE     | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | GND    |
| SLCT   | 13 |    |    |    |    |    |    |    |    |    |    |    |    |    | GND    |

2.10.1 Parallel Port Mode Selection

The parallel port mode is selected via the jumper block at J6 per the following table :

| J6<br>Jumpering | SPP Mode | EPP Mode | ECP Mode | EPP/ECP Mode |
|-----------------|----------|----------|----------|--------------|
|                 | 3-5      | 3-5      | 1-3      | 1-3          |
|                 | 4-6      | 2-4      | 4-6      | 2-4          |

## 2.10.2 ECP DMA Configuration

When the parallel port is used in an ECP configuration, the jumper blocks at J21 and J24 are used to select the desired DMA channel as shown here :



## 2.11 Speaker/Sound Interface

The LBC-Plus utilizes a high-impedance piezo type device for audio output. BIOS beep codes, error signaling, or user defined tones can be presented via this device.

## 2.12 PC/104 Bus Interface

The LBC-Plus supports I/O expansion through the standard PC/104 connectors at J26 and J29. The LBC-Plus supports both 8-bit and 16-bit PC/104 modules. The PC/104 connector pin definitions are provided on the following page for reference purposes.

## 2.13 Floppy Disk Interface

The LBC-Plus supports up to 2 standard 3 1/2" or 5 1/4" PC compatible floppy disk drives. The drives are connected via the I/O connector at J17. Note that the interconnect cable to the drives is a standard floppy I/O cable used on desk-top PCs. The cable must have the twisted section prior to the drive A position. The pin definitions for the J17 connector are shown here :

| J17 |    |   |   |           |
|-----|----|---|---|-----------|
| GND | 1  | • | • | 2 RPM/LC  |
| GND | 3  | • | • | 4 N/C     |
| GND | 5  | • | • | 6 N/C     |
| GND | 7  | • | • | 8 INDEX   |
| GND | 9  | • | • | 10 MTR0   |
| GND | 11 | • | • | 12 DRV1   |
| GND | 13 | • | • | 14 DRV0   |
| GND | 15 | • | • | 16 MTR1   |
| GND | 17 | • | • | 18 DIR    |
| GND | 19 | • | • | 20 STEP   |
| GND | 21 | • | • | 22 WDATA  |
| GND | 23 | • | • | 24 WGATE  |
| GND | 25 | • | • | 26 TRK0   |
| GND | 27 | • | • | 28 WPRT   |
| GND | 29 | • | • | 30 RDATA  |
| GND | 31 | • | • | 32 HDSEL  |
| GND | 33 | • | • | 34 DSKCHG |

| J26     |     |   |   |     | J29     |      |     |   |   |     |         |
|---------|-----|---|---|-----|---------|------|-----|---|---|-----|---------|
| GND     | B1  | 0 | 0 | A1  | IOCHK   | GND  | C0  | 0 | 0 | D0  | GND     |
| RESET   | B2  | 0 | 0 | A2  | BD7     | SBHE | C1  | 0 | 0 | D1  | MEMCS16 |
| +5V     | B3  | 0 | 0 | A3  | BD6     | LA23 | C2  | 0 | 0 | D2  | IOCS16  |
| IRQ9    | B4  | 0 | 0 | A4  | BD5     | LA22 | C3  | 0 | 0 | D3  | IRQ10   |
| -5V     | B5  | 0 | 0 | A5  | BD4     | LA21 | C4  | 0 | 0 | D4  | IRQ11   |
| DRQ2    | B6  | 0 | 0 | A6  | BD3     | LA20 | C5  | 0 | 0 | D5  | IRQ12   |
| -12V    | B7  | 0 | 0 | A7  | BD2     | LA19 | C6  | 0 | 0 | D6  | IRQ15   |
| 0WS     | B8  | 0 | 0 | A8  | BD1     | LA18 | C7  | 0 | 0 | D7  | IRQ14   |
| +12V    | B9  | 0 | 0 | A9  | BD0     | LA17 | C8  | 0 | 0 | D8  | DACK0   |
| GND     | B10 | 0 | 0 | A10 | IOCHRDY | MEMR | C9  | 0 | 0 | D9  | DRQ0    |
| MEMW    | B11 | 0 | 0 | A11 | AEN     | MEMW | C10 | 0 | 0 | D10 | DACK5   |
| MEMR    | B12 | 0 | 0 | A12 | SA19    | SD8  | C11 | 0 | 0 | D11 | DRQ5    |
| IOW     | B13 | 0 | 0 | A13 | SA18    | SD9  | C12 | 0 | 0 | D12 | DACK6   |
| IOR     | B14 | 0 | 0 | A14 | SA17    | SD10 | C13 | 0 | 0 | D13 | DRQ6    |
| DACK3   | B15 | 0 | 0 | A15 | SA16    | SD11 | C14 | 0 | 0 | D14 | DACK7   |
| DRQ3    | B16 | 0 | 0 | A16 | SA15    | SD12 | C15 | 0 | 0 | D15 | DRQ7    |
| DACK1   | B17 | 0 | 0 | A17 | SA14    | SD13 | C16 | 0 | 0 | D16 | VCC     |
| DRQ1    | B18 | 0 | 0 | A18 | SA13    | SD14 | C17 | 0 | 0 | D17 | MASTER  |
| REFRESH | B19 | 0 | 0 | A19 | SA12    | SD15 | C18 | 0 | 0 | D18 | GND     |
| SYSCLK  | B20 | 0 | 0 | A20 | SA11    | KEY  | C19 | 0 | 0 | D19 | GND     |
| IRQ7    | B21 | 0 | 0 | A21 | SA10    |      |     |   |   |     |         |
| IRQ6    | B22 | 0 | 0 | A22 | SA9     |      |     |   |   |     |         |
| IRQ5    | B23 | 0 | 0 | A23 | SA8     |      |     |   |   |     |         |
| IRQ4    | B24 | 0 | 0 | A24 | SA7     |      |     |   |   |     |         |
| IRQ3    | B25 | 0 | 0 | A25 | SA6     |      |     |   |   |     |         |
| DACK2   | B26 | 0 | 0 | A26 | SA5     |      |     |   |   |     |         |
| TC      | B27 | 0 | 0 | A27 | SA4     |      |     |   |   |     |         |
| BALE    | B28 | 0 | 0 | A28 | SA3     |      |     |   |   |     |         |
| +5V     | B29 | 0 | 0 | A29 | SA2     |      |     |   |   |     |         |
| OSC     | B30 | 0 | 0 | A30 | SA1     |      |     |   |   |     |         |
| GND     | B31 | 0 | 0 | A31 | SA0     |      |     |   |   |     |         |
| GND     | B32 | 0 | 0 | A32 | GND     |      |     |   |   |     |         |

## 2.14 IDE Hard Disk Interface

The LBC-Plus supports standard IDE fixed disks through the I/O connector at J18. A red activity LED is present at D1. The pin definitions for J18 are shown here :

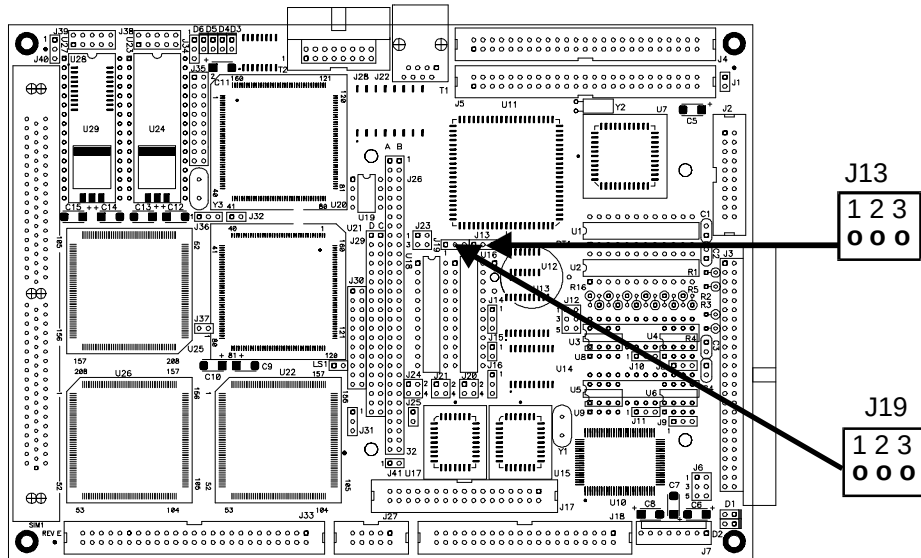
| J18   |    |    |        |
|-------|----|----|--------|
| RESET | 1  | 2  | GND    |
| D7    | 3  | 4  | D8     |
| D6    | 5  | 6  | D9     |
| D5    | 7  | 8  | D10    |
| D4    | 9  | 10 | D11    |
| D3    | 11 | 12 | D12    |
| D2    | 13 | 14 | D13    |
| D1    | 15 | 16 | D14    |
| D0    | 17 | 18 | D15    |
| GND   | 19 | 20 | N/C    |
| GND   | 21 | 22 | GND    |
| IOW   | 23 | 24 | GND    |
| IOR   | 25 | 26 | GND    |
| N/C   | 27 | 28 | ALE    |
| N/C   | 29 | 30 | GND    |
| INTRQ | 31 | 32 | IOCS16 |
| A1    | 33 | 34 | N/C    |
| A0    | 35 | 36 | A2     |
| HDCS0 | 37 | 38 | HDCS1  |
| N/C   | 39 | 40 | GND    |

## 2.15 Watchdog Timer Configuration

The LBC-Plus board features a power-on voltage detect and power-down/power brown-out reset circuit to protect memory and I/O from faulty CPU operation during periods of illegal voltage levels. This supervisor circuitry also features a watchdog timer which can be used to guard against software lockups. An internal timer with a period of 1.5 seconds will, when enabled, reset the CPU if the watchdog has not been serviced within the allotted time. There are three watchdog modes available on the LBC-Plus. With no jumper installed on J19, the watchdog is totally disabled and can never reset the CPU. When J19 is jumpered on pins 2-3, the watchdog circuit is permanently enabled and timing begins immediately with power-on. This mode is NOT compatible with the AWARD BIOS or with MS-DOS but is available for directly embedded code that takes the place of the BIOS. The watchdog must be accessed every 1.5 seconds or a reset will occur. Petting in this mode is accomplished by writing to I/O port 1EFH with any value.

An alternate mode of operation is via software enable/disable control. This mode is set by jumpering J19 pins 1-2. In this mode the watchdog timer powers-up disabled and must be enabled in software before timing will begin. Enabling is accomplished by writing a 1 to I/O port 1EEH. Writing a 0 to I/O port 1EEH will disable the watchdog. After enabling, petting may be accomplished by writing any value to I/O port 1EFH at least every 1.5 seconds or a reset will occur. This mode of operation can be used with the BIOS or DOS provided that the watchdog is disabled before making any extensive BIOS or DOS calls, especially video or Disk IO calls which could exceed the 1.5 seconds allowed. The draw-

back to this mode is that a lockup during the time the watchdog is disabled will not allow for auto-recovery and will require an external reset.



## 2.16 Status LED

A green LED is populated on the board at D2 which can be used for any application specific purpose. The LED can be turned on in software by writing a 1 to I/O port 1EDH. The LED can be turned off by writing a 0 to 1EDH.

## 2.17 Battery Select Control

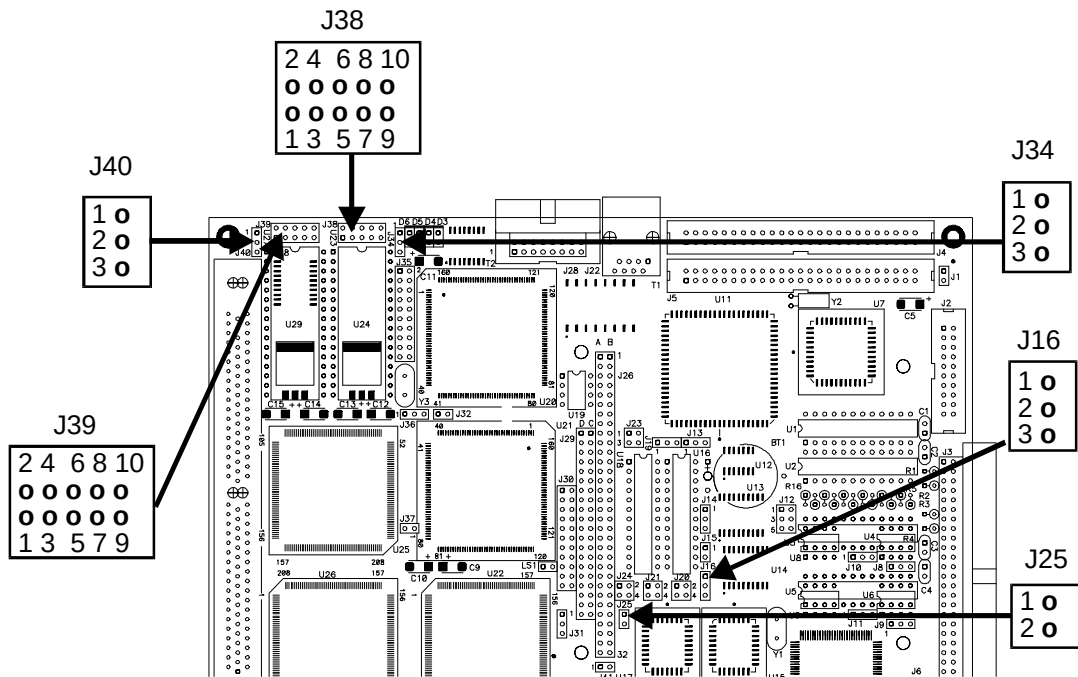
An onboard 200mAh nominal capacity, lithium coin-cell battery is provided for the CMOS Clock/Calendar and for battery backing-up Solid State Disk SRAMs. A master battery enable jumper is provided at J13. When J13 is jumpered pins 1-2, battery power is supplied to the Clock/Calendar and to the individual jumper blocks for battery backup of SSD SRAMs. When J13 is jumpered pins 2-3, the battery is totally disconnected and no current will be drawn from it. Battery life is highly dependent upon duty cycle as there is no current drawn from the battery when +5 volts is applied to the board. Both storage and operational temperatures play a prominent factor in battery life. High temperatures will shorten battery life significantly. J13 must be jumpered 2-3 in the clear position if a battery is not installed.

## 2.18 Power/Reset Connection

Power is supplied to the LBC-Plus via the connector at J7. The pin definitions for J7 are given below. An optional normally-open push-button-reset switch may also be connected to J7 between PBRESET\* and ground.

| J7 |          |
|----|----------|
| 8  | PBRESET* |
| 7  | GND      |
| 6  | GND      |
| 5  | GND      |
| 4  | +5V      |
| 3  | +5V      |
| 2  | +12V     |
| 1  | -12V     |

## 2.19 Silicon Disk Configuration

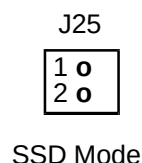


The LBC-Plus supports the use of EPROM, PEROM (Flash), SRAM, and the M-Systems DiskOn-Chip (DOC) devices to be used as Solid State Disk (SSD) drives. Section 4 of this manual provides the necessary information for the generation and usage of the Silicon drives. This section documents the required hardware configurations for the various type of devices. Two 32-pin JEDEC memory sockets at U27 and U23 are used to contain the RAM, ROM, Flash, or DOC devices used for the disk. The silicon

disk array is memory mapped into a 16k byte hole at segment E400H and has an I/O control register at 1ECH.

### 2.19.1 Silicon Disk Mode

There are two basic modes of Silicon Disk operation on the LBC-Plus. The first uses the onboard BIOS extension and supports the use of 512K or 1M EPROMs, 512K SRAMS, or 512K ATMEL Flash Devices. The second mode uses the M-Systems DiskOnChip device. The mode is controlled via the jumper block at J25 as shown here :

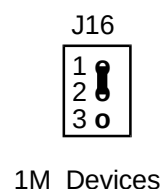
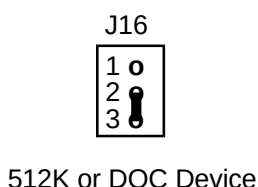


**NOTE :** Jumpering for DOC mode with EPROMs, RAMs, or Flash devices installed effectively acts as a disable to the Solid State Disk and similarly when a DOC device is installed and the jumper is selected for standard devices the DOC is disabled.

**IMPORTANT NOTE :** To insure Windows 95 compatibility, J25 must be jumpered 1-2.

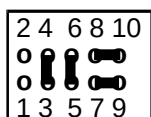
### 2.19.2 Device Size Selection

The onboard Solid State Disk array supports either 512K EPROMs, SRAMs or FLASH device or 1M EPROM devices. The device size selection is made at J16 as shown here :

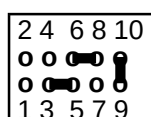


### 2.19.3 Device Type Selection

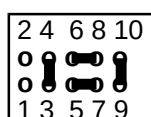
Each of the devices in the array has an individual device type jumper block at the device socket. J39 sets the device type for U27 and J38 sets the device type for U23. The supported device type jumperings are shown here :



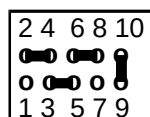
512K X 8  
SRAM



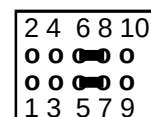
512K X 8  
EPROM



512K X 8  
PEROM



1 MEG X 8  
EPROM



DOC  
DEVICE

### 2.19.4 Battery Backup Selection

When using SRAM devices and nonvolatile operation is desired, battery backup can be selected on a socket-by-socket basis. J40 for U27 and J34 for U23. The illustration below shows the jumpering for battery backup or standard operation.



Battery Backup  
Enabled



Battery Backup  
Disabled

**NOTE :** Having the jumper(s) selected for battery backup when using other than low-power-standby SRAMs (such as with EPROMs, or PEROMs) will result in the quick draining of the onboard battery.

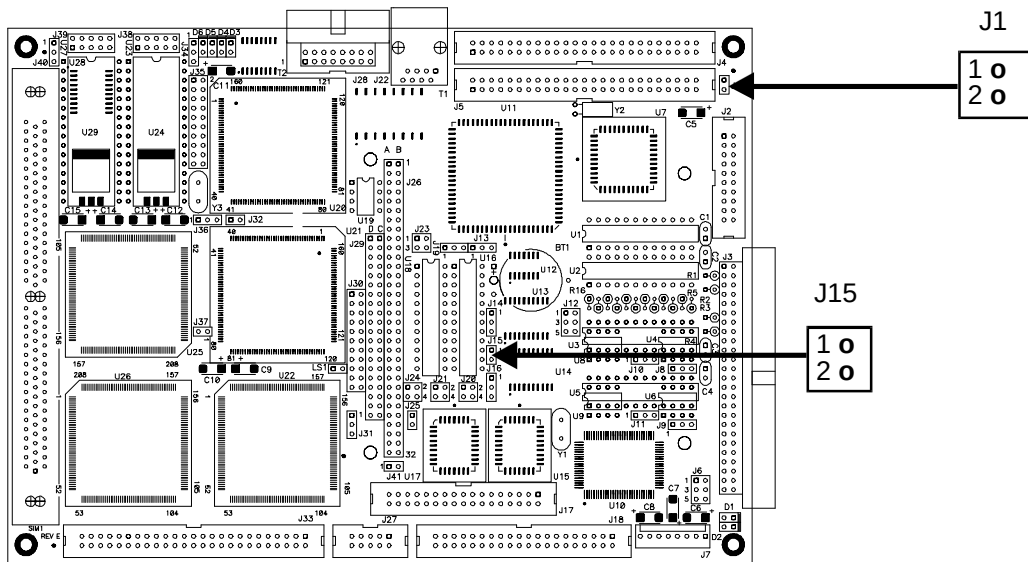
### 2.19.5 Silicon Disk Notes

1. When installing devices, U27 is the first device in the array and must always contain the first device of a bootable disk.

2. The DiskOnChip option must use the socket at U23. When a DOC is installed, U27 is available as a Secondary Silicon Disk device. See section 4.4 for more information.

## 2.20 Parallel I/O

The LBC-Plus utilizes the WinSystems WS16C48 ASIC high-density I/O chip mapped at a base address of 120H. The first 24 lines are capable of fully latched event sensing with sense polarity being software programmable. Two 50-pin connectors allow for easy mating with industry standard I/O racks.



### 2.20.1 Parallel I/O Enable

The parallel features of the LBC-Plus can be enabled or disabled using the jumper block at J15. When J15 is jumpered the parallel I/O is enabled at I/O address 120H. When J15 is open the 16 addresses starting at I/O address 120H are free for use by other devices.

### 2.20.2 Parallel I/O Connectors

The 48 lines of parallel I/O are terminated through two 50-pin connectors at J4 and J5. The J4 connector handles I/O ports 0-2 while J5 handles ports 3-5. The pin definitions for J4 and J5 are shown on the following page.

| J4           |           |     | J5           |           |     |
|--------------|-----------|-----|--------------|-----------|-----|
| Port 2 Bit 7 | 1 0 0 2   | GND | Port 5 Bit 7 | 1 0 0 2   | GND |
| Port 2 Bit 6 | 3 0 0 4   | GND | Port 5 Bit 6 | 3 0 0 4   | GND |
| Port 2 Bit 5 | 5 0 0 6   | GND | Port 5 Bit 5 | 5 0 0 6   | GND |
| Port 2 Bit 4 | 7 0 0 8   | GND | Port 5 Bit 4 | 7 0 0 8   | GND |
| Port 2 Bit 3 | 9 0 0 10  | GND | Port 5 Bit 3 | 9 0 0 10  | GND |
| Port 2 Bit 2 | 11 0 0 12 | GND | Port 5 Bit 2 | 11 0 0 12 | GND |
| Port 2 Bit 1 | 13 0 0 14 | GND | Port 5 Bit 1 | 13 0 0 14 | GND |
| Port 2 Bit 0 | 15 0 0 16 | GND | Port 5 Bit 0 | 15 0 0 16 | GND |
| Port 1 Bit 7 | 17 0 0 18 | GND | Port 4 Bit 7 | 17 0 0 18 | GND |
| Port 1 Bit 6 | 19 0 0 20 | GND | Port 4 Bit 6 | 19 0 0 20 | GND |
| Port 1 Bit 5 | 21 0 0 22 | GND | Port 4 Bit 5 | 21 0 0 22 | GND |
| Port 1 Bit 4 | 23 0 0 24 | GND | Port 4 Bit 4 | 23 0 0 24 | GND |
| Port 1 Bit 3 | 25 0 0 26 | GND | Port 4 Bit 3 | 25 0 0 26 | GND |
| Port 1 Bit 2 | 27 0 0 28 | GND | Port 4 Bit 2 | 27 0 0 28 | GND |
| Port 1 Bit 1 | 29 0 0 30 | GND | Port 4 Bit 1 | 29 0 0 30 | GND |
| Port 1 Bit 0 | 31 0 0 32 | GND | Port 4 Bit 0 | 31 0 0 32 | GND |
| Port 0 Bit 7 | 33 0 0 34 | GND | Port 3 Bit 7 | 33 0 0 34 | GND |
| Port 0 Bit 6 | 35 0 0 36 | GND | Port 3 Bit 6 | 35 0 0 36 | GND |
| Port 0 Bit 5 | 37 0 0 38 | GND | Port 3 Bit 5 | 37 0 0 38 | GND |
| Port 0 Bit 4 | 39 0 0 40 | GND | Port 3 Bit 4 | 39 0 0 40 | GND |
| Port 0 Bit 3 | 41 0 0 42 | GND | Port 3 Bit 3 | 41 0 0 42 | GND |
| Port 0 Bit 2 | 43 0 0 44 | GND | Port 3 Bit 2 | 43 0 0 44 | GND |
| Port 0 Bit 1 | 45 0 0 46 | GND | Port 3 Bit 1 | 45 0 0 46 | GND |
| Port 0 Bit 0 | 47 0 0 48 | GND | Port 3 Bit 0 | 47 0 0 48 | GND |
| +5V          | 49 0 0 50 | GND | +5V          | 49 0 0 50 | GND |

### 2.20.3 Parallel I/O VCC Enable

The I/O connectors can provide +5 volts to an I/O rack or for miscellaneous purposes by jumpering J1. When J1 is jumpered +5 volts is provided at pin 49 of both J4 and J5. It is the user's responsibility to limit current to a safe value (less than 1A) to avoid damaging the CPU board.

### 2.20.4 WS16C48 Register Definitions

The LBC-Plus uses the WinSystems' exclusive ASIC device, the WS16C48. This device provides 48 lines of digital I/O. There are 17 unique registers within the WS16C48. The following table summarizes the registers and the text that follows provides details on each of the internal registers.

| I/O Address Offset | Page 0      | Page 1      | Page 2      | Page 3      |
|--------------------|-------------|-------------|-------------|-------------|
| 00H                | Port 0 I/O  | Port 0 I/O  | Port 0 I/O  | Port 0 I/O  |
| 01H                | Port 1 I/O  | Port 1 I/O  | Port 1 I/O  | Port 1 I/O  |
| 02H                | Port 2 I/O  | Port 2 I/O  | Port 2 I/O  | Port 2 I/O  |
| 03H                | Port 3 I/O  | Port 3 I/O  | Port 3 I/O  | Port 3 I/O  |
| 04H                | Port 4 I/O  | Port 4 I/O  | Port 4 I/O  | Port 4 I/O  |
| 05H                | Port 5 I/O  | Port 5 I/O  | Port 5 I/O  | Port 5 I/O  |
| 06H                | Int_Pending | Int_Pending | Int_Pending | Int_Pending |
| 07H                | Page/Lock   | Page/Lock   | Page/Lock   | Page/Lock   |
| 08H                | N/A         | Pol 0       | Enab 0      | Int_ID0     |
| 09H                | N/A         | Pol 1       | Enab 1      | Int_ID1     |
| 0AH                | N/A         | Pol 2       | Enab 2      | Int_ID2     |

### **Register Details**

**Port 0-5 I/O** - Each I/O bit in each of the 6 ports can be individually programmed for input or output. Writing a '0' to a bit position causes the corresponding output pin to go to a High-Impedance state (pulled high by external 10K ohm resistors). This allows it to be used as an input. When used in the input mode, a read reflects the inverted state of the I/O pin, such that a high on the pin will read as a '0' in the register. Writing a '1' to a bit position causes the output pin to sink current (up to 12mA), effectively pulling it low.

**INT\_PENDING** - This read-only register reflects the combined state of the INT\_ID0 through INT\_ID2 registers. When any of the lower 3 bits are set, it indicates that an interrupt is pending on the I/O port corresponding to the bit position(s) that are set. Reading this register allows an Interrupt Service Routine to quickly determine if any interrupts are pending and which I/O port has a pending interrupt.

**PAGE/LOCK** - This register serves two purposes. The upper two bits select the register page in use as shown here :

#### **D7 D6 Page**

|   |   |        |
|---|---|--------|
| 0 | 0 | Page 0 |
| 0 | 1 | Page 1 |
| 1 | 0 | Page 2 |
| 1 | 1 | Page 3 |

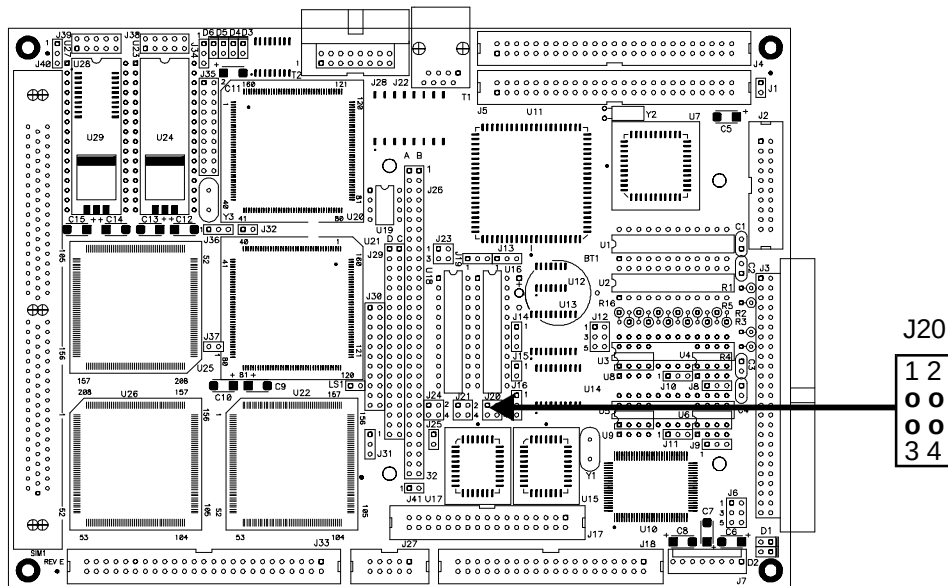
Bits 5-0 allow for locking the I/O ports. A '1' written to the I/O port position will prohibit further writes to the corresponding I/O port.

**POL0-POL2** - These registers are accessible when page 1 is selected. They allow interrupt polarity selection on a port-by-port and bit-by-bit basis. Writing a '1' to a bit position selects the rising edge detection interrupts while writing a '0' to a bit position selects falling edge detection interrupts.

**ENAB0-ENAB2** - These registers are accessible when page 2 is selected. They allow for port-by-port and bit-by-bit enabling of the edge detection interrupts. When set to a '1' the edge detection interrupt is enabled for the corresponding port and bit. When cleared to a '0' the bit's edge detection interrupt is disabled. Note that this register can be used to individually clear a pending interrupt by disabling and reenabling the pending interrupt.

**INT\_ID0 - INT\_ID2** - These registers are accessible when page 3 is selected. They are used to identify currently pending edge interrupts. A bit when read as a '1' indicates that an edge of the polarity programmed into the corresponding polarity register has been recognized. Note that a write to this register (value ignored) clears ALL of the pending interrupts in this register.

## 2.21 VGA Configuration



**2.21.1** Introduction

The LBC-Plus uses a third generation CRT/Flat panel VGA controller. It supports standard VGA output as well as a variety of Flat Panel Displays using optional Flat Panel Adapter (FPA) modules. The video on the LBC-Plus uses the Chips and Technologies 6554X series of high performance VGA controllers. The C&T controller supports standard and Super-VGA modes as well as Color and Monochrome panels with 8,9,12,15,16,18, and 24-bit interfaces. WinSystems provides flat panel support through a series of FPA (Flat Panel Adapter) modules. Contact your WinSystems Applications Engineer for the most current list of available FPAs and supported panels.

Details regarding interfacing to specific Flat Panels is not provided in this manual but should be referenced in the documentation accompanying the FPA module. Attempted connection to any flat panel not directly supported by a WinSystems FPA module is at the user's risk and extreme care should be exercised to avoid damaging or destroying the panel.

**HAZARD WARNING :** LCD panels can require a high voltage for the panel backlight. This high-frequency voltage can exceed 1000 volts and can present a shock hazard. Care should be taken when wiring or handling the inverter output. To avoid danger of shock and to avoid damaging fragile and expensive panels, make all connection changes with power removed.

**2.21.2** VGA BIOS ROM Type Selection

The LBC-Plus comes standard with a video BIOS expansion ROM populated at U15. Various ROM sizes can be used to support a variety of flat panel configurations each needing its own BIOS image. The FPA adapter modules, when connected to J33, automatically select the correct BIOS image for the panel family the FPA supports. The factory will ordinarily configure the BIOS ROM for the size provided but the illustration below shows the proper jumpering of J20 for the supported ROM sizes.



**2.21.3** CRT Output Connection

Video output to a standard VGA monitor is made via the connector at J27. An adapter cable part number CBL-207-1 is available from WinSystems to adapt from J27 to the standard DB15 VGA connector. The pin definitions for the J27 connector are shown here :

| J27   |          |     |
|-------|----------|-----|
| RED   | 1 0 0 2  | GND |
| GREEN | 3 0 0 4  | GND |
| BLUE  | 5 0 0 6  | GND |
| HSYNC | 7 0 0 8  | GND |
| VSNC  | 9 0 0 10 | GND |

**2.21.4** Flat Panel Output Connection

Connection to all flat panels is made via the 50-pin connector at J33. This connector is cabled to the appropriate FPA (Flat Panel Adapter) module which then breaks out the necessary cabling for attachment to the panel itself. The FPA module also supplies any special controls that may be needed for the panel. Refer to the FPA documentation for specific hook-up instructions. The pin definitions for J33 are shown here :

| J33    |           |       |
|--------|-----------|-------|
| SW0    | 1 0 0 2   | SW1   |
| SW2    | 3 0 0 4   | SW3   |
| P23    | 5 0 0 6   | P22   |
| P21    | 7 0 0 8   | P20   |
| P19    | 9 0 0 10  | P18   |
| GND    | 11 0 0 12 | GND   |
| P17    | 13 0 0 14 | P16   |
| P15    | 15 0 0 16 | P14   |
| P13    | 17 0 0 18 | P12   |
| GND    | 19 0 0 20 | GND   |
| P11    | 21 0 0 22 | P10   |
| P9     | 23 0 0 24 | P8    |
| P7     | 25 0 0 26 | P6    |
| GND    | 27 0 0 28 | GND   |
| P5     | 29 0 0 30 | P4    |
| P3     | 31 0 0 32 | P2    |
| P1     | 33 0 0 34 | P0    |
| GND    | 35 0 0 36 | GND   |
| SHFCLK | 37 0 0 38 | LP    |
| FLM    | 39 0 0 40 | M     |
| ENVCC  | 41 0 0 42 | ENBKL |
| ENVEE  | 43 0 0 44 | PHS   |
| PVS    | 45 0 0 46 | -12V  |
| +12V   | 47 0 0 48 | +12V  |
| VCC    | 49 0 0 50 | VCC   |

**2.21.5** Video Mode Tables

The LBC-Plus video section supports a number of standard and extended VGA modes. The following tables extracted from the C&T 65540/65545 databook show the video modes along with the required amount of RAM.

## Standard Video Modes - VGA Standard

| Mode #<br>(Hex) | Display Mode | Colors | Text Display                  | Font Size                 | Pixel Resolution                    | Dot Clock (MHz)            | Horizontal Frequency (KHz) | Vertical Frequency (Hz) | Video Memory | CRT CODE |
|-----------------|--------------|--------|-------------------------------|---------------------------|-------------------------------------|----------------------------|----------------------------|-------------------------|--------------|----------|
| 0+, 1+          | Text         | 16     | 40 X 25<br>40 X 25<br>40 X 25 | 9 X 16<br>8 X 14<br>8 X 8 | 360 X 400<br>320 X 350<br>320 X 200 | 28.322<br>25.175<br>25.175 | 31.5                       | 70                      | 256KB        | A,B,C    |
| 2+, 3+          | Text         | 16     | 80 X 25<br>80 X 25<br>80 X 25 | 9 X 16<br>8 X 14<br>8 X 8 | 720 X 400<br>640 X 350<br>620 X 200 | 28.322<br>25.175<br>25.175 | 31.5                       | 70                      | 256KB        | A,B,C    |
| 4               | Graphics     | 4      | 40 X 25                       | 8 X 8                     | 320 X 200                           | 25.175                     | 31.5                       | 70                      | 256KB        | A,B,C    |
| 5               | Graphics     | 4      | 40 X 25                       | 8 X 8                     | 320 X 200                           | 15.175                     | 31.5                       | 70                      | 256KB        | A,B,C    |
| 6               | Graphics     | 2      | 80 X 25                       | 8 X 8                     | 640 X 200                           | 25.175                     | 31.5                       | 70                      | 256KB        | A,B,C    |
| 7+              | Text         | Mono   | 80 X 25<br>80 X 25<br>80 X 25 | 9 X 16<br>9 X 14<br>9 X 8 | 720 X 400<br>720 X 350<br>720 X 350 | 28.322                     | 31.5                       | 70                      | 256KB        | A,B,C    |
| D               | Planar       | 16     | 40 X 25                       | 8 X 8                     | 320 X 200                           | 25.175                     | 31.5                       | 70                      | 256KB        | A,B,C    |
| E               | Planar       | 16     | 80 X 25                       | 8 X 8                     | 640 X 200                           | 25.175                     | 31.5                       | 70                      | 256KB        | A,B,C    |
| F               | Planar       | Mono   | 80 X 25                       | 8 X 14                    | 640 X 350                           | 25.175                     | 31.5                       | 70                      | 256KB        | A,B,C    |
| 10              | Planar       | 16     | 80 X 25                       | 8 X 14                    | 640 X 350                           | 25.175                     | 31.5                       | 70                      | 256KB        | A,B,C    |
| 11              | Planar       | 2      | 80 X 30                       | 8 X 16                    | 640 X 480                           | 25/175                     | 31.5                       | 60                      | 256KB        | A,B,C    |
| 12              | Planar       | 16     | 80 X 30                       | 8 X 16                    | 640 X 480                           | 25.175                     | 31.5                       | 60                      | 256KB        | A,B,C    |
| 13              | Packed Pixel | 256    | 40 X 25                       | 8 X 8                     | 320 X 200                           | 25.175                     | 31.5                       | 70                      | 256KB        | A,B,C    |

## CRT Codes

A - PS/2 Fixed Frequency analog CRT or equivalent (31.5/35.5 Khz Horizontal Frequency Specification)

B - Multi-Frequency CRT Monitor (37.5 Khz minimum Horizontal Frequency Specification) (NEC MultiSync 3D or equivalent)

C - Multi-Frequency High-Performance CRT Monitor (48.5 KHZ minimum Horizontal Frequency Specification) MultiSync 5D or equivalent

## Extended Resolution Modes

| Mode #<br>(Hex) | Display Mode  | Colors | Text Display | Font Size | Pixel Resolution | Dot Clock (MHz) | Horizontal Frequency (KHz) | Vertical Frequency (Hz) | Video Memory | CRT CODE |
|-----------------|---------------|--------|--------------|-----------|------------------|-----------------|----------------------------|-------------------------|--------------|----------|
| 20              | 4-Bit Linear  | 16     | 80 X 30      | 8 X 16    | 640 X 480        | 25.175          | 31.5                       | 60                      | 512KB        | A,B,C    |
| 22              | 4-Bit Linear  | 16     | 100 X 37     | 8 X 16    | 800 X 600        | 40.00           | 37.5                       | 60                      | 512KB        | B,C      |
| 24              | 4-Bit Linear  | 16     | 128 X 48     | 8 X 16    | 1024 X 768       | 65.00           | 48.5                       | 60                      | 512KB        | C        |
| 24I             |               |        |              |           |                  | 44.90           | 35.5                       | 43                      | 512KB        | B,C      |
| 30              | 8-Bit Linear  | 256    | 80 X 30      | 8 X 16    | 640 X 480        | 25/175          | 31.5                       | 60                      | 512K         | A,B,C    |
| 32              | 8-Bit Linear  | 256    | 100 X 37     | 8 X 16    | 800 X 600        | 40.00           | 37.5                       | 60                      | 512KB        | B,C      |
| 34              | 8-Bit Linear  | 256    | 128 X 48     | 8 X 16    | 1024 X 768       | 65.00           | 48.5                       | 60                      | 1MB          | C        |
| 34I             |               |        |              |           |                  | 44.90           | 35.5                       | 43                      | 1MB          | B,C      |
| 40              | 16-Bit Linear | 32K    | 80 X 30      | 8 X 16    | 640 X 480        | 50.350          | 31.5                       | 60                      | 1MB          | A,B,C    |
| 41              | 16-Bit Linear | 64K    | 80 X 30      | 8 X 16    | 640 X 480        | 50.350          | 31.5                       | 60                      | 1MB          | A,B,C    |
| 50              | 24-Bit Linear | 16M    | 80 X 30      | 8 X 16    | 640 X 480        | 65.00           | 27.1                       | 51.6                    | 1MB          | B,C      |
| 60              | Text          | 16     | 132 X 25     | 8 X 16    | 1056 X 400       | 40.00           | 30.5                       | 68                      | 256KB        | A,B,C    |
| 61              | Text          | 16     | 132 X 50     | 8 X 16    | 1056 X 400       | 40.00           | 30.5                       | 68                      | 256KB        | A,B,C    |
| 6A,70           | Planar        | 16     | 100 X 37     | 8 X 16    | 800 X 600        | 40.00           | 38.0                       | 60                      | 256KB        | B,C      |
| 72,75           | Planar        | 16     | 128 X 48     | 8 X 16    | 1024 X 768       | 65.00           | 48.5                       | 60                      | 512KB        | C        |
| 72,75I          |               |        |              |           |                  | 44.90           | 35.5                       | 43                      | 512KB        | B,C      |
| 78              | Packed Pixel  | 16     | 80 X 25      | 8 X 16    | 640 X 400        | 25.175          | 31.5                       | 70                      | 256KB        | A,B,C    |
| 79              | Packed Pixel  | 256    | 80 X 30      | 8 X 16    | 640 X 480        | 25.175          | 31.5                       | 60                      | 512KB        | A,B,C    |
| 7C              | Packed Pixel  | 256    | 100 X 37     | 8 X 16    | 800 X 600        | 40.00           | 37.5                       | 60                      | 512KB        | B,C      |
| 7E              | Packed Pixel  | 256    | 128 X 48     | 8 X 16    | 1024 X 768       | 65.00           | 48.5                       | 60                      | 1MB          | C        |
| 7EI             | Packed Pixel  |        |              |           |                  | 44.90           | 35.5                       | 43                      | 1MB          | B,C      |

Support for the modes above is included directly in the BIOS. The 'I' in the mode # column indicates "interlaced"

## CRT Codes

A - PS/2 Fixed frequency analog CRT or equivalent (31.5/35.5 Khz Horizontal Frequency Specification)

B - Multi-Frequency CRT Monitor (37.5 Khz minimum Horizontal Frequency Specification) (NEC MultiSync 3D or equivalent)

C - Multi-Frequency High-Performance CRT Monitor (48.5 KHZ minimum Horizontal Frequency Specification) MultiSync 5D or equivalent

## High Refresh Modes

| Mode #<br>(Hex) | Display Mode | Colors | Text Display | Font Size | Pixel Resolution | Dot Clock (MHz) | Horizontal Frequency (KHz) | Vertical Frequency (Hz) | Video Memory | CRT CODE |
|-----------------|--------------|--------|--------------|-----------|------------------|-----------------|----------------------------|-------------------------|--------------|----------|
| 12              | Planar       | 16     | 80 X 30      | 8 X 16    | 640 X 480        | 31.50           | 37.5                       | 75                      | 256KB        | B,C      |
| 30              | 8-Bit Linear | 256    | 80 X 30      | 8 X 16    | 640 X 480        | 31.50           | 37.5                       | 75                      | 256KB        | C        |
| 79              | Packed Pixel | 256    | 80 X 30      | 8 X 16    | 640 X 480        | 31.50           | 37.5                       | 75                      | 512KB        | C        |
| 6A,70           | Planar       | 16     | 100 X 37     | 8 X 16    | 800 X 600        | 49.50           | 46.9                       | 75                      | 512KB        | C        |
| 32              | 8-Bit Linear | 256    | 100 X 37     | 8 X 16    | 800 X 600        | 49.50           | 46.9                       | 75                      | 1MB          | C        |
| 7C              | Packed Pixel | 256    | 100 X 37     | 8 X 16    | 800 X 600        | 49.50           | 46.9                       | 75                      | 1MB          | C        |

## 2.22 Ethernet Configuration

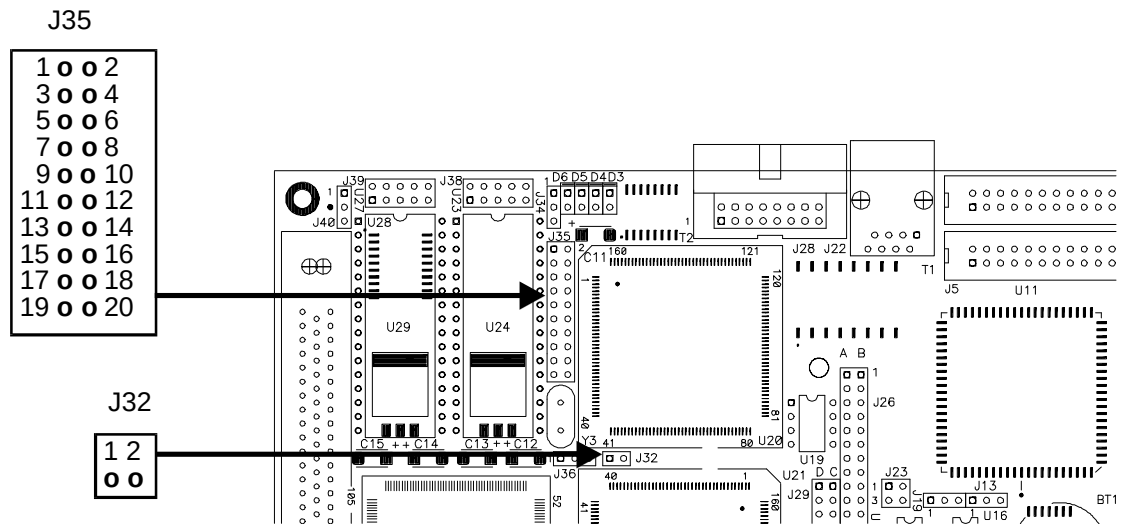
The Ethernet section of the LBC-Plus uses the National 83905 AT/LANTIC Local Area Network Twisted-Pair Interface controller. The AT/LANTIC controller is a CMOS/VLSI device used in the implementation of CSMA/CD local area networks. Supported network interfaces include 10BASE5 or 10BASE2 via an external transceiver connected to the AUI port, and twisted pair Ethernet (10BASE-T) using the onboard transceiver. The AT/LANTIC provides the Ethernet Media Access Control (MAC), Encode-Decode (ENDEC) with an AUI interface, and 10BASE-T transceiver functions in accordance with IEEE 802.3 standards.

This functional block incorporates the receiver, transmitter, collision heartbeat, loopback jabber, and link integrity blocks as defined in the standard. The transceiver when combined with the equalization resistors, transmit/receive filters, and pulse transformers provide a complete physical interface from the AT/LANTIC Controller ENDEC module and the twisted-pair medium.

The integrated ENDEC module allows the Manchester encoding and decoding via a differential transceiver and phase-lock-loop decoder at 10 Mbit/sec. Also included are a collision detect translator and diagnostic loopback capability. The ENDEC module interfaces directly to the transceiver module and provides full IEEE compliant AUI (Attachment Unit Interface) for connection to other media transceivers.

The Media Access Control (MAC) function is provided by the Network Interface Control (NIC) module which provides simple and efficient packet transmission and reception control by means of off-chip memory which can be accessed either through an I/O port or mapped into the system memory map.

An onboard EPROM holds the Ethernet Address and optional configuration information. This allows for "jumperless" configuration using software to configure the board for its operating mode, media type, I/O address, interrupt, etc.



### 2.22.1 Jumpered vs. Jumperless Mode

The Ethernet section can be configured either through the jumper block at J35 (described later) or via the configuration information stored in the onboard EEPROM. The source for the configuration information is selected via the jumper at J32 as shown here :



**NOTE :** The choice of “jumpered” or “jumperless” is totally exclusive. This means that if “jumperless” mode is selected, all of the jumpers on J35 are ignored and the configuration information comes totally from the EEPROM. Similarly if “jumpered” mode is selected the information in the EEPROM (except for the Ethernet Address) is ignored.

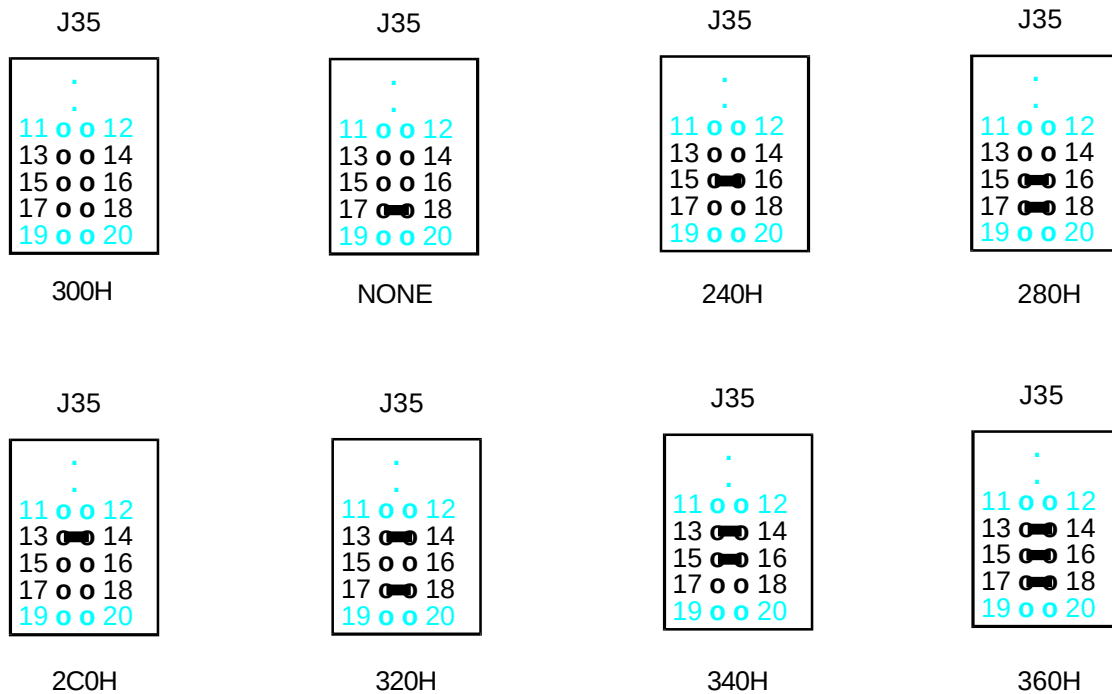
**IMPORTANT NOTE :** Interrupts must ALWAYS be jumpered manually via the jumper block at J30 (Section 1.6) which matches the “jumpered” or “jumperless” interrupt selection.

The following sections detail the J35 jumpering when the "jumped" mode is selected.

### 2.22.2 I/O Port Selection

The NE2000 section of the LBC-Plus uses 32 consecutive I/O addresses in the CPU's I/O space. The base address is selected using three pins on the J35 configuration jumper. The choices available are:

240H  
280H  
2C0H  
300H  
320H  
340H  
360H  
None



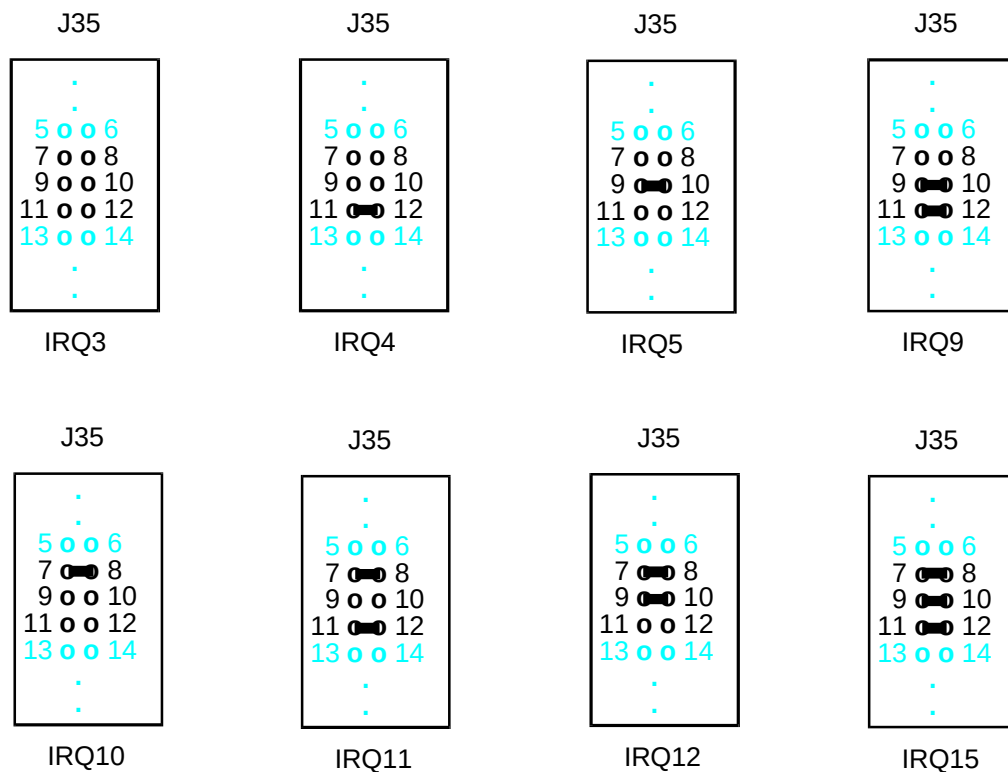
The proper jumpering for each of these choices is shown in the following illustrations.

**2.22.3** Interrupt Selection

The NE2000 section needs an interrupt line for signaling various conditions to the software driver. There are 8 possible choices as shown here :

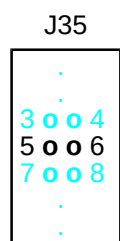
IRQ 3  
IRQ 4  
IRQ 5  
IRQ 9  
IRQ 10  
IRQ 11  
IRQ 12  
IRQ 15

The proper jumpering for the three relevant jumper positions corresponding to the available interrupt choices are shown here :

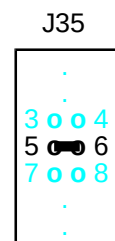


### 2.22.4 I/O vs. Shared Memory Mode

The Ethernet buffer RAM can be accessed in either of 2 ways. In the typical NE2000 compatible mode, the RAM is accessed through the NIC via I/O ports. An alternate access scheme is available using the shared memory mode. In this mode it is software compatible with the WD8013EBT from Standard Microsystems (formerly Western Digital). In this mode a 32K window in the PC adapter space is used to access packet memory. The address of this window is controlled by the driver. For NE2000 compatibility the I/O mode should be selected. The jumpering for each of the access modes is shown below :



I/O Mode



Shared Memory Mode

### 2.22.5 Media Type Selection

The media type is also jumper selectable via 2 pins on J35. The available choices are :

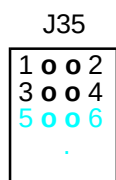
Twisted-pair 10BASE-T J22

Thin Ethernet Coax<sup>1</sup>

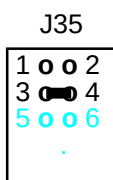
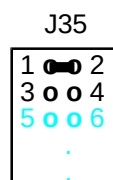
AUI<sup>2</sup> J28

Twisted-pair 10BASE-T Reduced Squelch<sup>3</sup>

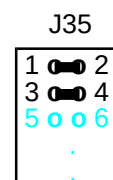
The J35 jumpering for each of the options is shown below.



10 BASE-T

THIN ETHERNET<sup>1</sup>

AUI

Non-Spec 10 BASE-T<sup>2</sup>

<sup>1</sup>The thin Ethernet mode is not usable with the LBC-Plus. If thin Ethernet is required, it is necessary to select the AUI mode and use an external transceiver.

<sup>2</sup>The AUI is connected via J28. An adapter cable, WinSystems part number CBL-147-1, is available which terminates in a standard DB15 connector.

<sup>3</sup>The non-spec twisted-pair mode with reduced squelch levels allows the use of longer cable lengths than specified in the twisted-pair specification, or the use of cable with higher losses.

### 2.22.6 Compatible Vs. Enhanced Mode

The NE2000 section uses two 32K byte buffer RAMs on board. In compatible mode, only 8K of each RAM (total of 16K) is accessible to the driver. When the Enhanced mode is chosen the full 32K is available from each RAM. This enhanced mode is generally supported by the supplied AT/LANTIC drivers but may not be usable with generic NE2000 software or drivers. When in doubt, choose the compatible mode. The J35 jumpering for the compatible and enhanced modes are shown here :



### 2.22.7 Status LEDs

There are 4 LEDs installed on the LBC-Plus used to give a visual indication of Ethernet status. The color, location, and general description of each LED is given here :

|    |        |           |
|----|--------|-----------|
| D3 | RED    | Collision |
| D4 | GREEN  | Transmit  |
| D5 | GREEN  | Receiver  |
| D6 | YELLOW | Link      |

### 2.22.8 Boot ROM Selection

The LBC-Plus supports the use of the remote boot feature available from NOVELL, QNX, and some other operating systems by allowing provisions for a user installed BIOS extension ROM into U23. Only a 27C010 EPROM device is supported in this mode although only 32K is available for the code. If the BIOS extension is supplied in a smaller device it will have to be reprogrammed into a 27C010 device. In order to use this BIOS extension, the board must be configured for the DOC mode. (See section 2.19 for details). It is also possible to select the address where the BIOS ROM will appear by configuring the SSD Socket Relocation option in the BIOS features menu of CMOS Setup.

**NOTE :** The Ethernet BOOT ROM support and onboard SSD support are mutually exclusive, only one or the other may be used. Contact WinSystems for boards that support this feature.

**2.22.9** PlusCfg Configuration Utility

When "jumperless" mode is selected (Section 2.22.1), the configuration is made via software which is then saved to the onboard EEPROM. PLUSCFG.EXE along with MESSAGE.MSG can be run from the provided floppy or can be copied to a hard disk. From the DOS command line PLUSCFG.EXE is executed by typing :

```
pluscfg [Enter]
```

The configuration program will load and display the basic menu and configuration screen. If any AT/LANTIC, or NE2000 adapters are recognized, they will be displayed in a window on the right side of the screen as shown here :

| WinSystems<br>Thick/Thin/TPI<br>August 20, 1993 11:34PM                                                                                                                                                 | PLUSCFG V1.17                                                                                                                                                                                                                                                                                                                                                                                                                                 | AT/LANTIC<br>Configuration<br>Software |          |      |     |       |          |    |       |          |   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|----------|------|-----|-------|----------|----|-------|----------|---|
| <div style="text-align: center; margin-bottom: 10px;"><b>CONFIGURATION</b></div> <p>Configure New Adapter<br/>Display/Change Adapter Configuration</p> <p>Diagnostics</p> <p>Quit and Return to DOS</p> | <div style="text-align: center; margin-bottom: 10px;"><b>AT/LANTIC ADAPTERS</b></div> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">I/O Port</th> <th style="text-align: left;">Mode</th> <th style="text-align: left;">IRQ</th> </tr> </thead> <tbody> <tr> <td>0x320</td> <td>I/O Port</td> <td>10</td> </tr> <tr> <td>0x360</td> <td>I/O Port</td> <td>5</td> </tr> </tbody> </table> |                                        | I/O Port | Mode | IRQ | 0x320 | I/O Port | 10 | 0x360 | I/O Port | 5 |
| I/O Port                                                                                                                                                                                                | Mode                                                                                                                                                                                                                                                                                                                                                                                                                                          | IRQ                                    |          |      |     |       |          |    |       |          |   |
| 0x320                                                                                                                                                                                                   | I/O Port                                                                                                                                                                                                                                                                                                                                                                                                                                      | 10                                     |          |      |     |       |          |    |       |          |   |
| 0x360                                                                                                                                                                                                   | I/O Port                                                                                                                                                                                                                                                                                                                                                                                                                                      | 5                                      |          |      |     |       |          |    |       |          |   |
| ***** Make Selection using arrow keys and <enter> *****<br>***** Scroll through options using <tab> *****                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                        |          |      |     |       |          |    |       |          |   |

From the main menu choose the desired function. Each of the main menu options will be discussed in the following sections.

## 2.22.10 Configure New Adapter

This screen is used to configure an installed adapter that is not present in the window on the right side of the screen. Typically this would be a board that had it's I/O port set to "None".

Two choices are provided to configure the new adapter.

The "Configure New Adapter Automatically" will search out an unconfigured adapter, if present, survey the system, and make automatic choices for I/O address and interrupts for what it believes are free for use. The system will then display a series of configuration options to the user. These include :

Adapter Architecture - I/O Port or Shared Memory

Select Cable Interface - Thin Ethernet or Thick Ethernet or 10BASE-T

The second prompt will only be present if there is no active cable attached or if the program is unable to determine the media type.

| WinSystems<br>Thick/Thin/TPI<br>August 20, 1993 11:34PM                                                                                                                                                                                                                                                                                                                                                                                                                                                              | PLUSCFG V1.17 | AT/LANTIC<br>Configuration<br>Software                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |  |  |          |      |     |       |          |    |       |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--|--|----------|------|-----|-------|----------|----|-------|--|--|
| <div style="border: 1px solid black; padding: 10px; margin: 10px auto; width: 80%;"> <p style="text-align: center; margin: 0;">CONFIGURATION</p> <div style="border: 1px solid black; padding: 10px; margin: 10px auto; width: 80%;"> <p style="text-align: center; margin: 0;">CONFIGURE NEW ADAPTER</p> <p style="margin: 5px 0;">Configure New Adapter Automatically</p> <p style="margin: 5px 0;">Configure New Adapter Manually</p> <p style="margin: 10px 0 0 20px;">Return to previous menu</p> </div> </div> |               | <table style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="3" style="text-align: center; padding: 5px;">AT/LANTIC ADAPTERS</th> </tr> <tr> <th style="text-align: left; padding: 5px;">I/O Port</th> <th style="text-align: left; padding: 5px;">Mode</th> <th style="text-align: left; padding: 5px;">IRQ</th> </tr> <tr> <td style="padding: 5px;">0x320</td> <td style="padding: 5px;">I/O Port</td> <td style="padding: 5px;">10</td> </tr> <tr> <td style="padding: 5px;">_____</td> <td></td> <td></td> </tr> </table> | AT/LANTIC ADAPTERS |  |  | I/O Port | Mode | IRQ | 0x320 | I/O Port | 10 | _____ |  |  |
| AT/LANTIC ADAPTERS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                    |  |  |          |      |     |       |          |    |       |  |  |
| I/O Port                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Mode          | IRQ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |  |  |          |      |     |       |          |    |       |  |  |
| 0x320                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | I/O Port      | 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                    |  |  |          |      |     |       |          |    |       |  |  |
| _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                    |  |  |          |      |     |       |          |    |       |  |  |
| ***** Make Selection using arrow keys and <enter> *****<br>***** Scroll through options using <tab> *****                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                    |  |  |          |      |     |       |          |    |       |  |  |

The "Configure New Adapter Manually" presents a screen similar to the one shown below :

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                        |                      |        |                  |         |                      |        |                |                 |                      |            |           |                |                                |  |                                  |  |                    |  |                         |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------------------------------|----------------------|--------|------------------|---------|----------------------|--------|----------------|-----------------|----------------------|------------|-----------|----------------|--------------------------------|--|----------------------------------|--|--------------------|--|-------------------------|--|
| WinSystems<br>Thick/Thin/TPI<br>August 20, 1993 11:34PM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | PLUSCFG V1.17   | AT/LANTIC<br>Configuration<br>Software |                      |        |                  |         |                      |        |                |                 |                      |            |           |                |                                |  |                                  |  |                    |  |                         |  |
| <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 10px;"><div style="width: 55%; text-align: center;">CONFIGURATION</div><div style="width: 40%; text-align: center;">AT/LANTIC ADAPTERS</div></div> <div style="border: 1px solid black; padding: 10px; margin: 0 auto; width: 80%;"><p style="text-align: center; margin: 0;">CONFIGURE NEW ADAPTER MANUALLY</p><table style="width: 100%; border-collapse: collapse;"><tr><td style="width: 50%;">Novell Configuration</td><td style="width: 50%;">- None</td></tr><tr><td>I/O Base Address</td><td>- 0x240</td></tr><tr><td>Interrupt assignment</td><td>- IRQ3</td></tr><tr><td>Physical Media</td><td>- TPI (10BaseT)</td></tr><tr><td>Adapter Architecture</td><td>- I/O Port</td></tr><tr><td>Boot Prom</td><td>- No Boot Prom</td></tr><tr><td colspan="2">Advanced Configuration Options</td></tr><tr><td colspan="2">Temporarily Change Configuration</td></tr><tr><td colspan="2">Save Configuration</td></tr><tr><td colspan="2">Return to previous menu</td></tr></table></div> <div style="text-align: center; margin-top: 10px; font-size: small;">***** Make Selection using arrow keys and &lt;enter&gt; *****<br/>***** Scroll through options using &lt;tab&gt; *****</div> |                 |                                        | Novell Configuration | - None | I/O Base Address | - 0x240 | Interrupt assignment | - IRQ3 | Physical Media | - TPI (10BaseT) | Adapter Architecture | - I/O Port | Boot Prom | - No Boot Prom | Advanced Configuration Options |  | Temporarily Change Configuration |  | Save Configuration |  | Return to previous menu |  |
| Novell Configuration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | - None          |                                        |                      |        |                  |         |                      |        |                |                 |                      |            |           |                |                                |  |                                  |  |                    |  |                         |  |
| I/O Base Address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | - 0x240         |                                        |                      |        |                  |         |                      |        |                |                 |                      |            |           |                |                                |  |                                  |  |                    |  |                         |  |
| Interrupt assignment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | - IRQ3          |                                        |                      |        |                  |         |                      |        |                |                 |                      |            |           |                |                                |  |                                  |  |                    |  |                         |  |
| Physical Media                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | - TPI (10BaseT) |                                        |                      |        |                  |         |                      |        |                |                 |                      |            |           |                |                                |  |                                  |  |                    |  |                         |  |
| Adapter Architecture                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | - I/O Port      |                                        |                      |        |                  |         |                      |        |                |                 |                      |            |           |                |                                |  |                                  |  |                    |  |                         |  |
| Boot Prom                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | - No Boot Prom  |                                        |                      |        |                  |         |                      |        |                |                 |                      |            |           |                |                                |  |                                  |  |                    |  |                         |  |
| Advanced Configuration Options                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |                                        |                      |        |                  |         |                      |        |                |                 |                      |            |           |                |                                |  |                                  |  |                    |  |                         |  |
| Temporarily Change Configuration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                        |                      |        |                  |         |                      |        |                |                 |                      |            |           |                |                                |  |                                  |  |                    |  |                         |  |
| Save Configuration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                        |                      |        |                  |         |                      |        |                |                 |                      |            |           |                |                                |  |                                  |  |                    |  |                         |  |
| Return to previous menu                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                        |                      |        |                  |         |                      |        |                |                 |                      |            |           |                |                                |  |                                  |  |                    |  |                         |  |

Use the up and down arrow keys and tab key to change the displayed configuration to what is desired and then select "Save Configuration" to program the EEPROM with the selected choices.

**NOTE :** PLUSCFG will not allow selection of I/O ports, interrupts, or memory addresses that it believes are being used by other hardware in the system. If PLUSCFG refuses to allow a desired selection for what you know are valid choices, it will be necessary to use the "jumpared" mode, described earlier, for configuration.

#### **2.22.11** Display/Change Adapter Configuration

This option of the main menu presents the same screen as shown for "Configure New Adapter Manually". Use the up and down arrow keys and the Tab key to alter the configuration as desired and then select "Save Configuration" to program the EEPROM with the new information.

**NOTE :** PLUSCFG will not allow selection of I/O ports, interrupts, or memory addresses that it believes are being used by other hardware in the system. If PLUSCFG refuses to allow a desired selection for what you know are valid choices, it will be necessary to use the "jumpared" mode, described earlier, for configuration.

### 2.22.12 Diagnostics

This third choice from the main menu allows the selection from the diagnostics sub-menu as shown in this screen :

| WinSystems<br>Thick/Thin/TPI<br>August 20, 1993 11:34PM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | PLUSCFG V1.17 | AT/LANTIC<br>Configuration<br>Software                                                                                                                                                                                                                                                                                                                                                                                                                                              |          |      |     |       |          |    |       |          |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------|-----|-------|----------|----|-------|----------|---|
| <div style="border: 1px solid black; padding: 5px; text-align: center; margin-bottom: 5px;">                     CONFIGURATION                 </div> <div style="border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; padding: 5px; text-align: center; margin-bottom: 5px;">                             INITIALIZATION AND DIAGNOSTICS                         </div> <div style="padding: 5px;">                             Adapter Initialization &amp; disagnostics<br/>                             Advanced Network Diagnostics<br/><br/>                             Return to previous menu                         </div> </div> |               | <div style="text-align: center; margin-bottom: 5px;">                         AT/LANTIC ADAPTERS                     </div> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">I/O Port</th> <th style="text-align: left;">Mode</th> <th style="text-align: left;">IRQ</th> </tr> </thead> <tbody> <tr> <td>0x320</td> <td>I/O Port</td> <td>10</td> </tr> <tr> <td>0x360</td> <td>I/O Port</td> <td>5</td> </tr> </tbody> </table> | I/O Port | Mode | IRQ | 0x320 | I/O Port | 10 | 0x360 | I/O Port | 5 |
| I/O Port                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Mode          | IRQ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |          |      |     |       |          |    |       |          |   |
| 0x320                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | I/O Port      | 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |          |      |     |       |          |    |       |          |   |
| 0x360                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | I/O Port      | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |          |      |     |       |          |    |       |          |   |
| ***** Make Selection using arrow keys and <enter> *****<br>***** Scroll through options using <tab> *****                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |          |      |     |       |          |    |       |          |   |

### 2.22.13 Adapter Initialization and Diagnostics

This choice initializes the selected adapter and confirms I/O address, interrupt, media type, etc. The adapter should be connected to the network cable at this time. A sample screen is shown on the following page :

| WinSystems<br>Thick/Thin/TPI<br>August 20, 1993 11:34PM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | PLUSCFG V1.17 | AT/LANTIC<br>Configuration<br>Software                                                                                                                                                                                                                                                                                                                               |          |      |     |  |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------|-----|--|--|--|
| <div style="border: 1px solid black; padding: 5px; margin: 5px;"> <div style="border: 1px solid black; padding: 5px; margin: 5px;"> <div style="border: 1px solid black; padding: 5px; margin: 5px;"> <p style="text-align: center;">CONFIGURATION</p> <p style="text-align: center;">INITIALIZATION AND DIAGNOSTICS</p> <p style="text-align: center;">INITIALIZATION AND DIAGNOSTICS</p> <p>Network Interface Controller (080017086050).....OK</p> <p>Buffer Memory Check.....OK</p> <p>Check cable connection (Cable Connected).....OK</p> <p>Interrupt Assignment (5).....OK</p> <p>Boot Prom Check (No Boot Prom).....OK</p> <p>Press &lt;ESC&gt; to return to previous menu.</p> </div> </div> </div> |               | <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">AT/LANTIC ADAPTERS</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="text-align: left;">I/O Port</th> <th style="text-align: left;">Mode</th> <th style="text-align: left;">IRQ</th> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> </table> </div> | I/O Port | Mode | IRQ |  |  |  |
| I/O Port                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Mode          | IRQ                                                                                                                                                                                                                                                                                                                                                                  |          |      |     |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |                                                                                                                                                                                                                                                                                                                                                                      |          |      |     |  |  |  |
| <p>***** Make Selection using arrow keys and &lt;enter&gt; *****</p> <p>***** Scroll through options using &lt;tab&gt; *****</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                                                                                                                                                                                                                                                                                                                                                      |          |      |     |  |  |  |

NOTE : The Initialization and Diagnostics must be run and must pass before any of the Advanced diagnostics can be executed.

## 2.22.14 Advanced Network Diagnostics

The Advanced Network Diagnostics screen is shown here :

| WinSystems<br>Thick/Thin/TPI<br>August 20, 1993 11:34PM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | PLUSCFG V1.17 | AT/LANTIC<br>Configuration<br>Software                                                                                                                                                                                                                                                                                                                                                                                                  |          |      |     |       |          |    |       |          |   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------|-----|-------|----------|----|-------|----------|---|
| <div style="border: 1px solid black; padding: 5px; margin: 5px;"> <div style="border: 1px solid black; padding: 5px; margin: 5px;"> <div style="border: 1px solid black; padding: 5px; margin: 5px;"> <p style="text-align: center;">CONFIGURATION</p> <p style="text-align: center;">INITIALIZATION AND DIAGNOSTICS</p> <p style="text-align: center;">ADVANCED NETWORK DIAGNOSTICS</p> <p>Set up as a master station..</p> <p>Setup as a slave station.</p> <p>Show packets on network.</p> <p>Return to previous menu</p> </div> </div> </div> |               | <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">AT/LANTIC ADAPTERS</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="text-align: left;">I/O Port</th> <th style="text-align: left;">Mode</th> <th style="text-align: left;">IRQ</th> </tr> <tr> <td>0x320</td> <td>I/O Port</td> <td>10</td> </tr> <tr> <td>0x360</td> <td>I/O Port</td> <td>5</td> </tr> </table> </div> | I/O Port | Mode | IRQ | 0x320 | I/O Port | 10 | 0x360 | I/O Port | 5 |
| I/O Port                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Mode          | IRQ                                                                                                                                                                                                                                                                                                                                                                                                                                     |          |      |     |       |          |    |       |          |   |
| 0x320                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | I/O Port      | 10                                                                                                                                                                                                                                                                                                                                                                                                                                      |          |      |     |       |          |    |       |          |   |
| 0x360                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | I/O Port      | 5                                                                                                                                                                                                                                                                                                                                                                                                                                       |          |      |     |       |          |    |       |          |   |
| <p>***** Make Selection using arrow keys and &lt;enter&gt; *****</p> <p>***** Scroll through options using &lt;tab&gt; *****</p>                                                                                                                                                                                                                                                                                                                                                                                                                  |               |                                                                                                                                                                                                                                                                                                                                                                                                                                         |          |      |     |       |          |    |       |          |   |

Three choices are provided for Advanced Network Diagnostics

#### **2.22.15** Setup as a Master Station

This enables the board under test to be set up as the Master. The master will initiate testing. The Slave must be enabled prior to starting the Master.

The system will then request a packet repetition length and after entered will begin the test.

#### **2.22.16** Setup as Slave Station

This choice should be made for a known good board. It will echo back across the network all packets initiated by the Master.

#### **2.22.17** Show Packet on Network

This option displays in HEX and ASCII packets as they are received from the network. A sample screen is shown here :

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------------------------------|
| WinSystems<br>Thick/Thin/TPI<br>August 20, 1993 11:34PM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | PLUSCFG V1.17 | AT/LANTIC<br>Configuration<br>Software |
| <div>RECEIVED PACKET CONTENTS<br/>Received Status : 01 Next Pointer : 54 Receiver Length : 1493<br/>Destination 0040F698A3E6 Source : 0040F6988448<br/>Length/Type : 05C3 Hex HW CRC : D703A649 SW CRC : NORMAL<br/><br/>0450 98 7D D0 40 03 00 00 00 01 00 00 00 00 00 01 04 ..}.@.....<br/>0460 51 33 33 87 02 01 00 00 00 04 00 20 44 6F 63 2D Q33.....(Doc-<br/>0470 06 00 F0 76 41 47 44 53 54 4D 00 00 00 40 E1 7A ..vAGDSTM...@.z<br/>0480 74 BF 05 00 02 77 4D 44 54 47 53 00 04 00 0C 77 t....wMDTGS....w<br/>0490 41 43 50 52 0E 00 14 77 41 43 44 49 4E 4F 50 52 ACPR...wACDINO<br/>04A0 53 54 55 58 4F 47 0E 00 26 77 41 43 44 49 4E 4F STUXMG..&amp;aACDINO<br/>04B0 50 52 53 54 55 58 4D 47 0C 00 38 77 49 54 45 4D PRSTUXMG..8wITEM<br/>04C0 20 4B 45 59 0C 00 54 77 56 41 4C 49 44 20 54 52 KEY ...Hw####,<br/>04D0 23 23 23 59 0C 00 54 77 56 41 4C 49 44 20 54 53 ###Y...TwALID.TR<br/>04E0 41 4E 53 3A 07 00 64 77 23 23 23 2C 23 23 23 52 ANS:...dw####,###R<br/><br/>Press &lt;ESC&gt; when finished examining receive packet</div> |               |                                        |

#### **2.22.18** Quit and Return to DOS

This main menu option exits PlusCfg and returns you to the DOS prompt.

## 2.23 Multi I/O Connector

The I/O to the primary serial channels, the printer port, and keyboard are all terminated via the connector at J3. An adapter cable, part number CBL-162-1, is available from WinSystems to adapt to the conventional I/O connectors. The pin definitions for J3 are shown here :

| J3            |           |              |
|---------------|-----------|--------------|
| COM1 - DCD    | 1 0 0 2   | COM1 - DSR   |
| COM1 - RXD    | 3 0 0 4   | COM1 - RTS   |
| COM1 - TXD    | 5 0 0 6   | COM1 - CTS   |
| COM1 - DTR    | 7 0 0 8   | COM1 - RI    |
| COM1 - GND    | 9 0 0 10  | COM2 - DCD   |
| COM2 - DSR    | 11 0 0 12 | COM2 - RSX   |
| COM2 - RTS    | 13 0 0 14 | COM2 - TXD   |
| COM2 - CTS    | 15 0 0 16 | COM2 - DTR   |
| COM2 - RI     | 17 0 0 18 | COM2 - GND   |
| LPT - STROBE  | 19 0 0 20 | LPT - AUTOFD |
| LPT - PD0     | 21 0 0 22 | LPT - ERROR  |
| LPT - PD1     | 23 0 0 24 | LPT - INIT   |
| LPT - PD2     | 25 0 0 26 | LPT - SLCTIN |
| LPT - PD3     | 27 0 0 28 | LPT - GND    |
| LPT - PD4     | 29 0 0 30 | LPT - GND    |
| LPT - PD5     | 31 0 0 32 | LPT - GND    |
| LPT - PD6     | 33 0 0 34 | LPT - GND    |
| LPT - PD7     | 35 0 0 36 | LPT - GND    |
| LPT - ACK     | 37 0 0 38 | LPT - GND    |
| LPT - BUSY    | 39 0 0 40 | LPT - GND    |
| LPT - PE      | 41 0 0 42 | LPT - GND    |
| LPT - SLCT    | 43 0 0 44 | KEYBD - GND  |
| KEYBD - GND   | 45 0 0 46 | KEYBD - GND  |
| KEYBD - KDATA | 47 0 0 48 | KEYBD - CLK  |
| KEYBD - +5V   | 49 0 0 50 | KEYBD - +5V  |

**2.23.1** Jumper/Connector Summary

| Connector/<br>Jumper | Description                            | Page Reference |
|----------------------|----------------------------------------|----------------|
| J1                   | Parallel I/O VCC Enable jumper         | 2-22           |
| J2                   | COM3/COM4 I/O Connector                | 2-7            |
| J3                   | Multi-I/O Connector                    | 2-41           |
| J4                   | Parallel I/O ports 0-2                 | 2-22           |
| J5                   | Parallel I/O ports 3-5                 | 2-22           |
| J6                   | Parallel port mode select              | 2-13           |
| J7                   | Power/Reset Connector                  | 2-18           |
| J8                   | COM1 mode select jumper                | 2-7            |
| J9                   | COM2 mode select jumper                | 2-7            |
| J10                  | COM1 mode select jumper                | 2-7            |
| J11                  | COM2 mode select jumper                | 2-7            |
| J12                  | CPU Speed Select jumper                | 2-2            |
| J13                  | Master battery enable jumper           | 2-17           |
| J14                  | PCI Bus Clock select jumper            | 2-3            |
| J15                  | Parallel I/O Enable jumper             | 2-21           |
| J16                  | SSD Array size select jumper           | 2-19           |
| J17                  | Floppy disk I/O connector              | 2-14           |
| J18                  | IDE I/O Connector                      | 2-16           |
| J19                  | Watchdog timer configuration jumper    | 2-16           |
| J20                  | VGA BIOS size select jumper            | 2-25           |
| J21                  | ECP mode DMA select jumper             | 2-14           |
| J22                  | 10BASET I/O connector                  | N/A            |
| J23                  | COM3/COM4 Enable Disable Select jumper | 2-6            |
| J24                  | ECP DMA select jumper                  | 2-14           |
| J25                  | SSD/DOC Mode select jumper             | 2-19           |
| J26                  | PC/104-8 connector                     | 2-15           |
| J27                  | Video output connector                 | 2-26           |
| J28                  | Ethernet AUI connector                 | N/A            |
| J29                  | PC/104-16 Connector                    | 2-15           |
| J30                  | Interrupt routing header               | 2-4            |
| J31                  | PCI Bus clock select jumper            | 2-3            |
| J32                  | NE2000 Mode select jumper              | 2-30           |
| J33                  | FPA50 Panel adapter I/O connector      | 2-26           |
| J34                  | U23 VBAT select jumper                 | 2-20           |
| J35                  | NE2000 Configuration jumper            | 2-31           |
| J36                  | CPU Clock multiplier select            | 2-3            |
| J37                  | SMI Interrupt                          | N/A            |
| J38                  | U23 Device type select jumper          | 2-20           |
| J39                  | U27 Device type select jumper          | 2-20           |
| J40                  | U27 VBAT Select Jumper                 | 2-20           |

## 3

# Award BIOS Configuration

### 3.1 General Information

The LBC-Plus comes equipped with a standard AWARD BIOS with Setup in ROM that allows users to modify the basic system configuration. This type of information is stored in battery-backed CMOS RAM so that it retains Setup information when power is turned off.

### 3.2 Entering Setup

To enter setup, power on the computer and press the DEL key immediately after the message “Press DEL to Enter Setup” appears on the lower left of the screen. If the message disappears before you respond and you still wish to enter setup, restart the system by turning it OFF and then ON or by pressing the RESET button, if so equipped, or by pressing the CTRL, ALT and DEL key simultaneously. Alternately, under certain error conditions of incorrect setup the message :

“Press F1 to continue or DEL to Enter Setup”

may appear. To Enter Setup at that time press the DEL key. To attempt to continue, ignoring the error condition, press the F1 key.

### 3.3 Setup Main Menu

The main menu screen is displayed on the following page. Each of the options will be discussed in this section. Use the arrow keys to highlight the desired selection and press ENTER to enter the sub-menu or to execute the function selected.

|                                                                                                                   |                                                                                          |
|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| ROM PCI/ISA BIOS (2A4KD000)<br>CMOS SETUP UTILITY<br>AWARD SOFTWARE, INC.                                         |                                                                                          |
| STANDARD CMOS SETUP<br>BIOS FEATURES SETUP<br>CHIPSET FEATURES SETUP<br>LOAD BIOS DEFAULTS<br>LOAD SETUP DEFAULTS | PASSWORD SETTING<br>IDE HDD AUTO DETECTION<br>SAVE AND EXIT SETUP<br>EXIT WITHOUT SAVING |
| Esc : Quit<br>F10 : Save & Exit Setup                                                                             | ↑ ↓ → ← : Select Item<br>(Shift) F2 : Change Color                                       |
| Time, Date, Hard Disk, Type...                                                                                    |                                                                                          |

### 3.4 Standard CMOS Setup

The items in the Standard CMOS Setup menu are divided into several categories. Each category may include one or more setup items. Use the arrow keys to highlight the item and then use the PgUp, PgDn, +, - keys to select the desired value for the item.

#### **Date**

The date format is <day>, <date>, <month>, <year>

day = The day, from Sun to Sat, determined by the BIOS and is display only

Date = the date, from 1 to 31 (or the maximum for the current month)

month = the month, JAN through DEC

year = The year, from 1900 to 2099

#### **Time**

The time is hour, minute, second. The time is calculated on the 24-hour, military-time clock such that 1:00PM is 13:00:00.

ROM PCI/ISA BIOS (2A4KD000)  
STANDARD CMOS SETUP  
AWARD SOFTWARE, INC.

Date (mm:dd:yy) : Wed, Sep 25 1996

Time (hh:mm:ss): 13 : 28 : 46

| HARD DISKS                                                                                                                                                                                                                                                                                                                                                                                                                                                        | TYPE   | SIZE | CYLS | HEAD | PRECOMP | LANDZ | SECTOR | MODE |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|------|------|---------|-------|--------|------|
| Primary Master                                                                                                                                                                                                                                                                                                                                                                                                                                                    | : Auto | 0    | 0    | 0    | 0       | 0     | 0      | AUTO |
| Primary Slave                                                                                                                                                                                                                                                                                                                                                                                                                                                     | : Auto | 0    | 0    | 0    | 0       | 0     | 0      | AUTO |
| <div style="display: flex; justify-content: space-between;"> <div>           Drive A : 1.44M, 3.5 in<br/>           Drive B: None<br/><br/>           Video : EGA/VGA<br/>           Halt On : No Errors         </div> <div style="border: 1px solid black; padding: 5px; text-align: center;">           Base Memory : 640K<br/>           Extended Memory : 19456K<br/>           Other Memory : 384K<br/> <hr/>           Total Memory:         </div> </div> |        |      |      |      |         |       |        |      |

ESC : Quit

↑ ↓ → ← : Select Item

PU/PD/+/- : Modify

F1 : Help

(Shift) F2 : Change Color

**Drive C / Drive D type**

This category identifies the type of hard disk C or hard disk D that has been installed in the system. There are 46 predefined types and a user definable type. Types 1-46 are shown in the following table.

| Type | Size | Cylinders | Heads | Sectors | Precomp | Landzone |
|------|------|-----------|-------|---------|---------|----------|
| 1    | 10   | 306       | 4     | 17      | 128     | 305      |
| 2    | 20   | 615       | 4     | 17      | 300     | 615      |
| 3    | 30   | 615       | 6     | 17      | 300     | 614      |
| 4    | 62   | 940       | 8     | 17      | 512     | 940      |
| 5    | 46   | 940       | 6     | 17      | 512     | 940      |
| 6    | 20   | 615       | 4     | 17      | None    | 615      |
| 7    | 30   | 462       | 8     | 17      | 256     | 511      |
| 8    | 30   | 733       | 5     | 17      | None    | 733      |
| 9    | 112  | 900       | 15    | 17      | None    | 901      |
| 10   | 20   | 820       | 3     | 17      | None    | 820      |
| 11   | 35   | 855       | 5     | 17      | None    | 855      |
| 12   | 49   | 855       | 7     | 17      | None    | 855      |
| 13   | 20   | 306       | 8     | 17      | 128     | 319      |

|    |     |          |    |    |      |      |
|----|-----|----------|----|----|------|------|
| 14 | 42  | 733      | 7  | 17 | None | 733  |
| 15 |     | Reserved |    |    |      |      |
| 16 | 20  | 612      | 4  | 17 | 0    | 663  |
| 17 | 40  | 977      | 5  | 17 | 300  | 977  |
| 18 | 56  | 977      | 7  | 17 | None | 977  |
| 19 | 59  | 1024     | 7  | 17 | 512  | 1023 |
| 20 | 30  | 733      | 5  | 17 | 300  | 732  |
| 21 | 42  | 733      | 7  | 17 | 300  | 732  |
| 22 | 30  | 306      | 5  | 17 | 300  | 733  |
| 23 | 10  | 977      | 4  | 17 | 0    | 336  |
| 24 | 40  | 1024     | 5  | 17 | None | 976  |
| 25 | 76  | 1224     | 9  | 17 | None | 1023 |
| 26 | 71  | 1224     | 7  | 17 | None | 1223 |
| 27 | 111 | 1224     | 11 | 17 | None | 1223 |
| 28 | 152 | 1024     | 15 | 17 | None | 1223 |
| 29 | 68  | 1024     | 8  | 17 | None | 1023 |
| 30 | 93  | 918      | 11 | 17 | None | 1023 |
| 31 | 83  | 925      | 11 | 17 | None | 1023 |
| 32 | 69  | 1024     | 9  | 17 | None | 926  |
| 33 | 85  | 1024     | 10 | 17 | None | 1023 |
| 34 | 102 | 1024     | 12 | 17 | None | 1023 |
| 35 | 110 | 1024     | 13 | 17 | None | 1023 |
| 36 | 119 | 1024     | 14 | 17 | None | 1023 |
| 37 | 17  | 1024     | 2  | 17 | None | 1023 |
| 38 | 136 | 1024     | 16 | 17 | None | 1023 |
| 39 | 114 | 918      | 15 | 17 | None | 1023 |
| 40 | 40  | 820      | 6  | 17 | None | 820  |
| 41 | 42  | 1024     | 5  | 17 | None | 1023 |
| 42 | 65  | 1024     | 5  | 26 | None | 1023 |
| 43 | 40  | 809      | 6  | 17 | None | 852  |
| 44 | 61  | 809      | 6  | 26 | None | 852  |
| 45 | 100 | 776      | 8  | 33 | None | 775  |
| 46 | 203 | 684      | 16 | 38 | None | 685  |

Press PgUp or PgDn to select a numbered hard disk type, or type the number and press ENTER. Most manufacturers supply type information with their drives that can be used to help identify the proper drive type. Modern IDE drives seldom fall into the predefined types and are usually best handled with the "auto" or "user" types. The "auto" mode, reads the hard disk type information from the drive at

boot time and uses it to access the drive. The "user" mode allows for either manual or automatic entry, via the setup option "IDE Auto Detect" of the drive parameters.

If you decide to create the user type manually, you must supply the required parameters as to Cylinder count, Head count, Precomp Cylinder, Landing Zone Cylinder, and number of sectors per track.

On Hard disks larger than 528MB, it will be necessary to choose the Logical Block Addressing mode (LBA) if you wish the drive to be accessible as a single drive letter.

If there is not hard disk installed, be sure to select "None".

### **Drive A type/Drive B type**

This category identifies the type of floppy drives attached as Drive A: or Drive B:. The choices are as follows :

NONE 360K, 5.25 in.  
1.2M, 5.25 in.  
720K, 3.5 in  
1.44M, 3.5 in.

### **Video**

This category specifies the type of video adapter used for the primary system monitor that matches your video display board and monitor. The available choices are :

EGA/VGA  
CGA40  
CGA80  
MONO

The LBC-Plus has built-in VGA support so EGA/VGA should be selected.

### **Error Halt**

This category determines whether the system will halt if a non-fatal error is detected during the power up self test. The choices are :

No Errors : The system will not be stopped for any error that may be detected.

All Errors : Whenever the BIOS detects a non-fatal error, the system will be stopped and a prompt will appear.

All, but Keyboard : The system will not stop for a keyboard error, it will stop for all other errors.

All, but diskette : The system will not stop for disk errors. All others will result in a prompt.

All but Disk/Key : All errors except diskette or keyboard will result in a halt and a prompt.

## **Memory**

This category is display only and is determined by the BIOS POST (Power On Self Test).

### **Base Memory**

The POST routines in the BIOS will determine the amount of base (conventional) memory installed in the system. The value of the base memory is typically 640K for systems with a Megabyte of memory or greater.

### **Extended Memory**

The BIOS determines how much extended memory is present during the POST. This is the amount of memory located above 1MB in the CPU's memory address space.

### **Other Memory**

This refers to memory located in the 640K to 1024K address space. This is memory that can be used for different applications. DOS may use this area to load device drivers and TSRs to keep as much base memory free as possible for application programs. The most common use of this area is for shadow RAM.

## **3.5 Bios Features Setup**

### **Virus Warning**

This option when enabled, protects the boot sector and partition table of the hard disk against unauthorized writes through the BIOS. Any attempt to alter these areas will result in an error message and a prompt to authorize the activity.

### **CPU Internal Cache**

This option, when enabled, provides maximum performance by caching instructions and data using the on-chip cache of the 486 or 586 processor.

### **External Cache**

This option, when enabled, further enhances performance by caching recently used instructions and data into fast SRAM.

### **Quick Power ON Self Test**

This option, when enabled, speeds up the POST during power up. If it is enabled, the BIOS will shorten and/or skip some items during POST.

| ROM PCI/ISA BIOS (2A4KD000)                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                 |                                                                                                                                                                                           |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| BIOS FEATURES SETUP                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                 |                                                                                                                                                                                           |  |
| AWARD SOFTWARE, INC.                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                 |                                                                                                                                                                                           |  |
| Virus Warning : Disabled<br>CPU Internal Cache : Enabled<br>External Cache : Enabled<br>Quick Power On Self Test : Disabled<br>Boot Sequence : A,C<br>Swap Floppy Drive : Disabled<br>Boot Up Floppy Seek : Enabled<br>Boot Up NumLock Status : On<br>Boot Up System Speed : High<br>Gate A20 Option : Fast<br>Typematic Rate Setting : Disabled<br>Typematic Rate (Chars/Sec) : 6<br>Typematic Delay (Msec) : 250<br>Security Option : Setup | Video BIOS Shadow : Enabled<br>C8000-CFFFF Shadow : Enabled<br>D0000-D7FFF Shadow : Disabled<br>D8000-DFFFF Shadow : Disabled<br>SSD Socket Relocate : Disabled |                                                                                                                                                                                           |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                 | ESC : Quit                      ↑ ↓ → ← : Select Item<br>F1 : Help                        PU/PD/+/- : Modify<br>F5 : Old Value                Shift F2 : Color<br>F6 : Load BIOS Defaults |  |

### **Boot Sequence**

This option determines the boot attempt sequence for the fixed disk and floppy disk.  
The choices are:

- C,A The system will attempt Hard disk boot first
- A,C The system will attempt Floppy disk boot first

### **Swap Floppy Drive**

This option allows for swapping of the A: and B: floppy drives without actually relocating the drives on the cable.

### **Boot Up Floppy Seek**

During POST, when this option is enabled, the BIOS will determine if the floppy drive is 40 track or 80 tracks, If disabled, no seek test will be performed and no error can be reported.

### **Boot Up Numlock Status**

This allows user selection of the Numlock state at boot time.

### **Boot Up System Speed**

This option allows specification of the processor speed at boot time. The options are :

HIGH  
LOW

### **Gate A20 Option**

This option allows for the selection of the source for the gate A20 signal. The choices are :

Normal - Sourced from the keyboard controller  
Fast - Sourced from the Chipset

### **Typematic Rate Setting**

This option enables or disables the typematic rate programming at boot time. Typematic is the auto-repeat function for the keyboard.

### **Typematic Rate**

When the typematic rate setting is enabled the typematic repeat speed is set via this option. The supported rates are :

6 characters per second  
8 characters per second  
10 characters per second  
12 characters per second  
15 characters per second  
20 characters per second  
24 characters per second  
30 characters per second

### **Typematic Delay**

When typematic rate setting is enabled, this option specifies the time in milliseconds before auto-repeat begins. The supported values are :

250 mS  
500 mS  
750 mS  
1000 mS

### **Security Option**

This option allows you to limit access to the system and setup, or just to setup. The choices are :

System - The system will not boot and access will be denied if the correct password is not entered at the prompt.

Setup - The system will boot, but access to Setup will be denied if the correct password is not entered at the prompt.

**NOTE :** To disable security, select "Password Setting" at the Setup Main Menu and then you will be asked to enter a password. Do not type anything, just hit ENTER. Once the security is disabled, the system will boot and you can enter Setup freely.

### **Shadowing Options**

When shadowing for a particular address range is enabled, it instructs the BIOS to copy the BIOS located in ROM into DRAM. This shadowing from an 8-bit EPROM into fast 32-bit DRAM results in a Multi-magnitude increase in performance. The main BIOS is shadowed automatically but there are other areas that may be selected for shadowing as shown here :

Video BIOS Shadow - C000-C7FFF EGA/VGA BIOS ROM  
C8000-CFFFF  
D0000-D7FFF  
D8000-DFFFF

### **SSD Socket Relocation**

The LBC-Plus supports an optional BIOS extension ROM in U27. This feature was implemented primarily to support network boot ROMs but can be used for other purposes by knowledgeable users.

Only 128K X 8 devices (27C010 type) are supported, although only 32K of the device may be used for code. The board is configured for the DOC mode as documented in the SSD configuration section of this manual. This setup option allows for the BIOS extension to be located at any of several addresses as shown here :

Disabled  
C8000  
CC000  
D0000  
D4000  
D8000  
DC000  
E0000

**Note :** This mode of usage is mutually exclusive of any onboard silicon disk usage. Further note that 'Disabled' must be selected when **any** SSD mode is desired.

## 3.6 Chipset Features Setup

The options in this section control the chipset programming at boot time. In most cases, the default settings should be used unless you have a clear understanding of the significance of the change. It is possible using these options to create a system that will either not boot or is very unstable or unreliable. If this should occur, there are two methods to return the system to a stable configuration. If the system works well enough to get into Setup, simply choose the "Load BIOS Defaults" option and then select "Save and Exit Setup" to restore factory defaults. If the system will not run well enough to run Setup, it will be necessary to remove the battery source temporarily until the CMOS memory decays. Refer to Section 2.X for details on reinitializing the CMOS RAM.

Each of the options for the Chipset Features Menu will be briefly discussed in the sections that follow.

### Auto Configuration

This option, when enabled, instructs the BIOS to auto-select the proper AT Bus Clock, the DRAM read timing, the DRAM write timing, the SRAM read timing, and the SRAM write timing base upon the calculated CPU speed. The default is "Enabled".

| ROM PCI/ISA BIOS (2A4KD000)                                                                                                                                                                |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| CHIPSET FEATURES SETUP                                                                                                                                                                     |            |
| AWARD SOFTWARE, INC.                                                                                                                                                                       |            |
| Auto Configuration                                                                                                                                                                         | : Enabled  |
| AT-BUS Clock                                                                                                                                                                               | : CLK/4    |
| DRAM Read Timing                                                                                                                                                                           | : Normal   |
| DRAM Write Timing                                                                                                                                                                          | : Normal   |
| SRAM Read Timing                                                                                                                                                                           | : 3-1-1-1  |
| SRAM Write Timing                                                                                                                                                                          | : 0 Wait   |
| ISA I/O Recovery                                                                                                                                                                           | : Disabled |
| Fast-Back-to-Back                                                                                                                                                                          | : Disabled |
| On-Chip Local Bus IDE                                                                                                                                                                      | : Enabled  |
| IDE Buffer for DOS & Win                                                                                                                                                                   | : Enabled  |
| IDE HDD Block Mode                                                                                                                                                                         | : Disabled |
| IDE Primary Master PIO                                                                                                                                                                     | : Auto     |
| IDE Primary Slave PIO                                                                                                                                                                      | : Auto     |
| ESC : Quit                      ↑ ↓ → ← : Select Item<br>F1 : Help                        PU/PD/+/- : Modify<br>F5 : Old Value                Shift) F2 : Color<br>F6 : Load BIOS Defaults |            |

### **AT-BUS Clock**

This option is available when the "Auto Configuration" option is disabled. This allows selection of the speed of the AT-BUS clock. This clock is any of 5 sub-multiples of the processor oscillator or is fixed at 7.19MHz. The choices available are:

7.19MHz  
 CLK/3  
 CLK/4  
 CLK/5  
 CLK/6  
 CLK/8

### **DRAM Read Timing**

This option controls the read timing to the DRAM array. The available options are shown here :

slow  
 normal - default  
 fast  
 fastest

### **DRAM Write Timing**

This option controls the write timing to the DRAM array. The available options are shown here :

slow  
normal - default  
fast  
fastest

### **SRAM Read Timing**

This option allows for selection of the timing patterns used to access the Cache RAM. The available choices are :

2-1-1-1  
3-1-1-1 Default  
3-2-2-2  
4-2-2-2

### **SRAM Write Timing**

This option controls the number of wait-states to be inserted during cache write operations. The choices are :

0 Wait  
1 Wait Default

### **ISA I/O Recovery**

The CPU and local bus are much faster than the standard for the ISA bus. Selecting enabled for this option allows additional time for I/O devices to respond to the system. The default is disabled.

### **Fast Back-To-Back**

When enabled, consecutive write cycles targeted to the same slave become fast back-to-back on the PCI bus. The default setting is disabled.

### **On Chip Local Bus IDE**

This option when enabled allows usage of the onboard PCI Bus IDE controller. The default is enabled.

### **IDE Buffer for DOS & Win**

Select Enabled to increase throughput to and from IDE devices by using the on-chip read-ahead and post-write IDE buffers. Note that the use of the buffer may cause some slow IDE devices to appear even slower. The default is Enabled.

### **IDE HDD Block Mode**

Block mode is also called block transfer, multiple command, or multiple sector read/write. If the IDE hard drive supports block mode, select Enabled for the automatic detection of the optimal number of block read/writes per sector that the drive can support. The default is disabled.

### **IDE Primary Master PIO**

There are 5 transfer modes available for hard disk IDE transfers ranging from mode 0 to mode 4 with each successive mode providing an increased level of performance. Selecting "Auto" will allow the BIOS to automatically select the optimum transfer mode for the master hard disk. The default setting is Auto.

### **IDE Primary Slave PIO**

Like the previous item, this option allows for the selection of any one of 5 IDE transfer modes or an Auto selection which allows the BIOS to auto-optimize the IDE transfers to/from the slave hard disk. The default setting is Auto.

## **3.7 Load BIOS Defaults**

This main-menu option will cause the CMOS RAM to be loaded with the default values assigned by the factory. These are usually considered safe values and do not necessarily represent the highest performance values.

## **3.8 Load Setup Defaults**

This option will cause the CMOS RAM to be loaded with default setup values assigned by the factory. These are usually values that were determined to give a higher level of performance along with reliable operation.

### **3.9 Password Setting**

This option allows the setting of the security password. Pressing enter at the password prompt disables the security function completely.

### **3.10 IDE HDD Auto Detection**

This function allows modern IDE fixed disks to be used to their maximum potential by interrogating the driver as to its preferred configuration of tracks, heads, and sectors; and automatically loading these parameters into a "user defined" hard disk type.

### **3.11 Save & Exit Setup**

This function writes all changes to CMOS RAM and restarts the system.

### **3.12 Exit without Saving**

This option exits setup without saving any changes made and then restarts the system.

## 4

# LBC-PLUS Silicon Disk Reference

## 4.1 Introduction

WinSystems provides silicon disk support for the LBC-Plus using four different media types depending upon the needs of the application.

1. The LBC-Plus provides support for a bootable ROMDISK with a size of up to 1.44 Megabytes. A simple disk imaging technique allows for the easy creation and maintenance of ROMDISKs. Since the bootable ROMDISK is an exact image of a bootable floppy diskette, all testing and debugging can be accomplished using a floppy drive. Once the application is ready for ROM, it's a simple matter to use the MKDISK utility to create the EPROM files necessary for the bootable ROMDISK equivalent of the functioning floppy diskette.

2. In applications requiring occasional program or data updates PEROM, (Flash) disks of up to 1 Megabyte may be used as the boot media. Onboard support is provided for the formatting, reading, and writing of the Floppy drive emulating PEROMs.

3. For Applications needing to log data, update the application, or for convenience during development, battery backed SRAM may be used as the boot media with a size of up to 1 Megabyte.

4. The LBC-Plus supports the M-Systems Disk-On-Chip Devices (DOC). These are single chip devices containing the BIOS Extension, TFFS Flash File System, and a Flash array ranging in size from 1 Megabyte to 12 Megabytes. These devices emulate a hard disk at the BIOS level.

## 4.2 ROMDISK Usage

MKDISK is a menu-driven utility for creating the ROM image(s) duplicating the desired floppy diskette. MKDISK is invoked at the DOS command line with :

MKDISK

Select the USSD mode from menu number 1. The other menu options are used with other WinSystems' Silicon Disk systems and are NOT compatible with the LBC-Plus board.

MKDISK - Solid State RomDisk Creation Utility V6.00  
(C) 1988-1994, WinSystems Inc.

SELECT SSD TYPE

Paged Memory Mode (SSD-XT)  
Extended Memory Mode (SSD-AT)  
V53 Expanded Memory Mode  
I/O Mapped Silicon Disk (USSD)  
sx386 On Board ROMDISK  
SBC53sx Expanded Memory Mode  
SAT-V40 Expanded Memory Mode

Use arrow keys and ENTER to make your selection.

MKDISK - Main Menu

From menu number 2 select the appropriate source disk size and type.

MKDISK - Solid State RomDisk Creation Utility V6.00  
(C) 1988-1994, WinSystems Inc.

SELECT SOURCE DISK TYPE

|         |       |        |       |    |         |    |        |
|---------|-------|--------|-------|----|---------|----|--------|
| 160 KB  | 5 1/4 | Single | Sided | 8  | Sectors | 40 | tracks |
| 180 KB  | 5 1/4 | Single | Sided | 9  | Sectors | 40 | tracks |
| 320 KB  | 5 1/4 | Double | Sided | 8  | Sectors | 40 | tracks |
| 360 KB  | 5 1/4 | Double | Sided | 9  | Sectors | 40 | tracks |
| 720 KB  | 3 1/2 | Double | Sided | 9  | Sectors | 80 | tracks |
| 720 KB  | 5 1/4 | Double | Sided | 9  | Sectors | 80 | tracks |
| 954 KB  | 3 1/2 | Double | Sided | 9  | Sectors | 53 | tracks |
| 960 KB  | 5 1/4 | Double | Sided | 15 | Sectors | 64 | tracks |
| 1.2 Meg | 5 1/4 | Double | Sided | 15 | Sectors | 80 | tracks |
| 1.4 Meg | 3 1/2 | Double | Sided | 18 | Sectors | 80 | tracks |

Use arrow keys and ENTER to make your selection.

MKDISK - Drive type Menu

MKDISK - Solid State RomDisk Creation Utility V6.00  
(C) 1988-1994, WinSystems Inc.

SELECT SOURCE DRIVE

Drive A

Drive B

Use arrow keys and ENTER to make your selection.

MKDISK - Drive Menu

Select the source drive as appropriate.

MKDISK - Solid State RomDisk Creation Utility V6.00  
(C) 1988-1994, WinSystems Inc.

SELECT ROM SIZE

32K X 8 ROM (27C256 type)

64K X 8 ROM (27C512 type)

128K X 8 ROM (27C010 type)

256K X 8 ROM (27C020 type)

512K X 8 ROM (27C040 type)

1M X 8 ROM (27C080 type)

Use arrow keys and ENTER to make your selection.

MKDISK - ROM type Menu

From menu number 4, select the appropriate EPROM size for the ROMDISK. EPROM size smaller than 512K are not usable with the LBC-Plus, but are provided as choices for use with other WinSystems' silicon disk devices.

MKDISK - Solid State RomDisk Creation Utility V6.00  
(C) 1988-1994, WinSystems Inc.

SELECT OUTPUT FILE TYPE

Binary Image Files

Hex ROM Image Files

S-Record ROM image files

Use arrow keys and ENTER to make your selection.

MKDISK - Output Menu

From menu number 5, select the appropriate ROM image file format that your EPROM programmer accepts. Selecting the Binary ROM image file format will result in the smallest files. MKDISK will then read the specified floppy diskette and create a ROMx.HEX or ROMx.S19 where x is the ROM number in the sequence (starting with 1) and the extension (.BIN, .HEX, .S19) indicates the output format for Binary, Hex, and Motorola respectively. If more than one file is created, it means that the disk will span more than a single EPROM. Once the ROM(s) have been created using the image files, install the ROM(s), jumper for correct ROM size, and enable the Silicon Disk boot option. The next power up should result in a boot from the A: Silicon Disk. The actual floppy drive, if present, will then be available as drive B:.

### 4.3 Bootable RAMDISK/FLASHDISK usage

The LBC-Plus supports bootable RAMDISKs and FLASHDISKs of up to 1 Megabyte in size. 512K X 8 Static RAMs/PEROMs can be installed in the board beginning at U27. One or two RAMs/PEROMs can be installed and the device jumpers should be appropriately set as described in section 2.20. After powerup, it is necessary to configure the silicon disk for the actual size of the drive using the SSDINIT utility. SSDINIT is invoked at the DOS command line with :

SSDINIT [A: | B: ] disk\_size[K | M]

the K or M arguments are optional and are actually ignored. Values below 32 are assumed to be in Megabytes while values above 32 are assumed to be in Kilobytes. An example might help to clarify. To prepare a 1Meg Flash or SRAM disk for formatting, type :

SSDINIT B: 1M

The disk is now prepared for formatting. The system must be rebooted prior to formatting with the simple DOS command :

```
format b: /s/u
```

After the next reset the formatted silicon disk will boot as the A: drive. If it is ever necessary to bypass the silicon disk boot in order to reformat or to boot the actual floppy drive, or the hard disk, simply press the <CTRL><ALT><LSHIFT> keys simultaneously immediately following display of the BIOS configuration BOX. The message :

Silicon Disk Boot Aborted by User

will be displayed and the system will boot from one of the available boot drives.

**IMPORTANT NOTE :** The FLASHDISK is fully writeable at all times but is not recommended for continuous updating or data logging. The onboard BIOS implements a simple FAT based file system (identical to a floppy disk) with no wear leveling implemented. The PEROMs can and will wear out with excessive write cycles. ATMEL specifies at least 10,000 write cycles.

#### 4.4 Non-Bootable RAMDISK Usage

A non bootable RAMDISK is often desired in conjunction with a bootable ROMDISK, FLASH-DISK, or rotational media. It can then be used for program updates, parameter storage, or data logging applications. a non-bootable RAMDISK uses the WinSystems Universal Solid State Disk Driver (USSD) which is loaded via the boot media's CONFIG.SYS file with the entry :

```
device = ussd.sys /mod:p /pad:1ec /seg:e400 /psz:16 /inc:1 /spg:xx /dsz:yy
```

where the YYY in /DSZ:YYY is the size of the disk in Kilobytes and the XXX in the /SPG:XXX is the starting page address in the array for this silicon disk. This hexadecimal value is actually the count of 16K byte blocks preceding the start of the RAMDISK. The simplest approach is to use the table below to determine the correct /SPG value.

| Total RAM/ROM/FLASH<br>Prior to this socket | /SPG Value |
|---------------------------------------------|------------|
| None                                        | /SPG:80    |
| 512K                                        | /SPG:A0    |
| 1M                                          | /SPG:C0    |

A couple of examples might help to illustrate. Suppose we're booting from a floppy or hard disk and we have installed two 512K X 8 SRAMs. In order to create the desired 1 Meg RAMDISK we would need the line :

```
device = ussd.sys /mod:p /seg:e400 /psz:16 /inc:1 /pad:1ec /spg:80 /dsz:1024
```

which would indicate that we wish to create a disk of 1M (1024K) starting at the beginning of the array.

For another example assume that we want a 512K ROMDISK and a 512K RAMDISK. We would create our bootable floppy with the CONFIG.SYS line :

```
device = ussd.sys /mod:p /pad:1ec /seg:e400 /psz:16 /inc:1 /spg:a0 /dsz:512
```

This would create the 512K RAMDISK which will be preceded by the 512K of ROMDISK. We would create our ROMDISK as previously described and place the EPROM into U27. We would install our 512K SRAM into U23.

A final example would be to use the non-bootable RAMDISK in U27 as a secondary silicon disk to a DISK-ON-CHIP. In this case we are booting from the DISK-ON-CHIP and will include the following CONFIG.SYS command line :

```
device = ussd.sys /mod:p /seg:e000 /psz:16 /inc:1 /pad:1ec /spg:80 /dsz:512
```

this will create a 512K RAMDISK in the silicon disk socket U27.

**NOTE :** USSD, as is the convention with DOS installable disk devices, creates a drive with the **NEXT AVAILABLE** drive letter. Drives A: and B: are always reserved for the physical floppy drive or the BIOS supported bootable Silicon Disk. In a system without a hard disk, the next available drive letter would be C:. In a system with one or more hard drive partitions, the silicon disk created with USSD will be the first available letter following any other drive letters already in use. Also note that it is never necessary to format a disk created with USSD. The disks are self formatting using the size and address information provided on the CONFIG.SYS invocation line. During initialization, USSD examines the silicon disk to determine if a disk already exists which matches the parameters specified. If so, no action is taken and the disk is used as is. If there is not a disk of the type and size specified, it is created.

## 4.5 Non-Bootable FLASHDISK Usage

The ATMEL 5 Volt Flash Parts (29C040/29C040A) may also be used as a non bootable drive in a manner nearly identical to the RAMDISK usage described in the previous section. The only change when using USSD for the ATMEL PEROMs is the addition of the /EPT:256 parameter to the CONFIG.SYS line which installs the USSD driver. An example using a 512K EPROM for a ROMDISK and a 512K PEROM device would need the line :

```
device = ussd.sys /mod:p /pad:1ec /seg:e400 /psz:16 /inc:1 /spg:a0 /dsz:512 /ept:256
```

in the CONFIG.SYS file on the floppy to be imaged. This invocation will create a 512K Flash disk in the second socket of the array. Refer to the previous section on non-bootable RAMDISK usage for additional details regarding the USSD driver.

## 4.6 DiskOnChip Usage

The LBC-Plus supports the M-Systems DISK-ON-CHIP (DOC) flash device in sizes ranging from 1MB to 12MB. The DOC device contains a BIOS extension, the TFFS (Tiny Flash File System), and the Flash memory all in a single 32-pin device. The DOC, unlike the other WinSystems' SSD support for the LBC-Plus, emulates a hard disk rather than a floppy disk. The DOC can be used as a secondary hard disk to a physical IDE drive or it can be the only hard disk in the system.

The DOC is installed into the socket at U23. Refer to the section 2.19 for correct device jumpering and enabling of the DOC.

### 4.6.1 DOC Initialization

The DOC is initialized in an identical fashion to a fixed disk. DOS is booted (from floppy or hard disk), FDISK is run on the DOC drive (be sure to get the right drive), the system is rebooted and then the DOC is formatted using the DOS format command.

If the /S switch was used during formatting and there is no other fixed disk device specified or attached to the system the DOC will become the boot device. If a hard disk is present, the DOC will become a secondary fixed disk.

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# 5

## WS16C48 Programming Reference

### 5.1 Introduction

This section provides basic documentation for the included I/O routines. It is intended that the accompanying source code equip the programmer with a basic library of I/O functions for the WS16C48 or can serve as the basis from which application specific code can be derived.

### 5.2 Function Definitions

This section briefly describes each of the functions contained in the driver. Where necessary, short examples will be provided to illustrate usage. Any application making use of any of the driver functions should include the header file “uio48.h”, which includes the function prototypes and the needed constant definitions.

Note that all of the functions utilize the concept of “bit\_number”. The “bit\_number” is a value from 1 to 48 (1 to 24 for interrupt related functions) that correlates to a specific I/O pin. Bit\_number 1 is port 0 bit 0 and continues through to bit\_number 48 at port 5 bit 7.

---

#### **INIT\_IO - Initialize I/O, set all ports to input**

##### **Syntax**

```
void init_io(unsigned io_address);
```

##### **Description**

This function takes a single argument :

io\_address - The I/O address of the WS16C48 chip.

There is no return value. This function initializes all I/O pins for input (Sets them high), disables all interrupt settings, and sets the image values.

---

## **READ\_BIT - Reads an I/O port Bit**

### **Syntax**

```
int read_bit(int bit_number);
```

### **Description**

This function takes a single argument :

bit\_number - This is a value from 1 to 48 that indicates the I/O pin to read from.

This function returns the state of the I/O pin. A '1' is returned if the I/O pin is low and a '0' is returned if the pin is high.

---

## **WRITE\_BIT - Write a 1 or 0 to an I/O pin**

### **Syntax**

```
void write_bit(int bit_number, int value);
```

### **Description**

This function takes two arguments

bit\_number - This is value from 1 to 48, which is the bit to be acted upon.

Value - is either 1 or 0.

This function allows for writing of a single bit to either a '0' or a '1' as specified by the second argument. There is no return value and other bits in the I/O port are not affected.

---

## **SET\_BIT - Set the specified I/O Bit**

### **Syntax**

```
void set_bit(int bit_number);
```

### **Description**

This function takes a single argument :

bit\_number - a value between 1 and 48 specifying the port bit to be set.

This function sets the specified I/O port bit. Note that setting a bit results in the I/O pin actually going low. There is no return value and other bits in the same I/O port are unaffected.

---

## **CLR\_BIT - Clear the specified I/O Bit**

### **Syntax**

```
void clr_bit(int bit_number);
```

### **Description**

This function takes a single argument :

bit\_number - a value from 1 to 48 indicates the bit number to clear.

This function clears the specified I/O bit. Note that clearing the I/O bit results in the actual I/O pin going high. This function does not affect any bits other than the one specified.

---

## **ENAB\_INT - Enable Edge Interrupt, Select Polarity**

### **Syntax**

```
void enab_int(int bit_number, int polarity);
```

### **Description**

This function requires two arguments :

bit\_number - A value from 1 to 24 specifying the appropriate bit

polarity - Specifies rising or falling edge polarity detect. The constants RISING and FALLING are defined in "uio48.h"

This function enables the edge detection circuitry for the specified bit at the specified polarity. It does not unmask the interrupt controller, install vectors, or handle interrupts when they occur. There is no return value and only the specified bit is affected.

---

## **DISAB\_INT - Disable Edge Detect Interrupt Detection**

### **Syntax**

```
void disab_int(int bit_number);
```

### **Description**

This function requires a single argument :

bit\_number - A value from 1 to 24 specifying the appropriate bit.

This function shuts down the edge detection interrupts for the specified bit. There is no return value and no harm is done by calling this function for a bit which did not have edge detection interrupts enabled. There is no affect on any other bits.

---

## **CLR\_INT - Clear the specified pending interrupt**

### **Syntax**

```
void clr_int(int bit_number);
```

### **Description**

This function requires a single argument :

bit\_number - The specified bit number from 1 to 24 to reset the interrupt.

This function clears a pending interrupt on the specified bit. It does this by disabling and reenabling the interrupt. The net result after the call is that the interrupt is no longer pending and is rearmed for the next transition of the same polarity. Calling this function on a bit that has not been enabled for interrupts will result in its interrupt being enabled with an undefined polarity. Calling this function with no interrupt pending will have no adverse affect. Only the specified bit is affected.

---

## **GET\_INT - Retrieve bit number of pending interrupt**

### **Syntax**

```
int get_int(void);
```

### **Description**

This function requires no arguments and returns either a '0' for no bit interrupts pending or a value between 1 and 24 representing a bit number that has a pending edge detect interrupt. The function returns with the first interrupt found and begins its search at Port 0 Bit 0 proceeding through to Port 2 Bit 7. It is necessary to use either `clr_int()` or `disab_int()` to avoid returning the same bit continuously. This function may either be used in an application's ISR or can be used in the foreground to poll for bit transitions.

## 5.3 Sample Programs

There are three sample programs in source code form included on the LBC-Plus diskette in the UIO48 directory. These programs are not useful by themselves but are provided to illustrate the usage of the I/O functions provided in UIO48.C.

### **FLASH.C**

This program was compiled with Borland C/C++ version 3.1 on the command line with :

```
bcc flash.c uio48.c
```

This program illustrates the most basic usage of the WS16C48. It uses three functions from the driver code. The `io_init()` function is used to initialize the I/O functions and the `set_bit()` and `clr_bit()` functions are used to sequence through all 48 bits turning each on and then off in turn.

### **POLL.C**

This program was compiled with Borland C/C++ version 3.1 on the command line with :

```
bcc poll.c uio48.c
```

This program illustrates additional features of the WS16C48 and the I/O library functions. It programs the first 24 bits for input, arms them for falling edge detection, and then polls using the library routine `get_int()` to determine if any transitions have taken place.

### **INT.C**

This program was compiled with Borland C/C++ version 3.1 on the command line with :

```
bcc int.c uio48.c
```

This program is identical in function to the "poll.c" program except that interrupts are active and all updating of the transition counters is accomplished in the background during the interrupt service routine.

### **Summary**

The source code for all three programs as well as the I/O routines are included on the accompanying diskette. The source code is also provided in printed form in APPENDIX F. These I/O routines along with the sample program provided should provide for a good basis on which to build an application using the features of the WS16C48.

# 6

## APPENDIX A - I/O Port Map

The following is a list of PC I/O ports. Addresses marked with a '-' are not used on the LBC-Plus but their use should be carefully qualified so as not to conflict with other I/O boards. I/O addresses marked with a '+' are used on the LBC-Plus board and are unique to the WinSystems design. I/O Addresses marked with '\*\*' are generally unused and should be the basis for the first choices in I/O address selection.

| Hex Range | Usage                        |
|-----------|------------------------------|
| 000-00F   | 8237 DMA #1                  |
| **010-01F | FREE                         |
| 020-021   | 8259 PIC #1                  |
| +022-023  | Finali 486 Chipset Registers |
| **024-03F | FREE                         |
| 040-043   | 8254 Timer                   |
| **044-05F | FREE                         |
| 060-06F   | 8042 Keyboard Controller     |
| 070-071   | CMOS RAM/RTC                 |
| **072-07F | FREE                         |
| 080-08F   | DMA Page Registers           |
| **090-09F | FREE                         |
| 0A0-0BF   | 8259 PIC #2                  |
| 0C0-0DF   | 8237 DMA #2                  |
| **0E0-0EF | FREE                         |
| 0F0-0F1   | Coprocessor Control          |
| **0F2-11F | FREE                         |
| +120-12F  | WS16C48 HDIO                 |
| **130-1DF | FREE                         |
| +1E0-1EF  | SSD, Led, Watchdog control   |
| 1F0-1FF   | Fixed Disk I/O               |
| -200-20F  | Joystick port                |
| -210-21F  | PCM SSD I/O Ports            |
| -220-22F  | Soundblaster I/O ports       |
| **230-237 | FREE                         |
| -238-23B  | BUS Mouse                    |
| **240-277 | FREE                         |
| 278-27F   | LPT1                         |
| **280-2AF | FREE                         |
| -2B0-2DF  | EGA Video                    |
| -2E0-2E7  | GPIF Interface               |
| 2E8-2EF   | COM4                         |
| **2F0-2F7 | FREE                         |
| 2F8-2FF   | COM2                         |
| -300-31F  | Prototype Card               |
| -320-32F  | XT Hard Disk                 |
| **330-377 | FREE                         |
| -378-37F  | Parallel Printer             |
| -380-3AF  | SDLC                         |

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|          |             |
|----------|-------------|
| -3B0-3BB | DMA         |
| -3C0-3CF | EGA         |
| 3E8-3EF  | COM3        |
| 3F0-3F6  | Floppy Disk |
| 3F8-3FF  | COM1        |

## 7

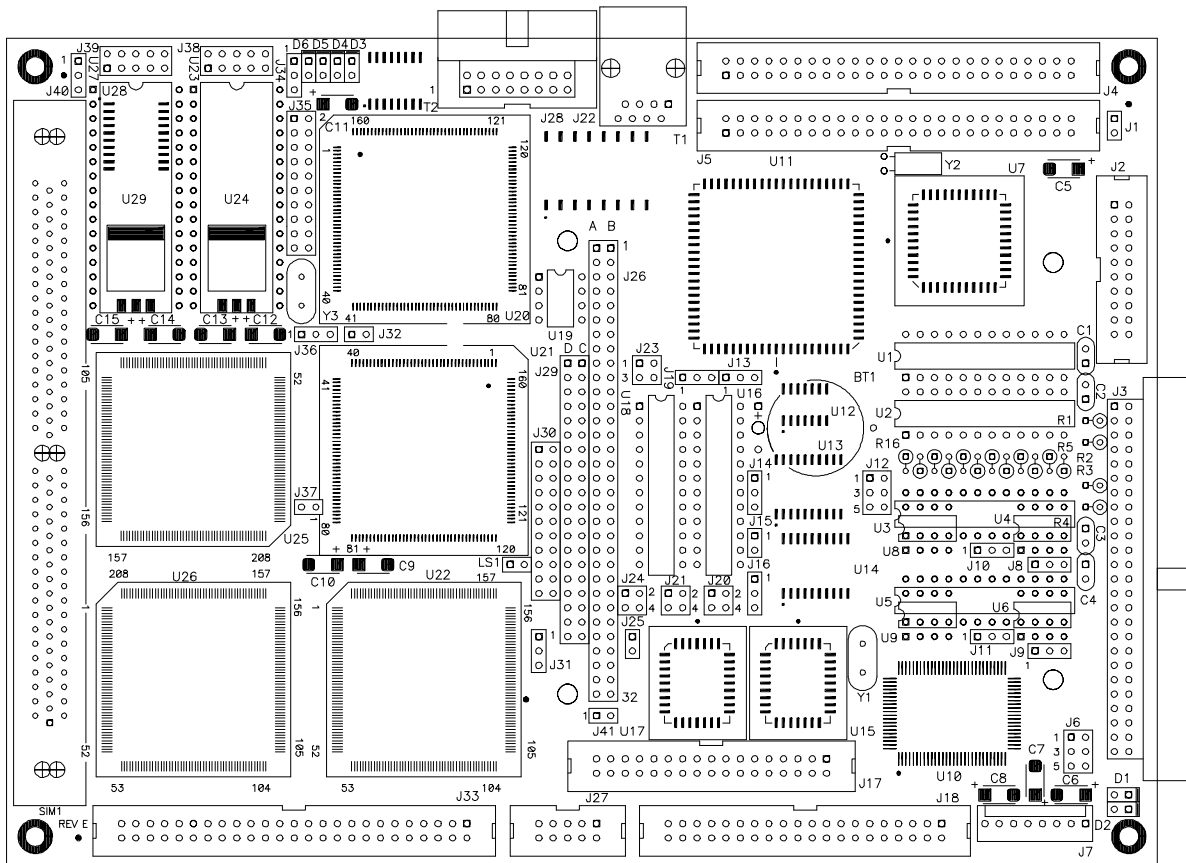
## APPENDIX B - Interrupt Map

| No. | Address | Type     | Description                                 |
|-----|---------|----------|---------------------------------------------|
| 0   | 00      | CPU      | Divide by 0                                 |
| 1   | 04      | CPU      | Single Step<br>386 Debug Exception          |
| 2   | 08      | CPU      | NMI                                         |
| 3   | 0C      | CPU      | Breakpoint                                  |
| 4   | 10      | CPU      | Overflow                                    |
| 5   | 14      | BIO      | Print Screen                                |
|     |         | 186      | Bound Exception                             |
| 6   | 18      | 186      | Invalid opcode exception                    |
| 7   | 1C      | 186      | Coprocessor unavailable                     |
| 8   | 20      | Hardware | IRQ0 - 18.2Hz heart beat                    |
|     |         | 286      | LIDT - Double fault exception               |
| 9   | 24      | Hardware | IRQ1 - Keyboard interrupt                   |
|     |         | 286      | Coprocessor segment                         |
| A   | 28      | Hardware | IRQ2 - XT Reserved,<br>AT-Slaved Controller |
|     |         | 286      | Invalid TSS exception                       |
| B   | 2C      | Hardware | IRQ3 - COM2                                 |
|     |         | 286      | Segment not present                         |
| C   | 30      | Hardware | IRQ4 - COM1                                 |
|     |         | 286      | Stack fault exception                       |
| D   | 34      | Hardware | IRQ5 - XT Hard Disk, AT Free                |
|     |         | 286      | Protection fault exception                  |
| E   | 38      | Hardware | IRQ6 - Floppy Disk Interrupt                |
|     |         | 386      | Page fault exception                        |
| F   | 3C      | Hardware | IRQ7 - LPT1                                 |
| 10  | 40      | BIOS     | Video BIOS functions                        |
|     |         | 286      | Coprocessor exception                       |
| 11  | 44      | BIOS     | BIOS Equipment check                        |
|     |         | 486      | Alignment check exception                   |
| 12  | 48      | BIOS     | Memory Size function                        |
| 13  | 4C      | BIOS     | BIOS Disk functions                         |
| 14  | 50      | BIOS     | BIOS serial functions                       |
| 15  | 54      | BIOS     | Cassette/protected mode<br>functions        |
| 16  | 58      | BIOS     | Keyboard BIOS functions                     |
| 17  | 5C      | BIOS     | BIOS printer functions                      |
| 18  | 60      | BIOS     | SRAM Basic Entry point (IBM)                |
| 19  | 64      | BIOS     | Boot loader function                        |
| 1A  | 68      | BIOS     | BIOS time of day functions                  |
| 1B  | 6C      | BIOS     | Keyboard break vector                       |
| 1C  | 70      | BIOS     | User chained timer tick                     |
| 1D  | 74      | BIOS     | Video Initialization                        |
| 1E  | 78      | BIOS     | Floppy Disk parameter table                 |

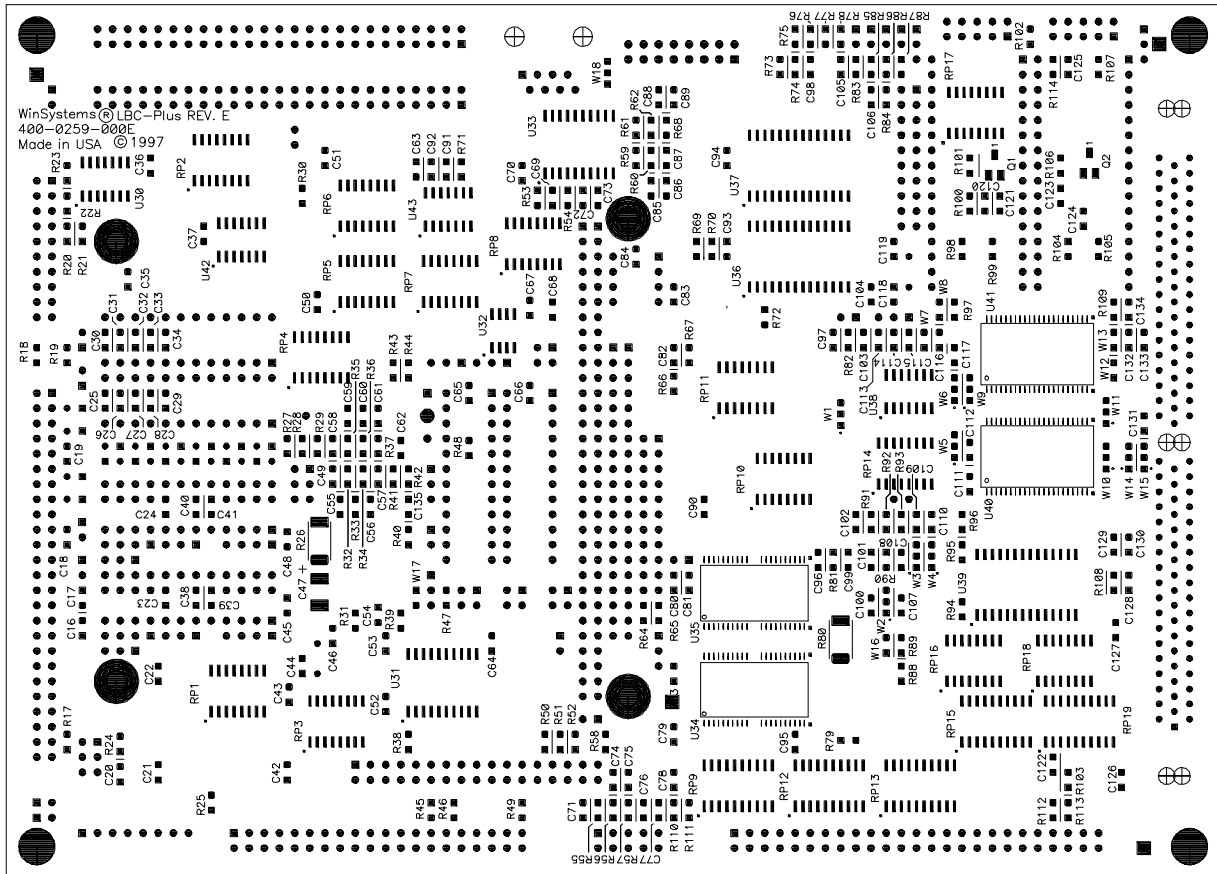
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|    |     |          |                                          |
|----|-----|----------|------------------------------------------|
| 1F | 7C  | BIOS     | CGA graphic character font               |
| 20 | 80  | MS-DOS   | Program terminate                        |
| 21 | 84  | MS-DOS   | DOS function call                        |
| 22 | 88  | MS-DOS   | Terminate Address                        |
| 23 | 8C  | MS-DOS   | Ctrl-Break Address                       |
| 24 | 90  | MS-DOS   | Fatal Error Vector                       |
| 25 | 94  | MS-DOS   | Absolute disk read                       |
| 26 | 98  | MS-DOS   | Absolute disk write                      |
| 27 | 9C  | MS-DOS   | Terminate                                |
| 28 | A0  | MS-DOS   | Idle Signal                              |
| 29 | A4  | MS-DOS   | TTY output                               |
| 2A | A8  | MS-DOS   | MS-Net services                          |
| 2F | BC  | MS-DOS   | Print Spool                              |
| 30 | C0  | MS-DOS   | Long jump interface                      |
| 33 | CC  | MS-DOS   | Mouse functions                          |
| 3F | FC  | MS-DOS   | Overlay interrupt                        |
| 40 | 100 | BIOS     | Floppy I/O when fixed disk<br>is present |
| 41 | 104 | BIOS     | Fixed disk 1 parameter table             |
| 42 | 108 | BIOS     | EGA Chain                                |
| 43 | 10C | BIOS     | EGA Parameter table pointer              |
| 44 | 110 | BIOS     | EGA graphics character font              |
| 4A | 128 | BIOS     | AT Alarm exit address                    |
| 50 | 140 | BIOS     | AT Alarm interrupt                       |
| 51 | 144 | BIOS     | Mouse functions                          |
| 5A | 168 | NET      | Functions                                |
| 5B | 16C | NET      | Boot chain                               |
| 5C | 170 | NET      | Net BIOS entry                           |
| 67 | 19C | MS-DOS   | EMS functions                            |
| 6D | 1B4 | VGA      | VGA Service                              |
| 70 | 1C0 | Hardware | IRQ8 - Real Time clock                   |
| 71 | 1C4 | Hardware | IRQ9 - Redirected IRQ2                   |
| 72 | 1C8 | Hardware | IRQ10 - Unassigned                       |
| 73 | 1CC | Hardware | IRQ11 - Unassigned                       |
| 74 | 1D0 | Hardware | IRQ12 - Unassigned                       |
| 75 | 1D4 | Hardware | IRQ13 - Unassigned                       |
| 76 | 1D8 | Hardware | IRQ14 - IDE Fixed Disk                   |
| 77 | 1DC | Hardware | IRQ15 - Unassigned                       |
| 80 | 200 |          |                                          |
| F0 | 3C0 | Basic    |                                          |
| F1 | 3C4 |          |                                          |
| FF | 3FC | Not used |                                          |

## LBC-Plus Parts Placement Guide - Top



# LBC- Plus Parts Placement Guide -Bottom



## LBC-Plus Parts List

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02/21/00

09:59:21

ASSM ITEM FROM: LBC-586PLUS-133-C

PARENT LOC FROM: &lt;FIRST&gt;

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PAGE 1

ASSM ITEM THRU: LBC-586PLUS-133-C

PARENT LOC THRU: &lt;LAST&gt;

DEFAULT COMPONENT LOCATION: ARLIN

| LVL               | ITEM KEY       | ITEM DESCRIPTION                        | BOM COMMENT                            | ITEM TYPE | QTY REQUIRED |
|-------------------|----------------|-----------------------------------------|----------------------------------------|-----------|--------------|
| LBC-586PLUS-133-C |                | 586DX SBC, 133 MHZ, 0 MB DRAM, 256 KB   | 586DX SBC, 133 MHZ, 0 MB DRAM, 256 KB  | CA F      | 1.0          |
| 1                 | 999-9999-001   | SPECIAL NOTES                           | 12-13-99 MEB ECO 99-83                 | I         | 1.0          |
| 1                 | 999-9999-001   | SPECIAL NOTES                           | 04-29-98 MEB (NEW)                     | I         | 1.0          |
| 1                 | 0259-004-0000E | ASSY CORE, TOP-SMT,5X86 LBC-Plus REV.E  | ASSY CORE, TOP-SMT,5X86 LBC-Plus REV.E | F         | 1.0          |
| 2                 | 999-9999-001   | SPECIAL NOTES                           | 12-13-99 MEB ECO 99-83                 | I         | 1.0          |
| 2                 | 603-1065-82D   | CAP 10uF 25v 20% TAN 6032               | C6-C8,C12-C15                          | I         | 7.0          |
| 2                 | 665-0001-102   | TRANSISTOR 2N7002 (SOT-23)              | Q1,Q2                                  | I         | 2.0          |
| 2                 | 621-0014-016   | IC, I/O CNTRLR ALi M5113 1F2S1P         | U10                                    | I         | 1.0          |
| 2                 | 611-0004-001   | IC, 74HC04M                             | U12                                    | I         | 1.0          |
| 2                 | 614-0244-002   | IC, 74F244SCX (NAT) OCTAL LINE DRIVER   | U13                                    | I         | 1.0          |
| 2                 | 622-0006-002   | FREQ SYNTH 2-100MHz AV9155-01CW20       | U14                                    | I         | 1.0          |
| 2                 | 650-0032-002   | SOCKET 32P AMP 822273-1 (28)            | U17                                    | I         | 1.0          |
| 2                 | 623-0005-016   | IC, M1487 (24)                          | U21                                    | I         | 1.0          |
| 2                 | 670-0001-025   | REGULATOR 5V-3.3V LINEAR TECH. LT1086CM | U24                                    | I         | 1.0          |
| 2                 | 620-0005-016   | IC, AM486DX5-133W16BHC                  | U25                                    | I         | 1.0          |
| 2                 | 623-0006-016   | IC, M1489 (24)                          | U26                                    | I         | 1.0          |
| 2                 | 611-0273-002   | IC, 74HC273M                            | U28                                    | I         | 1.0          |

SUB-ASSEMBLY TOTAL: 0259-004-0000E ARLIN - 13 Items

|   |                |                                   |                                          |   |      |
|---|----------------|-----------------------------------|------------------------------------------|---|------|
| 1 | 0259-001-0000E | ASSY CORE, BOT-SMT LBC-Plus REV.E | ASSY CORE, BOT-SMT LBC-Plus REV.E        | F | 1.0  |
| 2 | 999-9999-001   | SPECIAL NOTES                     | 12-13-99 MEB ECO 99-83                   | I | 1.0  |
| 2 | 603-1047-803   | CAP .1uF 50v 20% CER 0805         | C16-C19,C20-C24,C38-C43,C45,C48,C54,C56, | I | 45.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                     | C62,C64-C68,C82,C90,C97,C102,C103,C107,  | I | 1.0  |
| 2 | 999-9999-001   | SPECIAL NOTES                     | C110,C115,C120,C122-C128,C130,C131,C133, | I | 1.0  |
| 2 | 999-9999-001   | SPECIAL NOTES                     | C134                                     | I | 1.0  |
| 2 | 603-2207-403   | CAP 22pF 50v 1% NPO 0805          | C44,C46                                  | I | 2.0  |
| 2 | 603-82R7-303   | CAP 8.2pF 50v .50pF CER 0805      | C91                                      | I | 1.0  |
| 2 | 603-1047-803   | CAP .1uF 50v 20% CER 0805         | C92                                      | I | 1.0  |
| 2 | 603-1055-807   | CAP 1uF 25v 20% CER 1812          | C47                                      | I | 1.0  |
| 2 | 603-1507-403   | CAP 15pF 50v 1% CER 0805          | C49,C55,C57-C61,C135                     | I | 8.0  |
| 2 | 603-1037-803   | CAP .01uF 50v 20% CER 0805        | C109,C116,C121,C129,C132                 | I | 5.0  |
| 2 | 603-1027-703   | CAP 1000pF 50v 10% CER 0805       | C113                                     | I | 1.0  |
| 2 | 602-0103-512   | RN 10K 0h, 5%, 2506/16 pin, Bus   | RP1-RP4,RP10,RP11,RP14,RP16,RP18         | I | 9.0  |
| 2 | 602-0102-512   | RN 1K 0hm, 16 PIN, 15 RES BUSSED  | RP8                                      | I | 1.0  |
| 2 | 602-0220-523   | RN 22 0h, 5%, 20P, 10R, ISO       | RP15,RP19                                | I | 2.0  |
| 2 | 601-0103-503   | RES 10K 0hm 5% 1/10W 0805         | R17,R24,R27-R29,R40,R43,R44,R82,R91-R93, | I | 18.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                     | R96,R97,R102,R103,R107,R114              | I | 1.0  |
| 2 | 601-0102-503   | RES 1K 0hm 5% 1/10W 0805          | R18,R19,R38,R45,R46,R50-R52,R58,R88,R101 | I | 12.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                     | R106                                     | I | 1.0  |
| 2 | 601-0100-507   | RES 10 0hm 5% 1w 2512             | R26                                      | I | 1.0  |
| 2 | 601-0220-503   | RES 22 0hm 5% 1/10w 0805          | R31-R37,R41,R42                          | I | 9.0  |
| 2 | 601-0331-503   | RES 330 0h, 5%, 0805              | R48,R49,R64,R66,R67,R69,R70              | I | 7.0  |
| 2 | 601-0474-503   | RES 470K 0hm 5% 1/10W 0805        | R71                                      | I | 1.0  |
| 2 | 601-0101-507   | RES 100 0hm 5% 1w 2512            | R80                                      | I | 1.0  |
| 2 | 601-1210-303   | RES 121 0hm 1% 1/10w 0805         | R98,R104                                 | I | 2.0  |

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ASSM ITEM FROM: LBC-586PLUS-133-C

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PAGE 2

ASSM ITEM THRU: LBC-586PLUS-133-C

PARENT LOC THRU: &lt;LAST&gt;

DEFAULT COMPONENT LOCATION: ARLIN

| LVL | ITEM KEY      | ITEM DESCRIPTION                  | BOM COMMENT                             | ITEM TYPE | QTY REQUIRED |
|-----|---------------|-----------------------------------|-----------------------------------------|-----------|--------------|
| 2   | 601-2000-303  | RES 200 0hm 1% 1/10w 0805         | R99,R105                                | I         | 2.0          |
| 2   | 601-0101-503  | RES 100 0hm 5% 1/10w 0805         | R100                                    | I         | 1.0          |
| 2   | 622-0007-001  | IC, MAX692ACSA (Maxim only!)      | U32                                     | I         | 1.0          |
| 2   | 611-0125-001  | IC, 74HC125 QUAD TRI-STATE BUFFER | U42                                     | I         | 1.0          |
| 2   | 615-0069-001  | IC, CD4069UBCM (NAT)              | U43                                     | I         | 1.0          |
| 2   | 601-0000-503  | RES 0 0hm 5% 1/10w 0805           | R25,W1-W3,W9,W14,W15(2-3)W4-W8,W12(1-2) | I         | 14.0         |
| 2   | 999-9999-001  | SPECIAL NOTES                     | W18(1-2)                                | I         | 1.0          |
| 2   | 400-0259-000E | PCB, LBC-Plus REV. E              | PCB, LBC-Plus REV. E                    | I         | 1.0          |

SUB-ASSEMBLY TOTAL: 0259-001-0000E ARLIN - 33 Items

|   |                |                                       |                                  |   |     |
|---|----------------|---------------------------------------|----------------------------------|---|-----|
| 1 | 0259-002-0000E | ASSY CORE, TOP-TH LBC-Plus REV.E      | ASSY CORE, TOP-TH LBC-Plus REV.E | F | 1.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                         | 12-11-99 MEB ECO 99-83 REVE      | I | 1.0 |
| 2 | 124-0016-000   | LED RED RECTANGLE L-153HDT (KNGBRT)   | D1                               | I | 1.0 |
| 2 | 124-0017-000   | LED GREEN RECTANGLE L-153GDT (KNGBRT) | D2                               | I | 1.0 |
| 2 | 201-0050-121   | HEADER RA 2X25 IDH50LP-SR3-TR/TG [RN] | J3                               | I | 1.0 |

|   |              |                                          |                                                 |   |     |
|---|--------------|------------------------------------------|-------------------------------------------------|---|-----|
| 2 | 201-0008-601 | HDR 8 POS MOLEX 22-11-2082               | J7                                              | I | 1.0 |
| 2 | 201-0036-010 | HDR 1X36 UN TSW-136-07-G-S (SAM)         | J8-J11, J13, J14, J16, J19, J31, J34, J36, J40= | I | 1.0 |
| 2 | 999-9999-001 | SPECIAL NOTES                            | =1X3 , J25=1X2                                  | I | 1.0 |
| 2 | 201-0072-120 | HDR 2X36 UN TSW-136-07-G-D               | J6, J12=2X3 J21, J24=2X2 J30=2X11               | I | .9  |
| 2 | 999-9999-001 | SPECIAL NOTES                            | J38, J39=2X5                                    | I | 1.0 |
| 2 | 201-0034-021 | HDR 34 POS ST IDH-34LP-S3-TG/TR (720)    | J17                                             | I | 1.0 |
| 2 | 201-0040-021 | HDR 40 PIN ST IDH-40LP-S3-TG/TR (576)    | J18                                             | I | 1.0 |
| 2 | 200-0072-100 | SOCKET 72 PIN SIMM VERT 15-82-0762 (MLX) | SIMM1*INSTALL ON COMPONENT SIDE OF BOARD        | I | 1.0 |
| 2 | 250-0320-200 | SKT STRP 32 POS SS-132-G-2 (SAM)         | U3, U4, U5, U6, U8, U9, U23, U27                | I | 4.5 |
| 2 | 200-0243-100 | SOCKET 24 P .3 IC0-243-S8A-T (1496)      | U16, U18                                        | I | 2.0 |
| 2 | 220-0032-001 | XTAL-14.31818 (ABRACON) ABL-14.31818     | Y1 *USE INSULATOR                               | I | 1.0 |
| 2 | 220-0000-000 | HC49 INSULATOR XTAL                      | PLACE UNDER Y1                                  | I | 1.0 |
| 2 | 220-0001-000 | XTAL 32.768KHZ TF U3X832768              | Y2 *USE DOUBLE SIDED TAPE                       | I | 1.0 |
| 2 | 500-0027-003 | TAPE .5" X 2592" X 1/32" 3M=4032         | TAPE Y2 TO BOARD                                | I | .1  |
| 2 | 114-0000-450 | RESISTOR ZERO OHM 1/4 W                  | R1-R4                                           | I | 4.0 |
| 2 | 999-9999-001 | SPECIAL NOTES                            | *MASK:R5-R16, C1-C4 *SEE NEXT(J26, J29)         | I | 1.0 |
| 2 | 999-9999-001 | SPECIAL NOTES                            | *MASK J26, J29 WHEN STACK-THRU ASSEMBLY         | I | 1.0 |
| 2 | 999-9999-001 | SPECIAL NOTES                            | 0259-041-0000X IS ON WORK ORDER*                | I | 1.0 |
| 2 | 999-9999-001 | SPECIAL NOTES                            | OTHERWISE INSTALL W/ASSY CORE, TOP-TH.          | I | 1.0 |

SUB-ASSEMBLY TOTAL: 0259-002-0000E ARLIN - 23 Items

|   |                |                                         |                                           |   |     |
|---|----------------|-----------------------------------------|-------------------------------------------|---|-----|
| 1 | 0259-012-0000E | SUB ASSY CORE, TOP, 5X86 LBC-Plus REV.E | SUB ASSY CORE, TOP, 5X86 LBC-Plus REV.E   | F | 1.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                           | 12-13-99 MEB ECO 99-83                    | I | 1.0 |
| 2 | 730-0026-000   | PIEZO TRANSDUCER BRP2407L-30            | LS1 *MUST BE HAND SOLDERED, USE INSULATOR | I | 1.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                           | *LS1-INSTALL ON U21                       | I | 1.0 |
| 2 | 111-0043-000   | BATTERY KEEPER LTC-3PN-S2               | BT1 *MUST BE HAND SOLDERED, USE INSULATOR | I | 1.0 |
| 2 | 111-0032-000   | INSULATOR BATTERY CR2032                | PLACE UNDER LS1, BT1                      | I | 2.0 |
| 2 | 730-0083-000   | IC, SP208CP (SIPEX), MAX208CNG (15)     | U3, U5                                    | I | 2.0 |
| 2 | 901-0011-000   | IC, PALC22V10-35PC (15, TI) (17, CYP)   | U16 CS=952F\SPRINT\LBCPLUS\U16.JED        | I | 2.0 |

02/21/00

09:59:22

ASSM ITEM FROM: LBC-586PLUS-133-C

PARENT LOC FROM: <FIRST>

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ASSM ITEM THRU: LBC-586PLUS-133-C

PARENT LOC THRU: <LAST>

| LVL | ITEM KEY     | ITEM DESCRIPTION               | BOM COMMENT                        | ITEM TYPE | QTY REQUIRED |
|-----|--------------|--------------------------------|------------------------------------|-----------|--------------|
| 2   | 999-9999-001 | SPECIAL NOTES                  | U18 CS=306E\SPRINT\LBCPLUS\U18.JED | I         | 1.0          |
| 2   | 633-0001-015 | IC, AT27C010-15JC (32) (ATMEL) | U17 CS=50BF\LBCPLUS\REL0811.BIN    | I         | 1.0          |
| 2   | 201-0002-000 | PLUG JUMPER 999-19-310-00      | J6=3-5 4-6                         | I         | 32.0         |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J8=OPEN                            | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J9=OPEN                            | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J10=OPEN                           | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J11=OPEN                           | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J12=1-2 5-6                        | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J13=2-3                            | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J14=2-3                            | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J15=1-2                            | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J16=2-3                            | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J19=1-2                            | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J21=3-4                            | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J24=3-4                            | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J25=OPEN                           | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J30=1-2 3-4 9-10 11-12 13-14       | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J30(CONT)=15-16 17-18 19-20 21-22  | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J31=1-2                            | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J34=1-2                            | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J36=2-3                            | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J37=OPEN                           | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J38=3-4 5-6 7-9 8-10               | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J39=3-4 5-6 7-9 8-10               | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | J40=1-2                            | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                  | *SHIPMENT JUMPERS: J25=1-2         | I         | 1.0          |

SUB-ASSEMBLY TOTAL: 0259-012-0000E ARLIN - 33 Items

|   |                |                                          |                                          |   |     |
|---|----------------|------------------------------------------|------------------------------------------|---|-----|
| 1 | 0259-040-0000E | ASSY, TOP-THR LBCPLUSNON-STACKTHRU REV.E | ASSY, TOP-THR LBCPLUSNON-STACKTHRU REV.E | F | 1.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                            | 12-13-99 MEB ECO 99-83                   | I | 1.0 |
| 2 | 200-0064-000   | SOCKET 64 POS QPHF2-64-020-1W (PLASTRON) | J26                                      | I | 1.0 |
| 2 | 200-0040-000   | SOCKET 40 POS QPHF2-40-020-1W (PLASTRON) | J29                                      | I | 1.0 |

SUB-ASSEMBLY TOTAL: 0259-040-0000E ARLIN - 3 Items

|   |                |                                    |                                    |   |     |
|---|----------------|------------------------------------|------------------------------------|---|-----|
| 1 | 0259-101-0000E | ASSY CACHE, BOT-SMT LBC-Plus REV.E | ASSY CACHE, BOT-SMT LBC-Plus REV.E | F | 1.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                      | 12-13-99 MEB ECO 99-83             | I | 1.0 |
| 2 | 603-1047-803   | CAP .1uF 50v 20% CER 0805          | C111, C112, C114, C117             | I | 4.0 |
| 2 | 601-0103-503   | RES 10K Ohm 5% 1/10W 0805          | R94, R95                           | I | 2.0 |

|   |              |                                  |                   |   |     |
|---|--------------|----------------------------------|-------------------|---|-----|
| 2 | 601-0000-503 | RES 0 Ohm 5% 1/10w 0805          | R109 W10,W11(2-3) | I | 3.0 |
| 2 | 614-0008-001 | IC, 74F08SCX (NAT) QUAD AND GATE | U38               | I | 1.0 |
| 2 | 630-0003-002 | 32K X 8 SRAM 20NS IDT71256SA20PE | U39               | I | 1.0 |
| 2 | 630-0002-023 | 64K X 16 SRAM 20NS IDT71016S20PH | U40,U41           | I | 2.0 |

SUB-ASSEMBLY TOTAL: 0259-101-0000E ARLIN - 7 Items

|                                   |                                   |                                   |   |
|-----------------------------------|-----------------------------------|-----------------------------------|---|
| 02/21/00                          | BOM for Manuals                   | PAGE                              | 4 |
| 09:59:23                          | WinSystems, Inc.                  |                                   |   |
| ASSM ITEM FROM: LBC-586PLUS-133-C |                                   | ASSM ITEM THRU: LBC-586PLUS-133-C |   |
| PARENT LOC FROM: <FIRST>          | DEFAULT COMPONENT LOCATION: ARLIN | PARENT LOC THRU: <LAST>           |   |

| LVL | ITEM KEY       | ITEM DESCRIPTION                        | BOM COMMENT                       | ITEM TYPE | QTY REQUIRED |
|-----|----------------|-----------------------------------------|-----------------------------------|-----------|--------------|
| 1   | 0259-200-0000E | ASSY ENET, TOP-SMT LBC-Plus REV.E       | ASSY ENET, TOP-SMT LBC-Plus REV.E | F         | 1.0          |
| 2   | 999-9999-001   | SPECIAL NOTES                           | 12-13-99 MEB ECO 99-83            | I         | 1.0          |
| 2   | 603-1065-82D   | CAP 10uF 25v 20% TAN 6032               | C11                               | I         | 1.0          |
| 2   | 606-0002-000   | IC, 78Z1122D-01 INTERFACE MODULE        | T1                                | I         | 1.0          |
| 2   | 606-0001-000   | IC, 23Z91SM PULSE                       | T2                                | I         | 1.0          |
| 2   | 621-0013-016   | IC, DP83905AVQB AT/LANTIC AT LAN TWPAIR | U20                               | I         | 1.0          |

SUB-ASSEMBLY TOTAL: 0259-200-0000E ARLIN - 5 Items

|   |                |                                   |                                   |   |     |
|---|----------------|-----------------------------------|-----------------------------------|---|-----|
| 1 | 0259-201-0000E | ASSY ENET, BOT-SMT LBC-Plus REV.E | ASSY ENET, BOT-SMT LBC-Plus REV.E | F | 1.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                     | 12-13-99 MEB ECO 99-83            | I | 1.0 |
| 2 | 603-1047-803   | CAP .1uF 50v 20% CER 0805         | C83,C84,C89,C93,C94,C104,C106     | I | 7.0 |
| 2 | 603-1037-803   | CAP .01uF 50v 20% CER 0805        | C69,C73,C86,C98,C105              | I | 5.0 |
| 2 | 603-1027-803   | CAP 1000pF 50v 20% CER 0805       | C72,C85                           | I | 2.0 |
| 2 | 603-3307-503   | CAP 33pF 50v 2% CER 0805          | C87,C88                           | I | 2.0 |
| 2 | 603-2207-403   | CAP 22pF 50v 1% NPO 0805          | C118,C119                         | I | 2.0 |
| 2 | 602-0103-512   | RN 10K Oh, 5%, 2506/16 pin, Bus   | RP17                              | I | 1.0 |
| 2 | 601-499A-303   | RES 49.9 Ohm 1% 1/10w 0805        | R53,R54                           | I | 2.0 |
| 2 | 601-665A-303   | RES 66.5 Ohm 1% 1/10w 0805        | R59,R61                           | I | 2.0 |
| 2 | 601-2740-303   | RES 274 Ohm 1% 1/10w 0805         | R60,R62                           | I | 2.0 |
| 2 | 601-8060-303   | RES 806 Ohm 1% 1/10w 0805         | R68                               | I | 1.0 |
| 2 | 601-0000-503   | RES 0 Ohm 5% 1/10w 0805           | R72                               | I | 1.0 |
| 2 | 601-0271-503   | RES 270 Ohm 5% 1/10w 0805         | R73,R74,R83,R85-R87               | I | 6.0 |
| 2 | 601-392A-303   | RES 39.2 Ohm 1% 1/10w 0805        | R75-R78                           | I | 4.0 |
| 2 | 601-0220-503   | RES 22 Ohm 5% 1/10w 0805          | R84                               | I | 1.0 |
| 2 | 630-0001-002   | 32K BYTE SRAM 70NS                | U36,U37                           | I | 2.0 |

SUB-ASSEMBLY TOTAL: 0259-201-0000E ARLIN - 16 Items

|   |                |                                         |                                  |   |     |
|---|----------------|-----------------------------------------|----------------------------------|---|-----|
| 1 | 0259-202-0000E | ASSY ENET, TOP-TH LBC-Plus REV.E        | ASSY ENET, TOP-TH LBC-Plus REV.E | F | 1.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                           | 12-13-99 MEB ECO 99-83           | I | 1.0 |
| 2 | 124-0016-000   | LED RED RECTANGLE L-153HDT (KNGBRT)     | D3                               | I | 1.0 |
| 2 | 124-0017-000   | LED GREEN RECTANGLE L-153GDT (KNGBRT)   | D4,D5                            | I | 2.0 |
| 2 | 124-0021-000   | LED YELLOW RETCANGLE LTL-3253A          | D6                               | I | 1.0 |
| 2 | 201-0008-500   | TEL JACK RJ45 MOLEX 950-01-2881         | J22                              | I | 1.0 |
| 2 | 201-0016-021   | HEADER 16 POS ST IDH-16LP-S3-TG/TR [RN] | J28                              | I | 1.0 |
| 2 | 201-0036-010   | HDR 1X36 UN TSW-136-07-G-S (SAM)        | J32                              | I | .1  |
| 2 | 201-0072-120   | HDR 2X36 UN TSW-136-07-G-D              | J35                              | I | 1.0 |
| 2 | 200-0083-100   | SOCKET 8 PIN IC0-083-S8A-T (4488)       | U19                              | I | 1.0 |
| 2 | 220-0039-000   | XTAL 20.000 U49S-18-200                 | Y3                               | I | 1.0 |
| 2 | 220-0000-000   | HC49 INSULATOR XTAL                     | INSTALL UNDER Y3                 | I | 1.0 |

SUB-ASSEMBLY TOTAL: 0259-202-0000E ARLIN - 11 Items

|   |                |                                  |                                  |   |     |
|---|----------------|----------------------------------|----------------------------------|---|-----|
| 1 | 0259-210-0000E | SUB ASSY ENET,TOP LBC-Plus REV.E | SUB ASSY ENET,TOP LBC-Plus REV.E | F | 1.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                    | 12-13-99 MEB ECO 99-83           | I | 1.0 |

|                                   |                                   |                                   |   |
|-----------------------------------|-----------------------------------|-----------------------------------|---|
| 02/21/00                          | BOM for Manuals                   | PAGE                              | 5 |
| 09:59:23                          | WinSystems, Inc.                  |                                   |   |
| ASSM ITEM FROM: LBC-586PLUS-133-C |                                   | ASSM ITEM THRU: LBC-586PLUS-133-C |   |
| PARENT LOC FROM: <FIRST>          | DEFAULT COMPONENT LOCATION: ARLIN | PARENT LOC THRU: <LAST>           |   |

| LVL | ITEM KEY     | ITEM DESCRIPTION                   | BOM COMMENT                          | ITEM TYPE | QTY REQUIRED |
|-----|--------------|------------------------------------|--------------------------------------|-----------|--------------|
| 2   | 201-0002-000 | PLUG JUMPER 999-19-310-00          | J32=1-2                              | I         | 4.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                      | J35=7-8 13-14 17-18                  | I         | 1.0          |
| 2   | 999-9999-001 | SPECIAL NOTES                      | *** PROGRAMMING INSTRUCTIONS ***     | I         | 1.0          |
| 2   | 901-0036-000 | IC, EEPROM NM93C06N (NAT) 256 X 16 | U19 CS=ENET2000 SEE NEXT TO PROGRAM: | I         | 1.0          |

|   |              |               |                                        |   |     |
|---|--------------|---------------|----------------------------------------|---|-----|
| 2 | 999-9999-001 | SPECIAL NOTES | *INSTRUCTIONS:                         | I | 1.0 |
| 2 | 999-9999-001 | SPECIAL NOTES | (1)EXIT TO DOS ON SPRINT MACHINE       | I | 1.0 |
| 2 | 999-9999-001 | SPECIAL NOTES | (2)AT PROMPT TYPE> DO ENET2000 <ENTER> | I | 1.0 |

SUB-ASSEMBLY TOTAL: 0259-210-0000E ARLIN - 8 Items

|   |                |                                    |                                    |   |     |
|---|----------------|------------------------------------|------------------------------------|---|-----|
| 1 | 0259-300-0000E | ASSY VIDEO, TOP-SMT LBC-Plus REV.E | ASSY VIDEO, TOP-SMT LBC-Plus REV.E | F | 1.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                      | 12-13-99 MEB ECO 99-83             | I | 1.0 |
| 2 | 603-1065-82D   | CAP 10uF 25v 20% TAN 6032          | C9,C10                             | I | 2.0 |
| 2 | 650-0032-002   | SOCKET 32P AMP 822273-1 (28)       | U15                                | I | 1.0 |
| 2 | 621-0011-016   | IC, C&T F65545/B2-5 (24)           | U22                                | I | 1.0 |

SUB-ASSEMBLY TOTAL: 0259-300-0000E ARLIN - 4 Items

|   |                |                                    |                                       |   |      |
|---|----------------|------------------------------------|---------------------------------------|---|------|
| 1 | 0259-301-0000E | ASSY VIDEO, BOT-SMT LBC-Plus REV.E | ASSY VIDEO, BOT-SMT LBC-Plus REV.E    | F | 1.0  |
| 2 | 999-9999-001   | SPECIAL NOTES                      | 12-13-99 MEB ECO 99-83                | I | 1.0  |
| 2 | 603-1047-803   | CAP .1uF 50v 20% CER 0805          | C52,C53,C70,C78-C81,C95,C96,C99,C100, | I | 13.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                      | C101,C108                             | I | 1.0  |
| 2 | 603-2207-403   | CAP 22pF 50v 1% NPO 0805           | C71,C74-C77                           | I | 5.0  |
| 2 | 602-0220-523   | RN 22 Oh, 5%, 20P, 10R, ISO        | RP9,RP12,RP13                         | I | 3.0  |
| 2 | 601-0103-503   | RES 10K Ohm 5% 1/10W 0805          | R47,R63,R65                           | I | 3.0  |
| 2 | 601-0151-503   | RES 150 Ohm 5% 1/10w 0805          | R55-R57                               | I | 3.0  |
| 2 | 601-2670-303   | RES 267 Ohm 1% 1/10w 0805          | R79                                   | I | 1.0  |
| 2 | 601-0100-503   | RES 10 Ohm 5% 1/10w 0805           | R81,R90                               | I | 2.0  |
| 2 | 601-0331-503   | RES 330 Oh, 5%, 0805               | R89                                   | I | 1.0  |
| 2 | 611-0245-002   | IC, 74HC245DW (SM)                 | U31                                   | I | 1.0  |
| 2 | 612-0688-002   | IC, 74HCT688AF (SM)                | U33                                   | I | 1.0  |
| 2 | 631-0001-023   | 256k X 16 DRAM TSOP-II             | U34,U35                               | I | 2.0  |
| 2 | 601-0220-503   | RES 22 Ohm 5% 1/10w 0805           | R110-R113                             | I | 4.0  |
| 2 | 601-0000-503   | RES 0 Ohm 5% 1/10w 0805            | W16,W17                               | I | 2.0  |

SUB-ASSEMBLY TOTAL: 0259-301-0000E ARLIN - 15 Items

|   |                |                                         |                        |   |     |
|---|----------------|-----------------------------------------|------------------------|---|-----|
| 1 | 0259-302-0000E | ASSY VIDEO, TOP-TH LBC-Plus REV.E       |                        | F | 1.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                           | 12-13-99 MEB ECO 99-83 | I | 1.0 |
| 2 | 201-0072-120   | HDR 2X36 UN TSW-136-07-G-D              | J20=2X2                | I | .1  |
| 2 | 201-0010-021   | HDR 2X5 ST PRO IDH-10LP-S3-TG/TR (1800) | J27                    | I | 1.0 |
| 2 | 201-0050-021   | HDR 2X25 ST PRO IDH50LP-S3-TG/TR        | J33                    | I | 1.0 |

SUB-ASSEMBLY TOTAL: 0259-302-0000E ARLIN - 4 Items

|   |                |                     |                |   |     |
|---|----------------|---------------------|----------------|---|-----|
| 1 | 0259-310-0000E | SUB ASSY VIDEO, TOP | LBC-Plus REV.E | F | 1.0 |
|---|----------------|---------------------|----------------|---|-----|

|                                   |                                   |                                   |   |
|-----------------------------------|-----------------------------------|-----------------------------------|---|
| 02/21/00                          | BOM for Manuals                   | PAGE                              | 6 |
| 09:59:24                          | WinSystems, Inc.                  |                                   |   |
| ASSM ITEM FROM: LBC-586PLUS-133-C |                                   | ASSM ITEM THRU: LBC-586PLUS-133-C |   |
| PARENT LOC FROM: <FIRST>          | DEFAULT COMPONENT LOCATION: ARLIN | PARENT LOC THRU: <LAST>           |   |

| LVL | ITEM KEY     | ITEM DESCRIPTION            | BOM COMMENT                             | ITEM TYPE | QTY REQUIRED |
|-----|--------------|-----------------------------|-----------------------------------------|-----------|--------------|
| 2   | 999-9999-001 | SPECIAL NOTES               | 12-13-99 MEB ECO 99-83                  | I         | 1.0          |
| 2   | 634-0002-015 | IC, AT27C040-15JC [SM] (15) | U15 CS=1E00 \LBCPLUS\PCIVID\REL0128.BIN | I         | 1.0          |
| 2   | 201-0002-000 | PLUG JUMPER 999-19-310-00   | J20=3-4                                 | I         | 1.0          |

SUB-ASSEMBLY TOTAL: 0259-310-0000E ARLIN - 3 Items

|   |                |                                       |                        |   |     |
|---|----------------|---------------------------------------|------------------------|---|-----|
| 1 | 0259-400-0000E | ASSY SERIAL/+, TOP-SMT LBC-Plus REV.E |                        | F | 1.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                         | 12-13-99 MEB ECO 99-83 | I | 1.0 |
| 2 | 650-0044-002   | SOCKET, 44 POSITION PLCC 213-044-602  | U7                     | I | 1.0 |

SUB-ASSEMBLY TOTAL: 0259-400-0000E ARLIN - 2 Items

|   |                |                                       |                        |   |      |
|---|----------------|---------------------------------------|------------------------|---|------|
| 1 | 0259-401-0000E | ASSY SERIAL/+, BOT-SMT LBC-Plus REV.E |                        | F | 1.0  |
| 2 | 999-9999-001   | SPECIAL NOTES                         | 12-13-99 MEB ECO 99-83 | I | 1.0  |
| 2 | 603-1047-803   | CAP .1uF 50v 20% CER 0805             | C25-C37                | I | 13.0 |
| 2 | 601-0103-503   | RES 10K Ohm 5% 1/10W 0805             | R20,R23                | I | 2.0  |
| 2 | 601-0102-503   | RES 1K Ohm 5% 1/10W 0805              | R21,R22                | I | 2.0  |
| 2 | 611-0004-001   | IC, 74HC04M                           | U30                    | I | 1.0  |
| 2 | 601-0220-503   | RES 22 Ohm 5% 1/10w 0805              | R39                    | I | 1.0  |

SUB-ASSEMBLY TOTAL: 0259-401-0000E ARLIN - 6 Items

|   |                |                                         |                        |   |     |
|---|----------------|-----------------------------------------|------------------------|---|-----|
| 1 | 0259-402-0000E | ASSY SERIAL/+, TOP-TH LBC-Plus REV.E    |                        | F | 1.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                           | 12-13-99 MEB ECO 99-83 | I | 1.0 |
| 2 | 201-0020-021   | HEADER 2X10 IDH-20LP-S3-TG/TR (50) [RN] | J2                     | I | 1.0 |
| 2 | 200-0243-100   | SOCKET 24 P .3 ICO-243-S8A-T (1496)     | U1,U2                  | I | 2.0 |
| 2 | 201-0072-120   | HDR 2X36 UN TSW-136-07-G-D              | J23                    | I | 1.0 |

SUB-ASSEMBLY TOTAL: 0259-402-0000E ARLIN - 4 Items

|   |                |                                      |                        |   |     |
|---|----------------|--------------------------------------|------------------------|---|-----|
| 1 | 0259-410-0000E | SUB ASSY SERIAL, TOP                 | LBC-Plus REV.E         | F | 1.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                        | 12-13-99 MEB ECO 99-83 | I | 1.0 |
| 2 | 621-0016-015   | IC, ST16C2552CJ44 DUAL UART W/FIFO'S | U7                     | I | 1.0 |
| 2 | 730-0083-000   | IC, SP208CP (SIPEX), MAX208CNG (15)  | U1,U2                  | I | 2.0 |
| 2 | 201-0002-000   | PLUG JUMPER 999-19-310-00            | J23=1-2 3-4            | I | 2.0 |

SUB-ASSEMBLY TOTAL: 0259-410-0000E ARLIN - 4 Items

|   |                |                           |                        |   |     |
|---|----------------|---------------------------|------------------------|---|-----|
| 1 | 0259-500-0000E | ASSY DIGITAL I/O, TOP-SMT | LBC-Plus REV.E         | F | 1.0 |
| 2 | 999-9999-001   | SPECIAL NOTES             | 12-13-99 MEB ECO 99-83 | I | 1.0 |
| 2 | 603-1065-82D   | CAP 10uF 25v 20% TAN 6032 | C5                     | I | 1.0 |
| 2 | 650-0084-002   | SOCKET, 84 POSITION PLCC  | 213-084-602 U11        | I | 1.0 |

SUB-ASSEMBLY TOTAL: 0259-500-0000E ARLIN - 3 Items

|   |                |                           |                |   |     |
|---|----------------|---------------------------|----------------|---|-----|
| 1 | 0259-501-0000E | ASSY DIGITAL I/O, BOT-SMT | LBC-Plus REV.E | F | 1.0 |
|---|----------------|---------------------------|----------------|---|-----|

02/21/00

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ASSM ITEM FROM: LBC-586PLUS-133-C

ASSM ITEM THRU: LBC-586PLUS-133-C

PARENT LOC FROM: <FIRST>

DEFAULT COMPONENT LOCATION: ARLIN

PARENT LOC THRU: <LAST>

| LVL | ITEM KEY     | ITEM DESCRIPTION                | BOM COMMENT            | ITEM TYPE | QTY REQUIRED |
|-----|--------------|---------------------------------|------------------------|-----------|--------------|
| 2   | 999-9999-001 | SPECIAL NOTES                   | 12-13-99 MEB ECO 99-83 | I         | 1.0          |
| 2   | 603-1047-803 | CAP .1uF 50v 20% CER 0805       | C50,C51,C63            | I         | 3.0          |
| 2   | 602-0103-512 | RN 10K Oh, 5%, 2506/16 pin, Bus | RP5-RP7                | I         | 3.0          |
| 2   | 601-0103-503 | RES 10K Ohm 5% 1/10W 0805       | R30                    | I         | 1.0          |

SUB-ASSEMBLY TOTAL: 0259-501-0000E ARLIN - 4 Items

|   |                |                                  |                        |   |     |
|---|----------------|----------------------------------|------------------------|---|-----|
| 1 | 0259-502-0000E | ASSY DIGITAL I/O, TOP-TH         | LBC-Plus REV.E         | F | 1.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                    | 12-13-99 MEB ECO 99-83 | I | 1.0 |
| 2 | 999-9999-001   | SPECIAL NOTES                    | 03-26-97 MEB (REVC)    | I | 1.0 |
| 2 | 201-0036-010   | HDR 1X36 UN TSW-136-07-G-S (SAM) | J1,J15=1X2             | I | .1  |
| 2 | 201-0050-021   | HDR 2X25 ST PRO IDH50LP-S3-TG/TR | J4,J5                  | I | 2.0 |

SUB-ASSEMBLY TOTAL: 0259-502-0000E ARLIN - 4 Items

|   |                |                           |                        |   |     |
|---|----------------|---------------------------|------------------------|---|-----|
| 1 | 0259-510-0000E | SUB ASSY DIGITAL I/O, TOP | LBC-Plus REV.E         | F | 1.0 |
| 2 | 999-9999-001   | SPECIAL NOTES             | 12-13-99 MEB ECO 99-83 | I | 1.0 |
| 2 | 905-0030-000   | IC, UD27-PL84-M3B:D       | U11                    | I | 1.0 |

SUB-ASSEMBLY TOTAL: 0259-510-0000E ARLIN - 2 Items

|   |              |                                           |                                           |   |     |
|---|--------------|-------------------------------------------|-------------------------------------------|---|-----|
| 1 | 910-0030-000 | LABEL, AWARD BIOS                         | *INSTALL BIOS LABEL AT TIME OF SHIPMENT   | I | 1.0 |
| 1 | 502-0010-000 | HEAT SINK, BDN10-3CB                      | *INSTALL ONTO CPU, ADHERE WITH CONDUCTIVE | I | 1.0 |
| 1 | 502-0009-000 | HEAT SINK ADHESIVE MATERIAL, DX CPU'S-SMT | SYNTHETIC RESIN COATED ALUMINUM MAT'L     | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | PROVIDED BY WINSYSTEMS.502-0009-000       | I | 1.0 |
| 1 | 950-0003-000 | BAG PINK POLY 8X10 CHISWICK 09-0810       | BAG PINK POLY 8X10 CHISWICK 09-0810       | I | 1.0 |
| 1 | 910-0024-000 | LABEL, STATIC SENSITIVE 130-02            | LABEL, STATIC SENSITIVE 130-02            | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | NOTE: SUMMARY OF JUMPER SETUP FOR TEST.   | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | J1=OPEN                                   | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | J6=3-5 4-6                                | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | J8=OPEN                                   | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | J9=OPEN                                   | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | J10=OPEN                                  | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | J11=OPEN                                  | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | J12=1-2 5-6                               | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | J13=2-3(TEST) 1-2(SHIPMENT)               | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | J14=2-3                                   | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | J15=1-2                                   | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | J16=2-3                                   | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | J19=1-2                                   | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | J20=3-4                                   | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | J21=3-4                                   | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | J23=1-2, 3-4                              | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | J24=3-4                                   | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | J25=OPEN                                  | I | 1.0 |
| 1 | 999-9999-001 | SPECIAL NOTES                             | J30=1-2 3-4 9-10 11-12 13-14 15-16 17-18  | I | 1.0 |

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ASSM ITEM FROM: LBC-586PLUS-133-C

PARENT LOC FROM: &lt;FIRST&gt;

DEFAULT COMPONENT LOCATION: ARLIN

ASSM ITEM THRU: LBC-586PLUS-133-C

PARENT LOC THRU: &lt;LAST&gt;

| LVL | ITEM KEY     | ITEM DESCRIPTION | BOM COMMENT           | ITEM TYPE | QTY REQUIRED |
|-----|--------------|------------------|-----------------------|-----------|--------------|
| 1   | 999-9999-001 | SPECIAL NOTES    | J30(CONT) 19-20 21-22 | I         | 1.0          |
| 1   | 999-9999-001 | SPECIAL NOTES    | J31=1-2               | I         | 1.0          |
| 1   | 999-9999-001 | SPECIAL NOTES    | J32=1-2               | I         | 1.0          |
| 1   | 999-9999-001 | SPECIAL NOTES    | J34=1-2               | I         | 1.0          |
| 1   | 999-9999-001 | SPECIAL NOTES    | J35=7-8 13-14 17-18   | I         | 1.0          |
| 1   | 999-9999-001 | SPECIAL NOTES    | J36=2-3               | I         | 1.0          |
| 1   | 999-9999-001 | SPECIAL NOTES    | J37=OPEN              | I         | 1.0          |
| 1   | 999-9999-001 | SPECIAL NOTES    | J38=3-4 5-6 7-9 8-10  | I         | 1.0          |
| 1   | 999-9999-001 | SPECIAL NOTES    | J39=3-4 5-6 7-9 8-10  | I         | 1.0          |
| 1   | 999-9999-001 | SPECIAL NOTES    | J40=1-2               | I         | 1.0          |

TOP ASSEMBLY TOTAL: LBC-586PLUS-133-C ARLIN - 59 Items

## REPORT RECAP

0 WARNING(S)

## PARAMETER RECAP

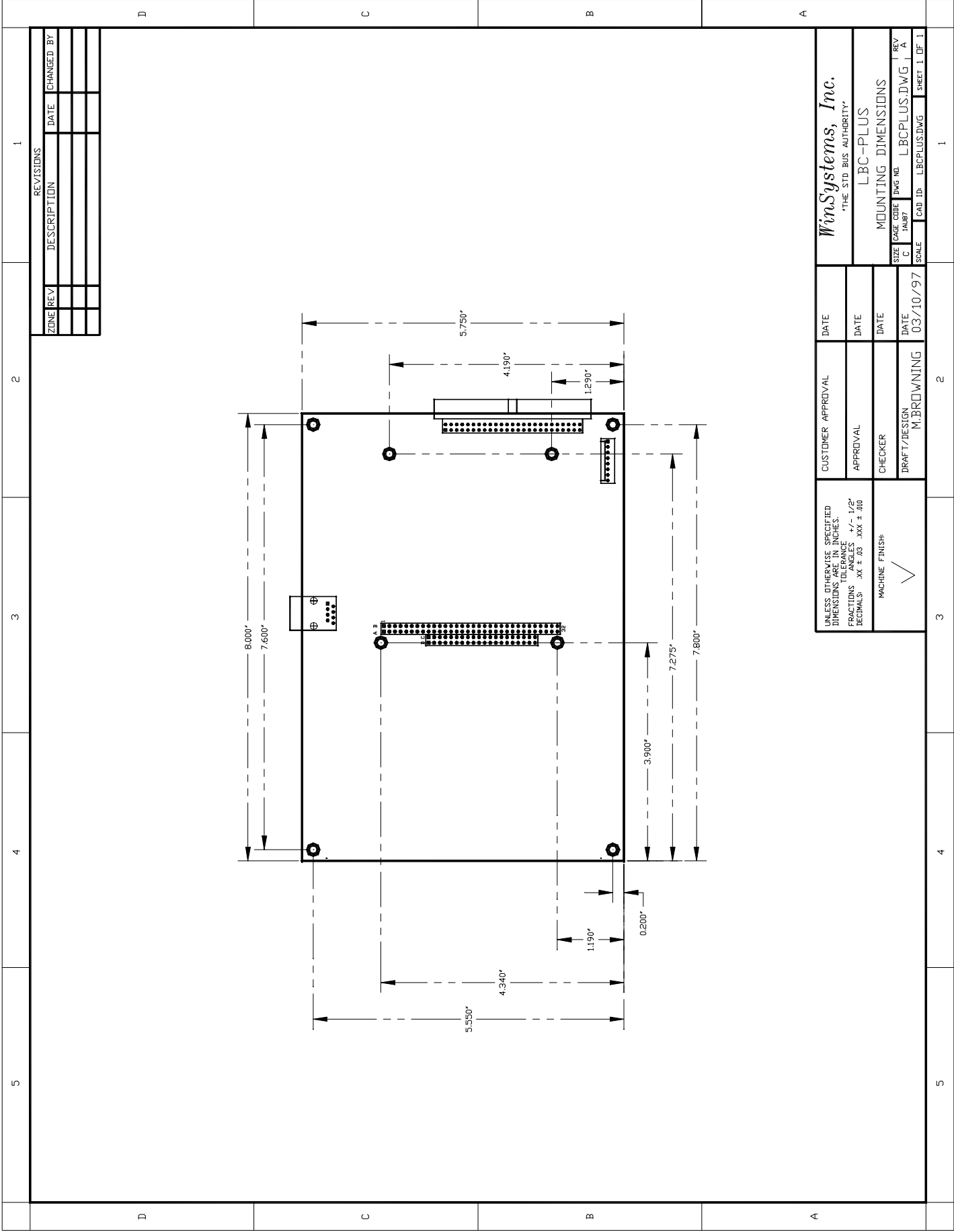
PARAMETER KEY : 10 BOM with Ref. Desc.  
REPORT TITLE : BOM for Manuals

|                     |                     |                        |                        |       |
|---------------------|---------------------|------------------------|------------------------|-------|
| ASSM ITEM RANGE     | : LBC-586PLUS-133-C | THRU LBC-586PLUS-133-C | COSTING METHOD         | : A   |
| PARENT LOC RANGE    | : <FIRST>           | THRU <LAST>            | QUANTITY TO EXPLODE    | : 1   |
| PRODUCT KEY RANGE   | : <FIRST>           | THRU <LAST>            | USE SCRAP FACTOR (Y/N) | : N   |
| COMMODITY KEY RANGE | : <FIRST>           | THRU <LAST>            | UPDATE INV STD COST    | : N   |
|                     |                     |                        | NO. LEVELS TO EXPLODE  | : 999 |
| DEFAULT COMP LOC    | : ARLIN             |                        | COLUMNS OF DESC TEXT   | : 42  |
| BOM STATUS PRIORITY | : A                 |                        | SHORT OR LONG (S/L)    | : S   |
|                     |                     |                        | PRINT ITEM DESC (Y/N)  | : Y   |

# **10 APPENDIX E**

LBC-Plus Mechanical Drawing

*WinSystems* - "The Embedded Systems Authority"



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# **11** **APPENDIX F**

WS16C48 I/O Routines and Sample program Listings

*WinSystems* - "The Embedded Systems Authority"

/\* UI048.H

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```
*/
/*****
*      Name      : uio48.h
*
*      Project   : PCM-UI048 Software Samples/Examples
*
*      Date      : October 30, 1996
*
*      Revision: 1.00
*
*      Author    : Steve Mottin
*
*****/
*
*      Changes :
*
*      Date          Revision Description
*      -----
*      10/30/96 1.00      Created
*
*****/
*/
```

```
#define RISING 1
#define FALLING 0
```

```
void init_io(unsigned io_address);
int read_bit(int bit_number);
void write_bit(int bit_number);
void set_bit(int bit_number);
void clr_bit(int bit_number);
void enab_int(int bit_number, int polarity);
void disab_int(int bit_number);
void clr_int(int bit_number);
int get_int(void);
```

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```
/* UI048.C
```

```
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```

```
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or damage, real or consequential resulting from the usage of this
source code. It is the user's sole responsibility to determine
fitness for any considered purpose.
```

```
*/
/*****
*      Name       : uio48.c
*
*      Project    : PCM-UI048 Software Samples/Examples
*
*      Date       : October 30, 1996
*
*      Revision: 1.00
*
*      Author     : Steve Mottin
*
*****/
*
*      Changes :
*
*      Date           Revision Description
*      -----
*      10/30/96 1.00      Created
*
*****/
*/
```

```
#include <dos.h>
```

```
/* This global holds the base address of the UI0 chip */
```

```
unsigned base_port;
```

```
/* This global array holds the image values of the last write to each I/O
ports. This allows bit manipulation routines to work without having to
actually do a read-modify-write to the I/O port.
*/
```

```
unsigned port_images[6];
```

```
/*=====
*                               INIT_IO
*
*      This function take a single argument :
*
*      io_address :   This is the base I/O address of the 16C48 UI0 Chip
*                      on the board.
*
*      This function initializes all I/O pins for input, disables all interrupt
*      sensing, and sets the image values.
*
*=====*/
```

```
void init_io(unsigned io_address)
```

```
{
int x;
```

```
    /* Save the specified address for later use */
```

```
    base_port = io_address;
```

```
    /* Clear all of the I/O ports. This also makes them inputs */
```

```
    for(x=0; x < 7; x++)
        outportb(base_port+x, 0);
```

```
    /* Clear our image values as well */
```

```
    for(x=0; x < 6; x++)
        port_images[x] = 0;
```

```
    /* Set page 2 access, for interrupt enables */
```

```
    outportb(base_port+7, 0x80);
```

```
    /* Clear all interrupt enables */
```

```
    outportb(base_port+8, 0);
    outportb(base_port+9, 0);
    outportb(base_port+0x0a, 0);
```

```
    /* Restore normal page 0 register access */
```

```
    outportb(base_port+7, 0);
```

```

}

/*=====
*
*                               READ_BIT
*
* This function takes a single argument :
*
* bit_number    : The integer argument specifies the bit number to read.
*                  Valid arguments are from 1 to 48.
*
* return value : The current state of the specified bit, 1 or 0.
*
* This function returns the state of the current I/O pin specified by
* the argument bit_number.
*=====*/

int read_bit(int bit_number)
{
    unsigned port;
    int val;

    /* Adjust the bit_number to 0 to 47 numbering */
    --bit_number;

    /* Calculate the I/O port address based on the updated bit_number */
    port = (bit_number / 8) + base_port;

    /* Get the current contents of the port */
    val = inportb(port);

    /* Get just the bit we specified */
    val = val & (1 << (bit_number % 8));

    /* Adjust the return for a 0 or 1 value */
    if(val)
        return 1;

    return 0;
}

/*=====
*
*                               WRITE_BIT
*
* This function takes two arguments :
*
* bit_number : The I/O pin to access is specified by bit_number 1 to 48.
*
* val : The setting for the specified bit, either 1 or 0.
*
* This function sets the specified I/O pin to either high or low as dictated
* by the val argument. A non zero value for val sets the bit.
*=====*/

void write_bit(int bit_number, int val)
{
    unsigned port;
    unsigned temp;
    unsigned mask;

    /* Adjust bit_number for 0 based numbering */
    --bit_number;

    /* Calculate the I/O address of the port based on the bit number */
    port = (bit_number / 8) + base_port;

    /* Use the image value to avoid having to read the port first. */
    temp = port_images[bit_number / 8]; /* Get current value */

    /* Calculate a bit mask for the specified bit */
    mask = (1 << (bit_number % 8));

    /* Check whether the request was to set or clear and mask accordingly */
    if(val) /* If the bit is to be set */
        temp = temp | mask;
    else
        temp = temp & ~mask;

    /* Update the image value with the value we're about to write */
    port_images[bit_number / 8] = temp;

```

```

        /* Now actually update the port. Only the specified bit is affected */
        outportb(port,temp);
    }

    /*=====
    *
    *                               SET_BIT
    *
    * This function takes a single argument :
    * bit_number : The bit number to set.
    * This function sets the specified bit.
    *=====*/

void set_bit(int bit_number)
{
    write_bit(bit_number,1);
}

    /*=====
    *
    *                               CLR_BIT
    *
    * This function takes a single argument :
    * bit_number : The bit number to clear.
    * This function clears the specified bit.
    *=====*/

void clr_bit(int bit_number)
{
    write_bit(bit_number,0);
}

    /*=====
    *
    *                               ENAB_INT
    *
    * This function takes two arguments :
    * bit_number : The bit number to enable interrupts for. Range from 1 to 48.
    * polarity : This specifies the polarity of the interrupt. A non-zero
    * argument enables rising-edge interrupt. A zero argument
    * enables the interrupt on the falling edge.
    * This function enables within the 16C48 an interrupt for the specified bit
    * at the specified polarity. This function does not setup the interrupt
    * controller, nor does it supply an interrupt handler.
    *=====*/

void enab_int(int bit_number, int polarity)
{
    unsigned port;
    unsigned temp;
    unsigned mask;

    /* Adjust for 0 based numbering */
    --bit_number;

    /* Calculate the I/O address based upon the bit number */
    port = (bit_number / 8) + base_port + 8;

    /* Calculate a bit mask based on the specified bit number */
    mask = (1 << (bit_number % 8));

    /* Turn on page 2 access */
    outportb(base_port+7,0x80);

    /* Get the current state of the interrupt enable register */
    temp = inportb(port);

    /* Set the enable bit for our bit number */
    temp = temp | mask;

    /* Now update the interrupt enable register */
    outportb(port,temp);

    /* Turn on access to page 1 for polarity control */
    outportb(base_port+7,0x40);

    /* Get the current state of the polarity register */

```

```

        temp = inportb(port);                /* Get current polarity settings */
/* Set the polarity according to the argument in the image value */
if(polarity)                                /* If the bit is to be set */
    temp = temp | mask;
else
    temp = temp & ~mask;

/* Write out the new polarity value */
outportb(port,temp);

/* Set access back to Page 0 */
outportb(base_port+7,0x0);
}

/*=====
*
*                               DISAB_INT
*
* This function takes a single argument :
*
* bit_number : Specifies the bit number to act upon. Range is from 1 to 48.
*
* This function shuts off the interrupt enabled for the specified bit.
*=====*/

void disab_int(int bit_number)
{
    unsigned port;
    unsigned temp;
    unsigned mask;

    /* Adjust the bit_number for 0 based numbering */
    --bit_number;

    /* Calculate the I/O Address for the enable port */
    port = (bit_number / 8) + base_port + 8;

    /* Calculate the proper bit mask for this bit number */
    mask = (1 << (bit_number % 8));

    /* Turn on access to page 2 registers */
    outportb(base_port+7,0x80);

    /* Get the current state of the enable register */
    temp = inportb(port);

    /* Clear the enable bit int the image for our bit number */
    temp = temp & ~mask;

    /* Update the enable register with the new information */
    outportb(port,temp);

    /* Set access back to page 0 */
    outportb(base_port+7,0x0);
}

/*=====
*
*                               CLR_INT
*
* This function takes a single argument :
*
* bit_number : This argument specifies the bit interrupt to clear. Range
*              is 1 to 24.
*
* This function is use to clear a bit interrupt once it has been recognized.
* The interrupt left enabled.
*=====*/

void clr_int(int bit_number)
{
    unsigned port;
    unsigned temp;
    unsigned mask;

    /* Adjust for 0 based numbering */
    --bit_number;

```

```

/* Calculate the correct I/O address for our enable register */
port = (bit_number / 8) + base_port + 8;
/* Calculate a bit mask for this bit number */
mask = (1 << (bit_number % 8));
/* Set access to page 2 for the enable register */
outportb(base_port+7,0x80);
/* Get current state of the enable register */
temp = inportb(port);
/* Temporarily clear only OUR enable. This clears the interrupt */
temp = temp & ~mask;          /* clear the enable for this bit */
/* Write out the temporary value */
outportb(port,temp);
/* Re-enable our interrupt bit */
temp = temp | mask;
/* Write it out */
outportb(port,temp);
/* Set access back to page 0 */
outportb(base_port+7,0x0);
}

/*=====
*
*                               GET_INT
*
* This function take no arguments.
*
* return value : The value returned is the highest level bit interrupt
*                currently pending. Range is 1 to 24.
*
* This function returns the highest level interrupt pending. If no interrupt
* is pending, a zero is returned. This function does NOT clear the interrupt.
*=====*/

int get_int(void)
{
int temp;
int x;

/* read the master interrupt pending register, mask off undefined bits */
temp = inportb(base_port+6) & 0x07;

/* If there are no interrupts pending, return a 0 */
if((temp & 7) == 0)
    return(0);

/* There is something pending, now we need to identify what it is */

/* Set access to page 3 for interrupt id registers */
outportb(base_port+7,0xc0);
/* Read interrupt ID register for port 0 */
temp = inportb(base_port+8);

/* See if any bit set, if so return the bit number */
if(temp !=0)
{
    for(x=0; x <=7; x++)
    {
        if(temp & (1 << x))
        {
            outportb(base_port+7,0); /* Turn off access */
            return(x+1);             /* Return bitnumber with active int */
        }
    }
}

/* None in Port 0, read port 1 interrupt ID register */
temp = inportb(base_port+9);

/* See if any bit set, if so return the bit number */

```

```

if(temp !=0)
{
    for(x=0; x <=7; x++)
    {
        if(temp & (1 << x))
        {
            outportb(base_port+7,0); /* Turn off access */
            return(x+9); /* Return bitnumber with active int */
        }
    }
}

/* Lastly, read status of port 2 int id */
temp = inportb(base_port+0x0a); /* Read port 2 status */

/* If any pending, return the appropriate bit number */
if(temp !=0)
{
    for(x=0; x <=7; x++)
    {
        if(temp & (1 << x))
        {
            outportb(base_port+7,0); /* Turn off access */
            return(x+17); /* Return bitnumber with active int */
        }
    }
}

/* We should never get here unless the hardware is misbehaving but just
   to be sure. We'll turn the page access back to 0 and return a 0 for
   no interrupt found.
*/

outportb(base_port+7,0);
return 0;
}

```

```
/* FLASH.C
```

```
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```

```
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fitness for any considered purpose.
```

```
*/
```

```
#include <stdio.h>
#include <conio.h>
#include <dos.h>
#include "uio48.h"
```

```
/* This is where we have our board jumpered to */
```

```
#define BASE_PORT 0x200
```

```
/* This is an ultra-simple demonstration program of some of the functions
available in the UIO48 source code library. This program simply sets and
clears each I/O line in succession. It was tested by hooking LEDs to all
of the I/O lines and watching the lit one race through the bits.
```

```
*/
```

```
void main()
{
    int x;
```

```
    /* Initialize all I/O bits, and set then for input */
```

```
    init_io(BASE_PORT);
```

```
    /* We'll repeat our sequencing until a key is pressed */
```

```
    while(!kbhit())
```

```
    {
```

```
        /* We will light the LED attached to each of the 48 lines */
        for(x=1; x <=48; x++)
```

```
        {
```

```
            /* Setting the bit lights the LED */
```

```
            set_bit(x);
```

```
            /* The wait time is subjective. We liked 100ms */
```

```
            delay(100);
```

```
            /* Now turn off the LED */
```

```
            clr_bit(x);
```

```
        }
```

```
    }
```

```
    getch();
```

```
}
```

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```
/* POLL.C
```

```
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```

```
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```

```
*/
```

```
#include <stdio.h>
#include <conio.h>
#include "uio48.h"
```

```
#define BASE_PORT 0x200
```

```
/* This program uses the edge detection interrupt capability of the
WS16C48 to count transitions on the first 24 lines. It does this
however, no by using true interrupts but by polling for transitions
using the get_int() function.
```

```
*/
```

```
/* Our transition totals are stored in this array */
```

```
unsigned int_counts[25];
```

```
/* Definitions for local functions */
```

```
void check_ints(void);
```

```
void main()
{
    int x;
```

```
    /* Initialize the I/O ports. Set all I/O pins to input */
```

```
    init_io(BASE_PORT);
```

```
    /* Initialize our transition counts, and enable falling edge
    transition interrupts.
```

```
*/
```

```
    for(x=1; x<25; x++)
```

```
    {
        int_counts[x] = 0;          /* Clear the counts */
        enab_int(x,FALLING);        /* Enable the falling edge interrupts */
```

```
    }
```

```
    /* Clean up the screen for our display. Nothing fancy */
```

```
    clrscr();
```

```
    for(x=1; x<25; x++)
```

```
    {
        gotoxy(1,x);
        printf("Bit number %02d ",x);
```

```
    }
```

```
    /* We will continue to display until any key is pressed */
```

```
    while(!kbhit())
    {
```

```
        /* Retrieve any pending transitions and update the counts */
```

```
        check_ints();
```

```
        /* Display the current count values */
```

```
        for(x=1; x < 25; x++)
```

```
        {
            gotoxy(16,x);
            printf("%05u",int_counts[x]);
```

```
        }
```

```
    }
    getch();
```

```
}
```

```
void check_ints()
```

```
{
    int current;
```

```
/* Get the bit number of a pending transition interrupt */
current = get_int();

/* If it's 0 there are none pending */
if(current == 0)
    return;

/* Clear and rearm this one so we can get it again */
clr_int(current);

/* Tally a transition for this bit */
++int_counts[current];
}
```

```
/* INTS.C
```

```
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```

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fitness for any considered purpose.
```

```
*/
```

```
#include <stdio.h>
#include <dos.h>
#include <conio.h>
#include "uio48.h"
```

```
#define BASE_PORT 0x200
```

```
/* This program like the poll.c sample uses the edge detection interrupt
capability of the WS16C48 to count edge transitions. Unlike poll.c,
however this program actually uses interrupts and update all of the
transition counters in the background.
```

```
*/
```

```
/* Our transition totals are stored in this global array */
```

```
unsigned int_counts[25];
```

```
/* Function declarations for local functions */
```

```
void check_ints(void);
void interrupt int_handler(void);
void interrupt (*old_handler)(void);
```

```
void main()
{
    int x;
```

```
    /* Initialize the I/O ports. Set all I/O pins to input */
```

```
    init_io(BASE_PORT);
```

```
    /* Install an interrupt handler for the board */
```

```
    /* We disable interrupts whenever we're changing the environment */
```

```
    disable();          /* Disable interrupts during initialization */
```

```
    /* Get the old handler and save it for later resoration */
```

```
    old_handler = getvect(0x0d);      /* Hardwired for IRQ5 */
```

```
    /* Install out new interrupt handler */
```

```
    setvect(0x0d,int_handler);
```

```
    /* Clear the transition count values and enable the falling edge
    interrupts.
```

```
*/
```

```
    for(x=1; x<25; x++)
```

```
    {
        int_counts[x] = 0;          /* Clear the counts */
        enab_int(x,FALLING);        /* Enable the falling edge interrupts */
    }
```

```
    /* Unmask the interrupt controller */
```

```
    outportb(0x21,(inportb(0x21) & 0xdf));    /* Unmask IRQ 5 */
```

```
    /* Reenable interrupts */
    enable();
```

```
    /* Set up the display */
```

```
    clrscr();          /* Clear the Text Screen */
```

```
    for(x=1; x<25; x++)
```

```
    {
        gotoxy(1,x);
        printf("Bit Number %02d ",x);
    }
```

```
    /* We will continuously print the transition totals until a
```

```

    key is pressed */

/* All of the processing of the transition interrupts, including
   updating the counts is done in the background when an interrupt
   occurs.
*/

while(!kbhit())
{
    for(x=1; x < 25; x++)
    {
        gotoxy(16,x);
        printf("%05u",int_counts[x]);
    }
}

getch();

/* Disable interrupts while we restore things */
disable();

/* Mask off the interrupt at the interrupt controller */
outportb(0x21,inportb(0x21) | 0x20);      /* Mask IRQ 5 */

/* Restore the old handler */
setvect(0x0d,old_handler); /* Put back the old interrupt handler */

/* Reenable interrupts. Things are back they way they were before we
   started.
*/
enable();
}

/* This function is executed when an edge detection interrupt occurs */
void interrupt int_handler(void)
{
    int current;

    /* Get the current interrupt pending. There really should be one
       here or we shouldn't even be executing this function.
    */
    current = get_int();

    /* We will continue processing pending edge detect interrupts until
       there are no more present. In which case current == 0
    */
    while(current)
    {
        /* Clear the current one so that it's ready for the next edge */
        clr_int(current);

        /* Tally up one for the current bit number */
        ++int_counts[current];

        /* Get the next one, if any others pending */
        current = get_int();
    }

    /* Issue a non-specific end of interrupt command (EOI) to the
       interrupt controller. This rearms it for the next shot.
    */
    outportb(0x20,0x20);      /* Do non-specific EOI */
}

```