O C T A G O N S Y S T E M S

Embedded PCs For Extreme Environments

6000 Series User's Manual

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IMPORTANT!

Please read the following section before installing your product:

Octagon's products are designed to be high in performance while consuming very little power. In order to maintain this advantage, CMOS circuitry is used.

CMOS chips have specific needs and some special requirements that the user must be aware of. Read the following to help avoid damage to your card from the use of CMOS chips.

Using CMOS circuitry in industrial control

Industrial computers originally used LSTTL circuits. Because many PC components are used in laptop computers, IC manufacturers are exclusively using CMOS technology. Both TTL and CMOS have failure mechanisms, but they are different. Described below are some of the failures which are common to all manufacturers of CMOS equipment. However, much of the information has been put in the context of the Micro PC.

Octagon has developed a reliable database of customer-induced, field failures. The average MTBF of Micro PC cards exceeds 11 years, yet there are failures. Most failures have been identified as customer-induced, but there is a small percentage that cannot be identified. As expected, virtually all the failures occur when bringing up the first system. On subsequent systems, the failure rate drops dramatically.

- Approximately 20% of the returned cards are problem-free. These cards, typically, have the wrong jumper settings or the customer has problems with the software. This causes frustration for the customer and incurs a testing charge from Octagon.
- Of the remaining 80% of the cards, 90% of these cards fail due to customer misuse and accident. Customers often cannot pinpoint the cause of the misuse.
- Therefore, 72% of the returned cards are damaged through some type of misuse. Of the remaining 8%, Octagon is unable to determine the cause of the failure and repairs these cards at no charge if they are under warranty.

The most common failures on CPU cards are over voltage of the power supply, static discharge, and damage to the serial and parallel ports. On expansion cards, the most common failures are static discharge, over voltage of inputs, over current of outputs, and misuse of the CMOS circuitry with regards to power supply sequencing. In the case of the video cards, the most common failure is to miswire the card to the flat panel display. Miswiring can damage both the card and an expensive display.

- **Multiple component failures** - The chance of a random component failure is very rare since the average MTBF of an Octagon card is greater than 11 years. In a 7 year study, Octagon has never found a single case where multiple IC failures were not caused by misuse or accident. It is very probable that multiple component failures indicate that they were user-induced.

- **Testing "dead" cards** - For a card that is "completely nonfunctional", there is a simple test to determine accidental over voltage, reverse voltage or other "forced" current situations. Unplug the card from the bus and remove all cables. Using an ordinary digital ohmmeter on the 2,000 ohm scale, measure the resistance between power and ground. Record this number. Reverse the ohmmeter leads and measure the resistance again. If the ratio of the resistances is 2:1 or greater, fault conditions most likely have occurred. A common cause is miswiring the power supply.

- **Improper power causes catastrophic failure** - If a card has had reverse polarity or high voltage applied, replacing a failed component is not an adequate fix. Other components probably have been partially damaged or a failure mechanism has been induced. Therefore, a failure will probably occur in the future. For such cards, Octagon highly recommends that these cards be replaced.

- **Other over-voltage symptoms** - In over-voltage situations, the programmable logic devices, EPROMs and CPU chips, usually fail in this order. The failed device may be hot to the touch. It is usually the case that only one IC will be overheated at a time.

- **Power sequencing** - The major failure of I/O chips is caused by the external application of input voltage while the Micro PC power is off. If you apply 5V to the input of a TTL chip with the power off, nothing will happen. Applying a 5V input to a CMOS card will cause the current to flow through the input and out the 5V power pin. This current attempts to power up the card. Most inputs are rated at 25 mA maximum. When this is exceeded, the chip may be damaged.

- **Failure on powerup** - Even when there is not enough current to destroy an input described above, the chip may be destroyed when the power to the card is applied. This is due to the fact that the input current biases the IC so that it acts as a forward biased diode on powerup. This type of failure is typical on serial interface chips.

- **Hot insertion** - Plugging cards into the card cage with the power on will usually not cause a problem. (**Octagon urges that you do not do this!**) However, the card may be damaged if the right sequence of pins contacts as the card is pushed into the socket. This usually damages bus driver chips and they may become hot when the power is applied. This is one of the most common failures of expansion cards.
- **Terminated backplanes** - Some customers try to use Micro PC cards in backplanes that have resistor/capacitor termination networks. CMOS cards cannot be used with termination networks. Generally, the cards will function erratically or the bus drivers may fail due to excessive output currents.
- **Excessive signal lead lengths** - Another source of failure that was identified years ago at Octagon was excessive lead lengths on digital inputs. Long leads act as an antenna to pick up noise. They can also act as unterminated transmission lines. When 5V is switch onto a line, it creates a transient waveform. Octagon has seen submicrosecond pulses of 8V or more. The solution is to place a capacitor, for example 0.1 µF, across the switch contact. This will also eliminate radio frequency and other high frequency pickup.

≡ Avoiding damage to the heatsink/CPU

WARNING!

When handling any Octagon CPU card, extreme care must be taken not to strike the heatsink against another object, such as a table edge. Also, be careful not to drop the CPU card, since this may cause damage to the heatsink/CPU as well.

Epoxy adhesive bonds the heatsink to the CPU chip. When the heatsink is struck, the epoxy adhesive does not allow the heatsink to separate from the chip. The force of the blow to the heatsink then causes the legs of the CPU chip to separate from the PCB. This force damages both the CPU chip and the PCB.

Note Any physical damage to the CPU control card is **not** covered under warranty.

About this manual

The *6000 Series user's manual* provides information about installing and configuring your model in the 6000 Series of PC Microcontrollers. This manual is divided into four sections:

- Section 1 – Installation

  Chapter 1: Overview
  Chapter 2: Quick start
  Chapter 3: Setup programs
  Chapter 4: Save and run programs

- Section 2 – Hardware

  Chapter 5: Serial ports
  Chapter 6: EZ I/O
  Chapter 7: AUX I/O
  Chapter 8: Analog I/O
  Chapter 9: SSDs, DRAM, and battery backup
  Chapter 10: External drives
  Chapter 11: Video
  Chapter 12: IRQ routing and opto IRQs
  Chapter 13: LED signaling and "beep" codes
  Chapter 14: PC/104 expansion
  Chapter 15: Counter timer controller

- Section 3 – System management

  Chapter 16: Watchdog timer, reset, and remote reset
  Chapter 17: Serial EEPROM
  Chapter 18: CPU power management
  Chapter 19: Using PICO FA
  Chapter 20: CAMBASIC
  Chapter 21: Software utilities
  Chapter 22: Troubleshooting

- Section 4 – Appendices

  Appendix A: 6010 technical data
  Appendix B: 6020 technical data
  Appendix C: 6030 technical data
  Appendix D: 6040 technical data
  Appendix E: 6050 technical data
  Appendix F: Miscellaneous
  Appendix G: Accessories

Chapter 1: Overview

≡ Introduction

The Octagon 6000 Series PC Microcontroller™ cards are intended for easy usage and high performance in embedded control applications.

The PC Microcontroller cards combine the best features of the PC architecture and microcontroller I/O. Bringing PC software to the microcontroller world eliminates the need to maintain development systems for the different microcontroller chips. The Octagon PC Microcontrollers operate in severe environments, providing an extra margin of reliability in any application. Although ROM-DOS™ 6.22 is included, you can download other operation systems into the flash drive. If you prefer operating in a high-level language, CAMBASIC has been built-in as a fast, easy-to-use, industrial control language.

Common features across the PC Microcontroller product line include:

- Suite of embedded software
  - — Datalight ROM-DOS™ 6.22 in ROM
  - — Phoenix PICO FA™ flash file system
  - — CAMBASIC™ multitasking language
  - — RS-422/485 networking software–up to 32 nodes
  - — Phoenix BIOS™ with industrial BIOS extensions
  - — Driver library
  - — Diagnostic software
- 40 MHz 386SX processor
- 2/4 MB of on-card DRAM
- Two solid-state disks
  - — 1 MB flash SSD with an integral programmer
  - — 128 KB SRAM SSD with battery backup
- Two serial ports with 8 KV ESD protection
- Multifunctional parallel port
- Keyboard and speaker ports
- Watchdog timer
- Real time calendar/clock
- Two opto-isolated interrupt inputs
- System status LEDs
- Stand alone or ISA bus expansion
- -40° to 85°C when operating at 25 MHz
  0° to 60° C when operating at 40 MHz
- 10g shock, 2g vibration

- 5V operation
- Low power mode
- Over voltage/reverse voltage protection

Unique features of each PC Microcontroller are listed in the following table.

Table 1-1 Features of the PC Microcontrollers

Features	6010	6020	6030	6040	6050
COM ports	2	2	4	2	2
COM3 and COM4	—	—	RS-232 industrial	—	—
RS-232 to RS-422/485 option	NO	YES	YES	YES	YES
EZ I/O digital lines	—	48	—	24	24
LPT port	1	1	1	1	1
Total digital lines—includes parallel port	17	65	17	41	41
High current drivers	—	—	—	—	8
Analog inputs	—	—	—	8	—
Analog outputs	—	—	—	2	—
PC/104 interface	YES	NO	NO	NO	NO
EIDE port	YES	NO	NO	NO	NO
Floppy port	YES	NO	NO	NO	NO
Counter timer controller	NO	YES	NO	NO	NO

≡ Major features

Suite of embedded software included in SSD0 flash drive

- Phoenix BIOS and Octagon industrial extensions. The BIOS is shadowed for fast operation.
- "Instant DOS" system. Datalight ROM-DOS 6.22 loads to high memory on powerup allowing more lower memory for data storage and applications programs.

- PICO FA flash file system makes flash memory appear as a hard disk to the PC Microcontroller.
- CAMBASIC, industrial control language includes drivers for all on-card hardware.
- The network kernel allows up to 32 systems to be linked into an RS-422/485 network.
- The utility library includes application examples in C and CAMBASIC.
- Diagnostic software is included to test the system on powerup.

CAMBASIC

CAMBASIC supports all on-card I/O including digital, analog, timing, interrupts, communications, and other functions. Thus, CAMBASIC eliminates the need to write hardware drivers. You spend your time writing the applications software rather than writing and debugging drivers.

Diagnostic software verifies system integrity automatically

The PC Microcontroller has built-in diagnostic software that can be used to verify on-card I/O and memory functions. On powerup, a series of tests is performed. If a problem occurs, the failed test can be identified by the color sequence on a bicolored LED. The test is performed automatically every time the system is reset or powered up. No monitor, keyboard, disks, test fixtures, test equipment, or software is required. See the *LED signaling and "beep" codes* chapter for a complete listing of system tests.

DRAM memory is fast and rugged

The PC Microcontroller has surface-mounted, fast page mode DRAM installed. The surface mounting is far more rugged than plug-in memory.

Solid-state disks withstand shock and vibration

SSD0 is a 1 MB flash memory disk containing the software suite in less than 512 KB, leaving more than 512 KB available for user programs. The flash memory is seen by software as a hard disk. The use of the flash allows easy installation of software updates.

SSD2 is an SRAM with 128 KB capacity for data storage. SSD2 is battery-backed with an on-board battery.

Boot sequence

A PC Microcontroller can be configured to boot from the on-card solid-state disk, an external floppy disk, or hard disk.

Serial ports protected against ESD

The COM1 and COM2 serial ports are 16C550 compatible. The 16 byte FIFO buffers minimize processor overhead in high speed serial communications. Baud rates are programmable from 150 to 115 KB baud. Both ports have an RS-232 interface with the RS-232 voltages generated on-card. The serial ports meet the new IEC1000, level 3, ESD protection specification with ±8 KV of ESD protection. Backdrive protection is also included.

CAMBASIC supports the serial ports with interrupt driven, 2 KB input and output buffers which operate in the background. This ensures that data is not lost while critical control loops are being executed.

Note The network interface module is not compatible with the 6010 model.

Convenient I/O termination with the breakout board (BOB)

Except for the serial and industrial I/O lines, all other I/O is terminated with a 34-pin IDC connector, also called the AUX I/O. The AUX I/O port eliminates cable clutter and the possibility of cables being plugged into the wrong sockets during maintenance. The breakout board terminates each function at the appropriate connector. These functions include the keyboard, speaker, printer, floppy drive, battery, and opto-isolated interrupts.

Speaker and keyboard

The PC Microcontroller accepts a PS-2 style AT keyboard and provides speaker output through the breakout board (BOB).

Parallel port is multifunctional

The multifunctional parallel port can be used as a printer port or general purpose I/O. The parallel port can also interface with a floppy disk drive, drive alphanumeric displays and matrix keypads, or drive high current AC and DC loads using an opto rack and opto modules.

The multifunctional parallel port applications include:

- LPT1 for PC compatible printers
- 17 general purpose digital I/O lines
- 4 x 4 matrix keypad
- 4 line alphanumeric display

- MPB-16PC, 16 position opto-module rack
- Floppy disk drive

The printer port is IEEE 1284A compliant, unidirectional and bidirectional, EPP (enhanced parallel port) mode, and ECP (extended capabilities port) mode compatible. The printer port features backdrive protection and allows for much higher speed transfers than Octagon's previous standard printer interface. The data lines can sink up to 24 mA. The printer port signals are routed through the PC Microcontroller's AUX I/O port when using the breakout board.

Keypad and LCD/VF display support for low cost operator interface

For embedded applications, a keypad and display (KAD) board and software are available to interface with an alphanumeric display and matrix keypad. The parallel port on the KAD can interface with a 16-key matrix keypad and a 2 or 4 line LCD or vacuum florescent display in applications where an inexpensive operator interface is needed. The microcontroller cards are supplied with the software which provides keypad scanning and display operation. The keypad and display board has sockets for the display and keypad. DISPLAY and KEYPAD commands in CAMBASIC and drivers in C support these devices.

Industrial I/O is EZ I/O

Several PC Microcontrollers feature the Octagon EZ I/O digital I/O chip. EZ I/O supplies 24 I/O lines which can be individually programmed as 5V input or 5V output. Each line can sink or source 15 mA. The 24 I/O lines are divided into three groups of 8 with 10 K resistors that can be connected to ground or +5V. The EZ I/O port can drive the MPB series opto-isolation module racks directly, controlling input and loads to 240V and 3A. CAMBASIC has several commands to support the EZ I/O port when working on bit, BCD, byte, or word bases.

High current outputs

Model 6050 dedicates 8 lines as high current outputs, capable of driving 100 mA loads rated up to 50V.

External interrupt and reset are optically isolated for safety

One opto-isolated input causes a master reset; and the other causes the system to generate an IRQ9. Both inputs accept voltages from 4.5 to 6 VDC. This could be used for an emergency stop, power failure, system synchronization, or a similar function. Drivers are provided in CAMBASIC and C.

Interrupts used to the maximum

Real time operation often requires many interrupts for high speed response to events. Five of the AT interrupts are connected to the ISA bus in addition to the four interrupts used on the card This provides the best use of the interrupts for demanding applications.

System expansion is flexible

The PC Microcontroller can expand via an 8-bit ISA unterminated backplane with the Octagon 5000 Series expansion cards.

Mounting

There are several ways to mount a PC Microcontroller:

- Plug it directly into an Octagon Micro PC card cage. Power is supplied through the backplane.
- Use the optional PC mounting bracket and plug it into any passive ISA backplane. Power is supplied through the backplane.
- Panel mount it using the four mounting holes for stand alone operation. A two position terminal connector is used to supply the 5V power.
- Stack it with other Micro PC cards. An Octagon two card stacking kit or a flexible backplane using 3M connectors and ribbon cable can be used to stack several cards together.

Hardware reset

A hardware reset can be done by any of the following means:

- Issuing the RESET software command, using the watchdog function
- Depressing the reset switch
- Cycling power
- Input from an optically-isolated reset.

A hardware reset ensures complete reset of the system and all attached peripherals. An expired watchdog timer cycle also causes a hardware reset to occur.

Watchdog timer for added safety

The watchdog timer resets the system if the program stops unexpectedly. The watchdog is enabled, disabled, and strobed under software control. The time-out is 1.6 seconds (typical).

SETUP information stored in EEPROM for high reliability

The loss of SETUP data is serious in industrial applications. In the PC Microcontroller, SETUP data is stored in nonvolatile serial EEPROM eliminating the problem with battery or power failure (with the exception of time and date). 512 bytes of the serial EEPROM are reserved by the BIOS. An additional 1536 bytes are available to the user. A software driver is supplied for accessing the EEPROM.

Real time calendar/clock with battery backup

The PC Microcontroller has a built-in AT style, real time clock. An on-card battery powers the calendar/clock when the 5 volt supply is removed. The clock may be read either through DOS or CAMBASIC. The calendar/clock also provides the user with 128 bytes of user-defined CMOS-RAM.

Power management reduces power by more than 70%

Power management can be used to reduce power consumption or to freeze the state of the program on the occurrence of a power management interrupt. Power consumption can be reduced by more than 70%, reducing the heat load and extending battery life in mobile applications.

Rugged environmental operation

The CPU case temperature may range from -40° to 85°C during operation at 25 MHz, or 0° to 60° C during operation at 40 MHz. The PC Microcontroller is designed to withstand 10g shock and 2g vibration.

5 volt only operation lowers system cost

The PC Microcontroller operates from a single 5V ± 4% supply. Located across the power supply, the 6.2V, 5W diode protects against reverse voltage and limits over voltage. Power is supplied to the card either through the ISA bus connector or the terminal block.

≡ Reference designators

Before you continue with the installation of your PC Microcontroller, review the following tables for a list of connectors and jumper blocks for the functions on your particular model in the 6000 Series of PC Microcontrollers.

Table 1-2 6000 Series connectors

Reference designator	6010	6020	6030	6040	6050
COM1	J3	J3	J3	J3	J3
COM2	J4	J4	J4	J4	J4
COM3	—	—	J1	—	—
COM4	—	—	J7	—	—
AUX I/O	J2	J2	J2	J2	J2
Power	J5	J5	J5	J5	J5
Battery	J6	J6	J6	J6	J6
Analog I/O	—	—	—	J7	—
USESETUP	W1	W1	W1	W1	W1
EZ I/O 1	—	J1/W3	—	J1/W2/W4	J1/W2
EZ I/O 2	—	J7/W3	—	—	—
D/A	—	—	—	W3	—
I/O range select A/ BIOS device	W2	W2	W2	W2	W2
PC/104	J1	—	—	—	—
Floppy	J8	—	—	—	—
Hard drive	J7	—	—	—	—

Chapter 2: Quick start

This chapter covers the basics of setting up a PC Microcontroller system. The following topics are discussed:

- Panel mounting, stacking, or installing the PC Microcontroller into an Octagon card cage
- Setting up a serial communications console I/O link between the PC Microcontroller and your desktop PC
- Downloading files to the PC Microcontroller and running a program from the virtual drive.

WARNING!

The PC Microcontroller may not be installed in a PC. These cards are designed to be independent CPU cards only, not accelerators or coprocessors.

≡ Hardware installation

WARNING!

The PC Microcontroller card contains static-sensitive CMOS components. The card is most susceptible to damage when it is plugged into a card cage. The PC Microcontroller becomes charged by the user, and the static discharges to the backplane from the pin closest to the card connector. If that pin happens to be an input pin, even TTL inputs may be damaged. To avoid damaging your card and its components:

- **Ground yourself before handling the card**
- **Disconnect power before removing or inserting the card.**

WARNING!

Take care to correctly position the PC Microcontroller in the card cage. The VCC and ground signals must match those on the backplane. Figure 2-1 shows the relative positions of the PC Microcontroller as it is installed in the card cage.

Your PC Microcontroller can be installed in one of several ways:

- Plugging it directly into an 8-bit Micro PC card cage
- Using the optional PC mounting bracket and plugging it into any 8-bit passive ISA backplane
- Panel mounting it using the four mounting holes
- Stacking it with other Micro PC cards.

Note The product-specific appendices provide component diagrams for the PC Microcontrollers in the 6000 Series. Refer to them as needed.

Using a Micro PC card cage

To install the PC Microcontroller in a Micro PC card cage, you will need the following equipment (or equivalent):

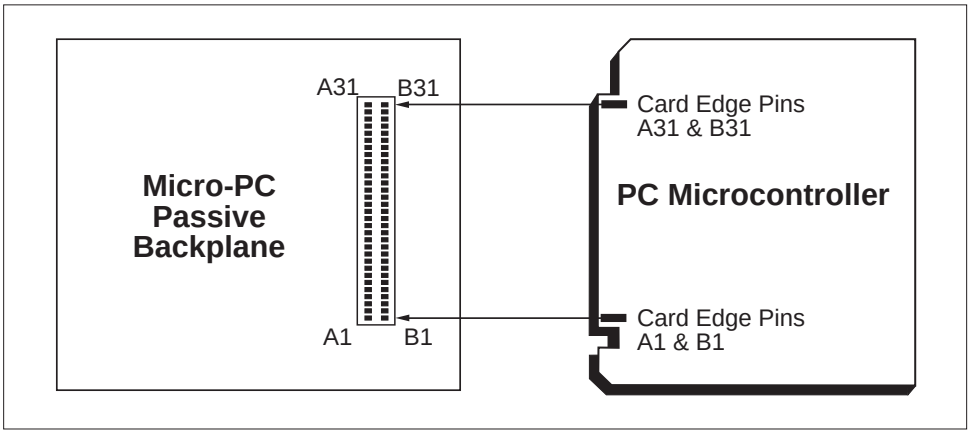
- PC Microcontroller
- Micro PC card cage (5xxx Card Cage)
- Power module (510x or 71xx Power Module)
- VTC-9F Cable
- Null modem adapter
- PC Microcontroller ROM-DOS and utility disk
- PC SmartLINK with manual
- Your PC

Refer to the *Miscellaneous* appendix if you are making your own serial cable or using other non-Octagon components.

To install the PC Microcontroller:

1. Refer to the component diagram in the appropriate product-specific appendix for the location of various connectors before installing the PC Microcontroller.

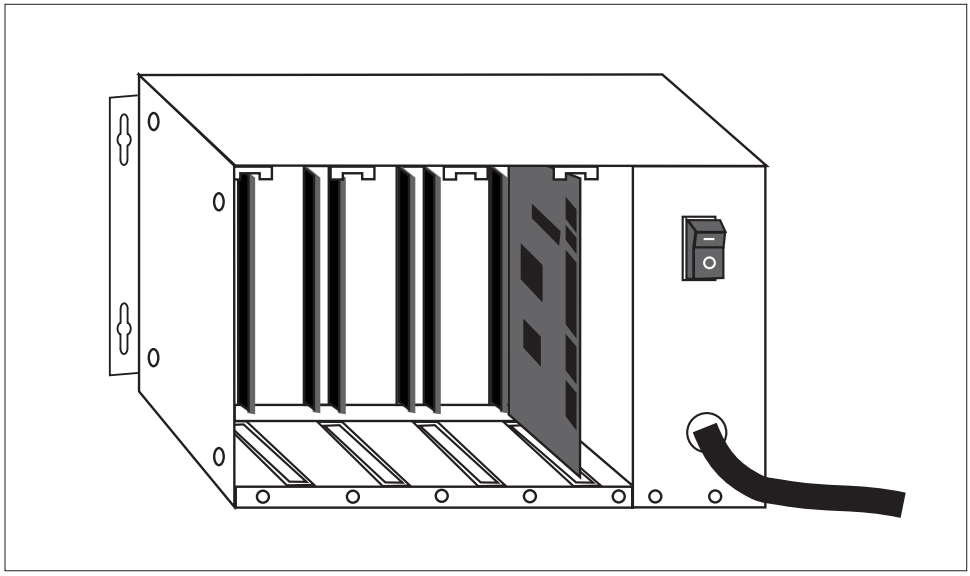
Figure 2-1 Edge connector orientation



2. Attach the Octagon power module to the card cage following the instructions supplied with the power module.
3. Make sure power to the card cage is OFF.

4. Slide the PC Microcontroller into the card cage. The ROM-BIOS label on the card should face away from the power supply. See Figure 2-2 for an illustration of a PC Microcontroller in a Micro PC card cage.

Figure 2-2 Populated Micro PC card cage



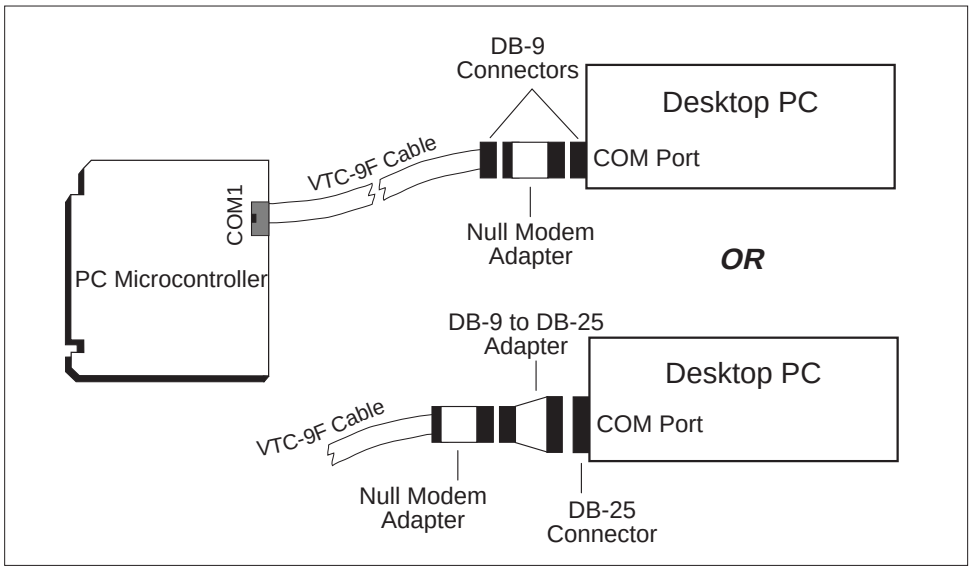
WARNING!
Plugging in the card incorrectly will destroy the card!

5. Connect one end of a VTC-9F cable to the null modem adapter. Connect the other end to COM1 on the PC Microcontroller.

Note You must use COM1 on the PC Microcontroller in order to establish a serial communications console I/O link with your PC.

6. If your PC has a 9-pin serial connector, connect the null modem adapter to any serial port (COM1 through COM4) on your PC. If your PC has a 25-pin serial connector, attach a 9-25 pin adapter to your null modem adapter, then insert the matching end of the 9-25 pin adapter into the serial port. See Figure 2-3.

Figure 2-3 Serial communications setup



Note Refer to the PC SmartLINK manual for more information on using a desktop PC COM port other than COM1.

You are now ready to transfer files between your PC and the PC Microcontroller. Continue with the section, *Establishing communications with the PC Microcontroller*, in this chapter.

Panel mounting or stacking the PC Microcontroller

To panel mount or stack the PC Microcontroller, you will need the following equipment (or equivalent):

- PC Microcontroller
- 5V power supply
- VTC-9F cable
- Null modem adapter
- PC Microcontroller ROM-DOS and utility disk
- PC SmartLINK with manual
- Your PC
- 5252MB stacking kit (required for stacking only) (P/N 3590)

Refer to the *Miscellaneous* appendix if you are making your own serial cable or using other non-Octagon components.

If you are panel mounting the PC Microcontroller, a screw terminal connector is provided to supply the 5V power. Refer to Figure 2-4 for an illustration of panel mounting the PC Microcontroller.

WARNING!

Miswiring the voltage at P2 of the PC Microcontroller or at the power connector of the 5252MB stacking kit (reversing +5V and ground, or applying a voltage greater than +5V), will destroy the card and void the warranty!

Figure 2-4 Panel mounting the PC Microcontroller

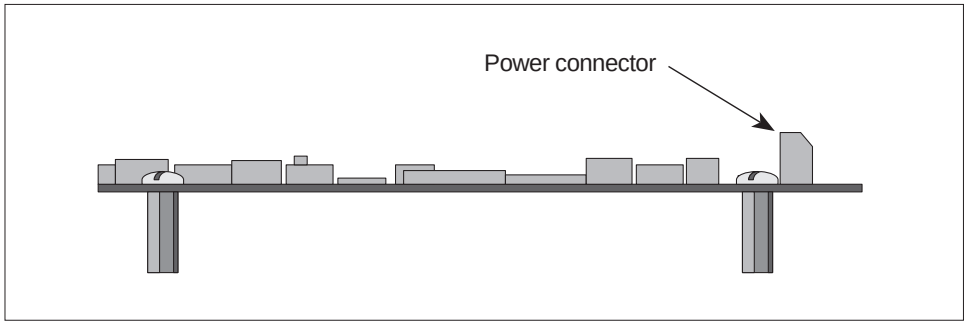
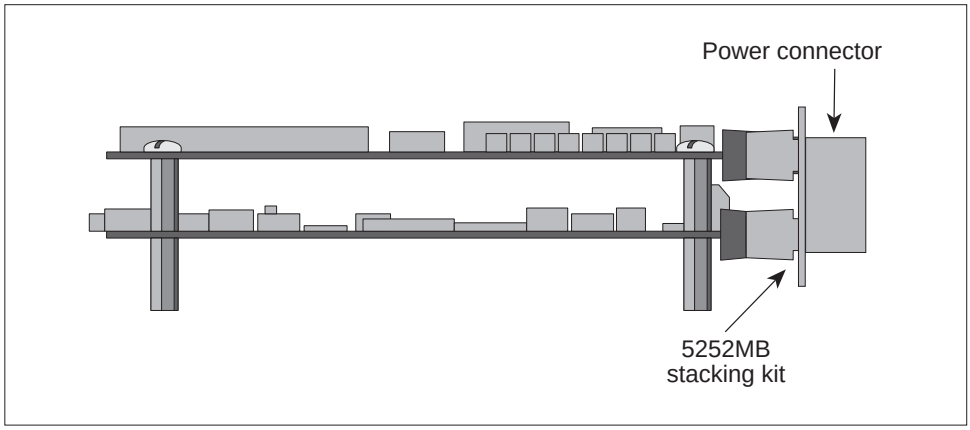


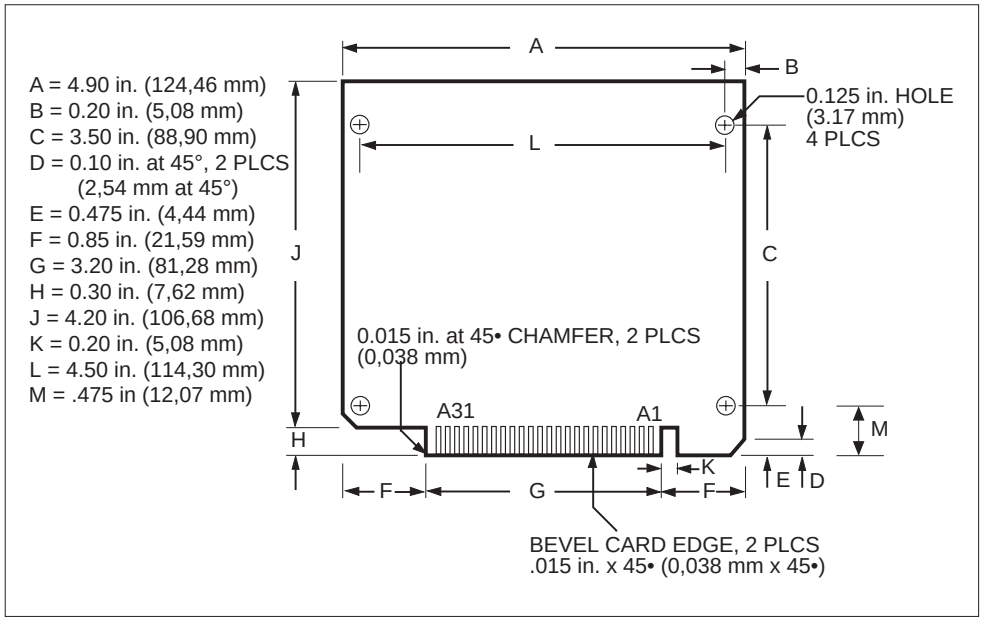
Figure 2-5 Stacking the PC Microcontroller



1. To panel mount the PC Microcontroller, use #4-40 standoffs and screws to secure the card. The following diagram shows the center-to-center mounting hole dimensions.

To stack the PC Microcontroller, refer to the *5252MB stacking kit product sheet* enclosed with the kit. Then proceed with Step 2 in this section.

Figure 2-6 PC Microcontroller center-to-center hole dimensions



2. Connect the ground and 5V wires to the terminal block of the PC Microcontroller or P2 of the stacking kit.

3. Connect one end of the VTC-9F cable to the null modem adapter. Connect the other end to COM1 on the PC Microcontroller.

Note You must use COM1 on the PC Microcontroller in order to establish a serial communications console I/O link with your PC.

4. If your PC has a 9-pin serial connector, connect the null modem adapter to any serial port (COM1 through COM4) on your PC. If your PC has a 25-pin serial connector, attach a 9-25 pin adapter to your null modem adapter, then insert the matching end of the 9-25 pin adapter into the serial port. See Figure 2-3.

Note Refer to the PC SmartLINK manual for more information on using a desktop COM port other than COM1.

You are now ready to transfer files between your PC and the PC Microcontroller. Continue with the section, *Establishing communications with the PC Microcontroller* in this chapter.

Using the PC Microcontroller in a passive ISA backplane

To plug the PC Microcontroller into a passive ISA backplane, you will need the following equipment (or equivalent):

- PC Microcontroller
- Unterminated backplane
- Mounting bracket (optional)
- Power module
- VTC-9F cable
- Null modem adapter
- PC Microcontroller ROM-DOS and utility disk
- PC SmartLINK with manual
- Your PC

Refer to the *Miscellaneous* appendix if you are making your own serial cable or using other non-Octagon components.

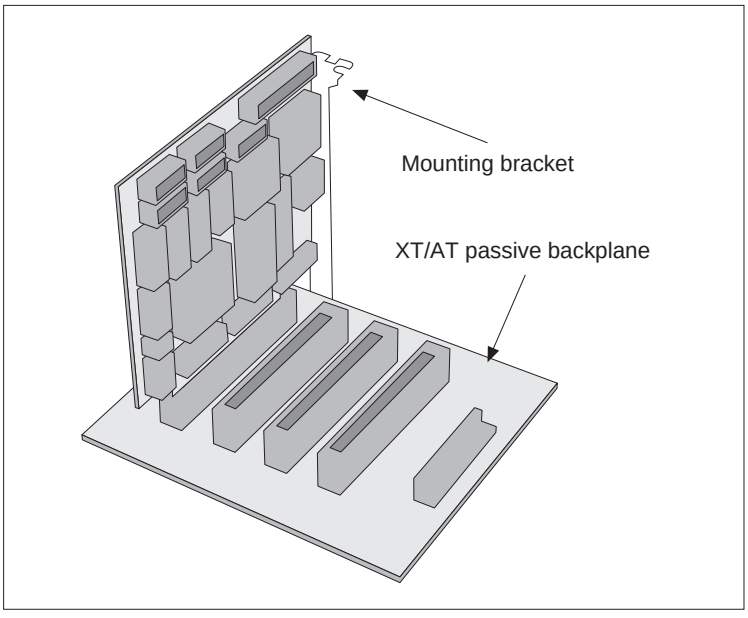
To install the PC Microcontroller:

1. Make sure power to the backplane is OFF.
2. Insert the PC Microcontroller into a connector on the backplane (see Figure 2-7). Take care to correctly position the card's edge with the connector of the backplane. Figure 2-1 shows the relative positions of the PC Microcontroller card as it is installed into a backplane.

WARNING!

Incorrectly plugging the card into the backplane will destroy the card and void the warranty!

Figure 2-7 Using a passive ISA backplane



3. Connect one end of a VTC-9F cable to the null modem adapter. Connect the other end to COM1 on the PC Microcontroller.

Note You must use COM1 on the PC Microcontroller in order to establish a serial communications console I/O link with your PC.

4. If your PC has a 9-pin serial connector, connect the null modem adapter to any serial port (COM1 through COM4) on your PC. If your PC has a 25-pin serial connector, attach a 9-25 pin adapter to your null modem adapter, then insert the matching end of the 9-25 pin adapter into the serial port. See Figure 2-3.

Note Refer to the PC SmartLINK manual for more information on using a desktop PC COM port other than COM1.

You are now ready to transfer files between your PC and the PC Microcontroller. Continue with the section, *Establishing communications with the PC Microcontroller* in this chapter.

≡ Establishing communications with the PC Microcontroller

1. Install PC SmartLINK (or other communications software) on your PC if you have not already done so. Refer to the PC SmartLINK manual for installation instructions.

2. Copy the PC Microcontroller files from the supplied utility disk to a subdirectory on your PC hard drive.

```
C:
MD C:\MPC
XCOPY A:\*.* C:\MPC /S
```

3. Start PC SmartLINK. You are now ready to establish communications between your PC and the PC Microcontroller.

4. Power on the PC Microcontroller.

5. A logon message similar to the one below will appear on your PC monitor:

```
PhoenixBIOS (TM) A386 Version x.xx
Copyright (C) 1985-1992 Phoenix Technologies, Ltd.
All Rights Reserved

Octagon Systems Corp. 40 MHz 60xx CPU
Release vx.xx - mm/dd/yy

Ali 386SX-V8T processor detected operating at 40 MHz

640K Base Memory, 1024K Extended

INT 17h BIOS extension vx.xx
Copyright (c) 1995-97  Octagon Systems Corporation

PICO Flash Array
```

```
Copyright (c) 1996,Phoenix Technologies Ltd.
Resident Flash (RFA) OEM Layer
  Phoenix PICO Flash Array (TM)
  Copyright (c) 1996
  Phoenix Technologies LTD
  Octagon Systems vx.xx
  First drive of size 896K is installed in SSD0 (AMD 1MB flash)
  Second drive of size 128K is installed in SSD2 (128K SRAM)
RS-485 support BIOS extension vx.xx
Copyright (c) 1996, Octagon Systems

Starting ROM-DOS...

HIMEM v6.22 (Revision x.xx)
Copyright (c) 1989-1995 Datalight, Inc.

VDISK v6.22 (Revision x.xx)
Copyright (c) 1989-1995 Datalight, Inc.
    Extended Memory Present

VDISK v6.22 (Revision x.xx)
Copyright (c) 1989-1995 Datalight, Inc.
    Formatting 1024K XMS memory as drive E:

60xx C:\>
```

If you do not get the proper logon message:

- Check the PC SmartLINK serial parameters of your PC to make sure they are set correctly. Parameters should be 9600 baud, 8 data bits, no parity, and 1 stop bit.
- Make sure a video card is not installed in the card cage
- Make sure all jumpers are set to factory defaults
- If the system still does not respond, refer to the *Troubleshooting* chapter.

6. Use the directory command to make sure your equipment and software are working properly. Enter:

   ```
   60xx C:\> DIR
   ```

   A directory listing of ROM-DOS files stored in the BIOS socket should appear:

   ```
   Volume in drive C has no label
   Directory of C:\

   AUTOEXEC   BAT      43    09-12-96  2:03p
   COMMAND    COM  26,321    04-17-95  6:22a
   CONFIG     SYS      73    09-12-96  2:03p
   DOS        <DIR>          02-24-97 10:57p
   UTILS      <DIR>          02-24-97 10:57p
   CAMBASIC   <DIR>          02-24-97 10:57p
       6 file(s)       26,437 bytes
                      489,472 bytes free
   ```

7. You are now ready to transfer files between your PC and the PC Microcontroller.

≡ Transferring files between the PC Microcontroller and your PC

Once you have established communications between your PC and the PC Microcontroller, you can serially download files to any read/write drive used by the PC Microcontroller. You can then test and debug your application files. You can also upload files from the PC Microcontroller to your desktop PC for editing and debugging.

When booting from the PC Microcontroller BIOS drive, the default CONFIG.SYS device drivers designate drive C: as the BIOS drive (SSD0), drive D: as the SRAM drive (SSD2), and drive E: as the virtual drive. All drives assigned, can be accessed as read/write drives and files can be serially transferred to and stored on any of these drives.

Note The virtual drive is optional when booting from SSD0, floppy drive or hard drive. If you do not need a virtual drive, do not use VDISK.SYS.

There are two methods to download files through the serial port to the PC Microcontroller:

- The TRANSFER utility is used to download files, one at a time, to the PC Microcontroller using the XMODEM protocol. TRANSFER.EXE resides on the PC Microcontroller BIOS drive and on the PC Microcontroller utility disk and is used to send or receive files via the serial port (e.g., COM1). TRANSFER.EXE uses the XMODEM protocol, as does PC SmartLINK. (See the note below on XMODEM).

Note In Windows 95 when the TRANSFER utility is used to download files, set the idle time sensitivity of PC SmartLINK on your desktop PC to "low" for TRANSFER to run quickly. To change your settings, follow the steps below:

1. Open Windows Explorer.
2. Select SL.EXE with the right mouse button.
3. Select the Properties menu item.
4. Select the Miscellaneous tab in the Properties window.
5. Move the Idle Sensitivity slide bar to low.
6. Select the Apply button.
7. Exit the Properties window.

- REMDISK/REMSERV utilities allow access to all of the files on a remote disk drive. REMDISK.EXE and REMSERV.EXE are located on the PC Microcontroller BIOS drive and the PC Microcontroller utility disk. Once these programs are executed, single or multiple files can then be transferred to and from the PC Microcontroller using DOS COPY or XCOPY commands.

Note REMDISK/REMSERV will not work with Windows 95. Use REMDISK/REMSERV with ROM–DOS, MS–DOS, or on a network.

TRANSFER.EXE, REMDISK.EXE, and REMSERV.EXE are located on the PC Microcontroller BIOS drive, in the DOS directory, and on the PC Microcontroller utility disk in the \DOS directory. Refer to the *Software utilities* chapter for more information on these programs.

Note XMODEM only transfers files in which the file size is exactly on a 128 byte boundary. If the file size does not fall exactly on the boundary, XMODEM automatically rounds the file size up to the next 128 byte boundary with padding characters. For example, a file with a size of 10,000 bytes, will be rounded up to 10,112 bytes, transferred, and written with the new file size. In most cases, this is not a concern, but in some instances the XMODEM padding causes problems. The padding problems become apparent when an application program is expecting a specific file size or is expecting characters other than the padding characters to be at the end of the file.

The following information on downloading files between the PC Microcontroller and your PC uses the example program DEMO.EXE. This file is on the PC Microcontroller utility disk in the \DEMO directory.

Downloading files to the PC Microcontroller using TRANSFER.EXE

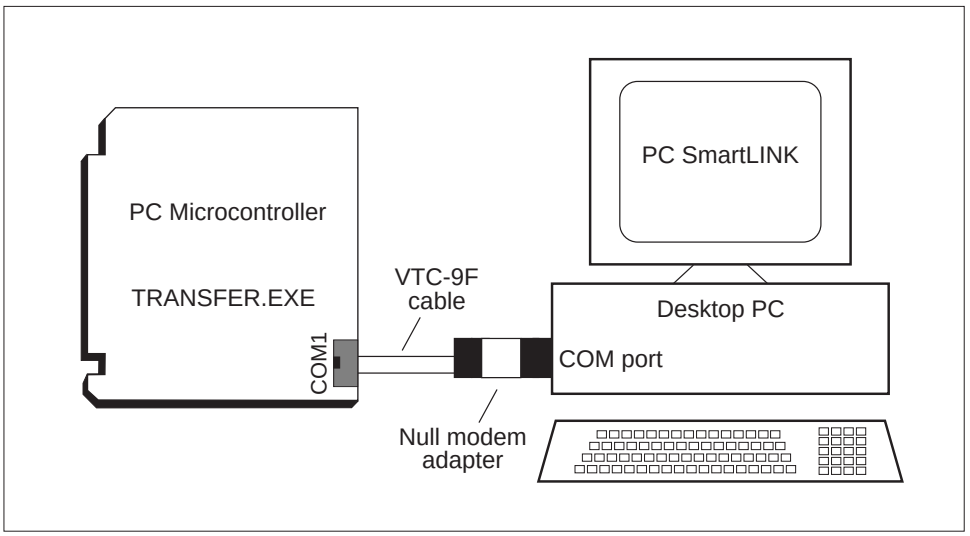
The following procedures assume you are using PC SmartLINK and that it is included in your directory path. For other communication programs, refer to their instructions on sending a file from your PC to a target system. Refer to the *Software utilities* chapter for specific information on using TRANSFER.EXE.

Hardware and software requirements:

- Desktop PC, running PC SmartLINK, connected by a VTC-9F cable and a null modem adapter to COM1 of the PC Microcontroller
- A PC Microcontroller running TRANSFER.EXE out of COM1.

1. Connect the equipment as per the following diagram:

Figure 2-8 Downloading files using TRANSFER.EXE



2. On the desktop PC, log into the directory which contains the file(s) you will download to the PC Microcontroller, for example:

   C:\MPC\60xx\DEMO

3. Start PC SmartLINK and power on the PC Microcontroller.

4. Execute the TRANSFER.EXE program from the PC Microcontroller by entering:

   60xx C:\> **TRANSFER E:DEMO.EXE**

Note In this case, E: is the virtual drive assigned in CONFIG.SYS. Any PC Microcontroller read/write drive could be substituted.

Note When sending a file, enter the following:

60xx C:\> **TRANSFER /S**

The following message is displayed from the PC Microcontroller:

Receiving E:DEMO.EXE . . .

5. Execute the following steps using PC SmartLINK:

   a. Press <ALT><D> to enter the download screen.

   b. Type in the name of the file to transfer, e.g. **DEMO.EXE** (if PC SmartLINK was not started in the DEMO directory as instructed in Step 2, then the entire path may have to be entered **C:\MPC\DEMO\DEMO.EXE**)

c. To begin the transfer, do one of the following:

- press **ENTER** (default download START)
- tab to **START** and press **ENTER**
- mouse click on the **START** button in the download screen.

d. When the file transfer is completed, press <ESC> twice to return to the main PC SmartLINK screen.

Note TRANSFER.EXE will time-out if the program has not been started after approximately 40 seconds. If the time-out occurs, the following message from the PC Microcontroller is displayed:

```
Failed to receive E:DEMO.EXE!
Deleting E:DEMO.EXE
```

6. When the file transfer is complete, type the following DOS command to view the E: drive directory and confirm that your file has been transferred to the PC Microcontroller:

```
60xx C:\> DIR E:
```

The system will display the contents of drive E:

```
Volume in drive E is VDISK vX.XX
Directory of E:\

DEMO  EXE   27264  06-07-96   2:57p
          1 file(s)  27264 bytes
```

7. To execute the program you have just downloaded, type:

```
60xx C:\> E:DEMO
```

The DEMO program displays a message on your PC.

Downloading files to the PC Microcontroller using REMDISK/REMSERV

There are three methods of using REMDISK/REMSERV with a PC Microcontroller:

- PC Microcontroller with no video card and one serial cable
- PC Microcontroller with no video card, two PCs, and two serial cables
- PC Microcontroller with a 5420 video card and one serial cable.

Refer to the *Software utilities* chapter for specific information on using REMDISK.EXE and REMSERV.EXE.

Note REMDISK/REMSERV will not work with Windows 95 or on a network. Use REMDISK/REMSERV with ROM–DOS or MS–DOS.

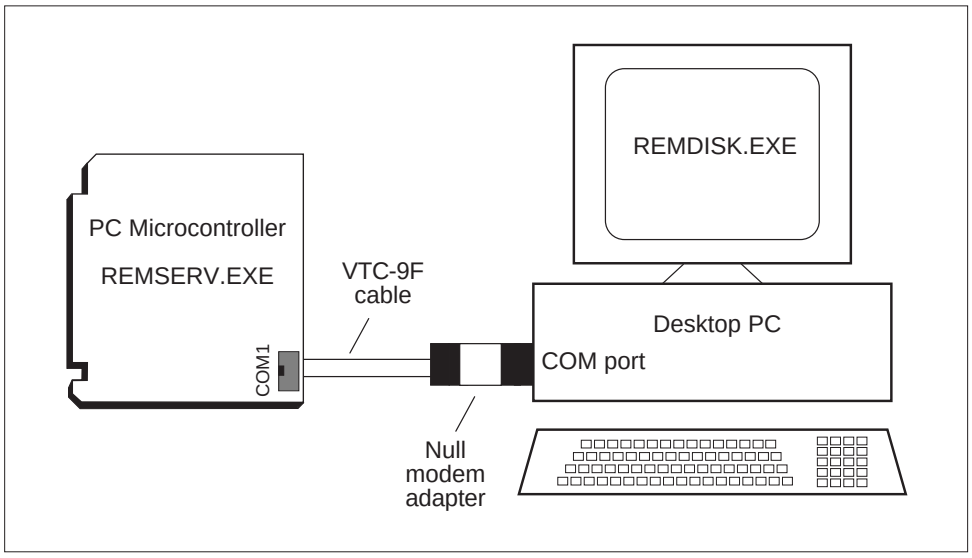
PC Microcontroller with no video card and one serial cable

Hardware and software requirements:

- Desktop PC, running C:\DOS\REMDISK, connected by a VTC-9F cable and a null modem adapter to COM1 of the PC Microcontroller
- A PC Microcontroller running C:\DOS\REMSERV out of COM1

1. Connect the equipment and load appropriate software on each system as per the following diagram:

Figure 2-9 Downloading files to the PC Microcontroller with no video card using REMDISK/REMSERV



2. On the desktop PC, start PC SmartLINK from the C:\MPC\60xx\DOS directory and power on the PC Microcontroller.
3. Execute REMSERV.EXE on the PC Microcontroller. Read/write SSD flash drive C: is the shared drive and COM1 is the default port. Enter:

```
60xx C:\DOS> \REMSERV C:
```

The following message is displayed from the PC Microcontroller:

```
REMSERV v1.0
Copyright (c) 1990-1994 Datalight, Inc.
All rights reserved.

Using COM1 at 115K+ baud. Accessing Drive C:
Time-out is 9 seconds
Press <Esc> to Exit.(There may be a delay before exit
occurs)
```

4. Exit PC SmartLINK by pressing <ALT><X>.

5. Execute REMDISK.EXE on the PC, by entering:

```
C:\> REMDISK
```

The following message is displayed on the PC:

```
Remote Disk v1.0
Copyright (c) 1990-1994 Datalight, Inc.
All rights reserved.

Installed as Drive E:   /COM1   /B115+   /T10
```

Note REMDISK.EXE is located in the \DOS directory on the PC Microcontroller utility disk. REMDISK assigns the remote drive as the last drive in the system. In this case, drive E: was assigned.

6. Files are transferred to the PC Microcontroller's read/write drives by using the DOS COPY or XCOPY commands. Enter:

```
C:\> COPY C:\MPC\60xx\DEMO.EXE E:
C:\> DIR E:
C:\> E:DEMO.EXE
```

The DEMO program displays a message on your PC.

In this case, drive E: is the remote read/write SSD flash disk drive of the PC Microcontroller. Files are easily copied between the drives.

7. When finished, execute:

```
C:\> REMDISK /U
```

This unloads REMDISK from the desktop PC.

8. Restart PC SmartLINK and reset the PC Microcontroller.

PC Microcontroller with no video card, two PCs, and two serial cables

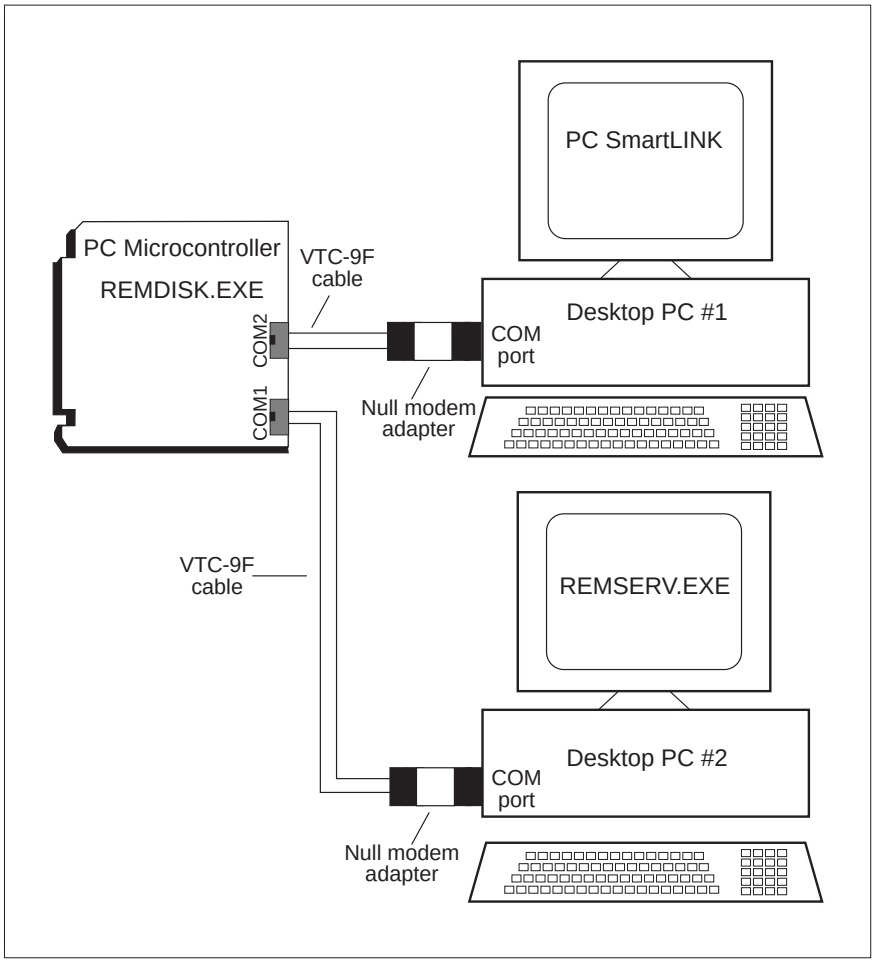
The first desktop PC is used as the terminal for the PC Microcontroller, and the second desktop PC's hard drive is accessed as a remote drive, containing the files to be downloaded to the PC Microcontroller.

Hardware and software requirements:

- Desktop PC, running PC SmartLINK, connected by a VTC-9F cable and a null modem adapter to COM1 of the PC Microcontroller
- Desktop PC, running REMSERV.EXE, connected by a VTC-9F cable and a null modem adapter to COM2 of the PC Microcontroller
- A PC Microcontroller running REMDISK.EXE from COM2.

1. Connect the equipment and load the appropriate software on each system as per the following diagram:

Figure 2-10 Downloading files to the PC Microcontroller with no video card and two PCs



2. On PC #1 (i.e., the terminal PC), start PC SmartLINK and power on the PC Microcontroller.

3. Execute REMDISK.EXE from COM2 on the PC Microcontroller by entering:

   ```
   60xx C:\> REMDISK /COM2
   ```

   The following message is displayed from the PC Microcontroller:

   ```
   Remote Disk v1.0
   Copyright (c) 1990-1994 Datalight, Inc.
   All rights reserved.

   Installed as Drive F:   /COM2   /B115+   /T10

   60xx C:\>
   ```

4. On PC #2 (i.e., the remote disk drive PC), execute REMSERV.EXE by entering:

   ```
   C:\> REMSERV C:
   ```

   The following message is displayed on PC #2:

   ```
   REMSERV v1.0
   Copyright (c) 1990-1994 Datalight, Inc.
   All rights reserved.

   Using COM1 at 115K+ baud. Accessing Drive C:
   Time-out is 9 seconds
   Press <Esc> to Exit.(There may be a delay before exit
   occurs)
   ```

5. At PC #1, access the remote disk drive by entering:

   ```
   60xx C:\> F:
   60xx G:\> CD F:\MPC\PC 60xx\DEMO
   ```

6. Files are transferred to the PC Microcontroller read/write drives by using the DOS COPY or XCOPY commands. Enter:

   ```
   60xx F:\MPC\60xx\DEMO> COPY DEMO.EXE C:
   60xx F:\MPC\60xx\DEMO> DIR C:
   60xx F:\MPC\60xx\DEMO> C:DEMO.EXE
   ```

   The DEMO program displays a message on your PC.

   In this case, drive F: is the remote disk drive of PC #2, and drive C: is the read/write SSD flash disk drive of the PC Microcontroller. Files are easily copied between the drives.

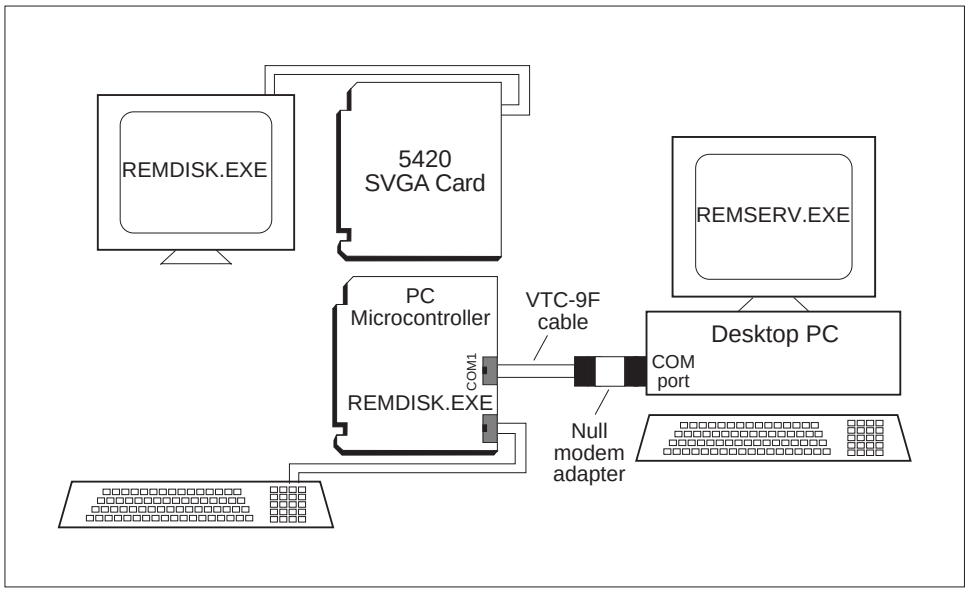
PC Microcontroller with a video card and one serial cable

Hardware and software requirements:

- Desktop PC, running REMSERV, connected by a VTC-9F cable and a null modem adapter to COM1 or COM2 of the PC Microcontroller.
- A PC Microcontroller system, including a keyboard, a 5420 SVGA video card and VGA monitor, running REMDISK from COM1.

1. Connect the equipment and load the appropriate software on each system as per the following diagram:

Figure 2-11 Downloading files to the PC Microcontroller with a video card



2. On the PC Microcontroller system, execute REMDISK.EXE by entering:

   ```
   60xx C:\> REMDISK
   ```

   The following message is displayed on the PC Microcontroller monitor:

   ```
   Remote Disk v1.0
   Copyright (c) 1990-1994 Datalight, Inc.
   All rights reserved.

   Installed as Drive F:   /COM1   /B115+   /T10
   ```

Note REMDISK assigns the remote drive as the last drive in the system. In this case, drive F: was assigned.

3. Execute REMSERV.EXE on the desktop PC:

   ```
   C:\> REMSERV C:
   ```

   The following message is displayed on the PC:

   ```
   REMSERV v1.0
   Copyright (c) 1990-1994 Datalight, Inc.
   All rights reserved.

   Using COM1 at 115K+ baud. Accessing Drive C:
   Time-out is 9 seconds
   Press <Esc> to Exit.(There may be a delay before exit
   occurs)
   ```

Note REMSERV.EXE is located in the PC Microcontroller utility disk \DOS directory.

4. Files are transferred to the PC Microcontroller's read/write drives by using the DOS COPY and XCOPY commands. From the PC Microcontroller system, enter:

   ```
   60xx C:\> COPY F:\MPC\60xx\DEMO.EXE C:
   60xx C:\> DIR C:
   60xx C:\> C:DEMO.EXE
   ```

   The DEMO program displays a message on the PC Microcontroller monitor.

   In this case, drive F: is the remote PC disk drive, and C: is the read/write SSD flash drive on the PC Microcontroller. Files are easily copied between the drives.

5. When finished, on the PC Microcontroller system, execute:

   ```
   60xx C:\> REMDISK /U
   ```

   This unloads REMDISK from the PC Microcontroller.

6. On the desktop PC press <ESC> to exit REMSERV.

Chapter 3: Setup programs

This chapter discusses running the SETUP configuration program, the SETSSD program, and the PMISETUP program on the PC Microcontroller.

- SETUP — Configures devices set up by the BIOS such as serial ports, floppy drives, etc.
- SETSSD — Configures PICO FA device order.
- PMISETUP — Configures power management options at a more detailed level than SETUP.

≡ SETUP

SETUP can be entered in one of two ways:

- Running SETUP.COM
- Pressing the "backspace" key followed by the "S" key during BIOS POST sequence (this occurs between the memory test and bootup).

Also, by removing the USESETUP jumper from the "S" position at W1, you may force the setup to temporarily revert to the defaults shown in the following table, which allows the user to reconfigure the setup.

The SETUP program defines the PC Microcontroller system parameters. It is shipped with default configuration parameters stored in the serial EEPROM. Changes are made by running the SETUP program. The SETUP program is stored on the SSD0 drive and on the PC Microcontroller utility disk.

Table 3-1 6000 Series setup parameters and defaults

SETUP parameters	Description	Default
Serial console for COM1	Specifies that COM1 is to be used for console if video card is not present	Enabled
COM1 console baud rate	Specifies communications rate between PC & 60xx when no video card is in use	9600
Power–on memory test	Extensive memory testing performed on bootup	Enabled
Boot sequence	Specifies whether the floppy drive will be ignored as a boot device	C: Only
Serial port A	Specifies COM1 enable/disable	Enabled
Serial port B	Specifies COM2 enable/disable	Enabled
Parallel (LPT) port	Specifies LPT port enable/disable	Enabled
Parallel port mode	Specifies mode to use with parallel port	Bidirectional printer port
Parallel port address	Specifies LPT address	378h
Number of floppy drives	Specifies number of floppy drives attached	0
Number of hard drives	Specifies number of hard drives attached	0
SETUP entry via hotkey	Specifies <backspace><S> hotkey enable/disable	Enabled
Power management for DOS	Specifies power management enable/disable	Enabled
Time update after suspend	Specifies to allow update of time after suspend mode	Enabled
Shadow video BIOS area	Specifies video BIOS shadow enable/disable	Disabled
Shadow C8000h-CFFFFh	Shadow enable/disable	Disabled
Shadow D0000h-D7FFFh	Shadow enable/disable	Disabled
Shadow D8000h-DFFFFh	Shadow enable/disable	Disabled

Running SETUP

1. Make sure you have established a serial communications console I/O link between the PC Microcontroller and your PC. Refer to the *Quick start* chapter for more information on establishing communications with your PC Microcontroller.

2. Enter:

   60xx C:\> **SETUP**

Note You may also enter **SETUP** after the memory test and before the system has booted by pressing the "backspace" key followed by the "S" key.

3. The system will display the PC Microcontroller setup parameters and available options. Select the option by pressing the space bar until the correct information appears, then press <ENTER>. Press <ESC> twice if you want to exit setup without saving your responses.

Note Options having an * are default settings.

- Serial Console on COM1:
  Enabled*
  Disabled

> **WARNING!**
>
> **Disabling the serial console when there is no video card present will stop further serial console communication with the system after the system resets. Once disabled, you may re-enable the serial console by running SETUP. To run SETUP, choose one of the following methods:**
>
> - **Remove the USESETUP jumper, reboot, and run SETUP**
> - **Install a video card/monitor, reboot, and run SETUP. (This method disables the serial console.)**

- COM1 Console Baud Rate:
  1200
  2400
  4800
  9600*
  14400
  19200
  28800
  38400
  57600
  115200

- Power on memory test:
  Enabled*
  Disabled

  You may want to disable the memory test to speed up the boot process. You may also press the space bar to cancel the memory test while in progress.

- Boot Sequence:
  C: Only*
  A: Then C:

- Serial Port A:
  Enabled*
  Disabled

- Serial Port B:
  Enabled*
  Disabled

- Parallel (LPT) Port:
  Enabled*
  Disabled

- Parallel Port Mode:
  Bidirectional mode*
  EPP mode
  ECP mode
  Floppy disk mode
  Standard (Unidirectional) mode

- Parallel Port Address:
  378h*
  278h
  3BCh

Note Standard mode is provided for compatibility only. We recommend the use of bidirectional mode. EPP and ECP modes are provided for equipment that has the capability to operate at these modes for enhanced performance.

- Number of floppy drives:
  0*, 1, 2

- Onboard floppy controller: (6010 only)
  Enabled
  Disabled*

- Floppy drive 1 size:
  5.25", 360KB
  5.25", 1.2 MB
  3.5", 720KB
  3.5", 1.44 MB*

- Floppy drive 2 size:
  5.25", 360KB
  5.25", 1.2 MB
  3.5", 720KB
  3.5", 1.44 MB*

- Number of hard drives:
  0*
  1
  2

Note If you are using a 5800A or a 5815 with the PC Microcontroller, set "Number of hard drives" to "0" on either the 5800A or 5815 or on the PC Microcontroller. See the following table for details.

Table 3-2 Hard drive setup

No. of drives in HDSETUP (5800A/5815)	IRQ setting in HDSETUP	No. of drives in CPU SETUP
1 or 2	IRQ14	0
0	N/A	1 or 2

Note The PC Microcontroller does not support floppy drives on the 5800A without first making some modifications to the 5800A. Call Technical Support for assistance.

- `Onboard IDE interface:` (6010 only)
  `Enabled`
  `Disabled*`

Note The 6010 has an on-board floppy controller and IDE controller. If an external controller is desirable, the on-board controllers can be disabled through SETUP.

- `Auto Drive Configuration`
  `Enabled*`
  `Disabled`

- `Drive 0 parameters`
  `Cylinders (xxx):`
  `Heads (x):`
  `Sectors (xx):`

- `Setup entry via hotkey`
  `Enabled*`
  `Disabled`

- `Power management`
  `Enabled*`
  `Disabled`

- `Time update after suspend`
  `Enabled*`
  `Disabled`

- `Shadow C8000H - CFFFFH`
  `Disabled*`
  `Enabled`

- `Shadow D0000H - D7FFFH`
  `Disabled*`
  `Enabled`

- `Shadow D8000H - DFFFFH`
  `Disabled*`
  `Enabled`

```
Press ENTER to SAVE the changes or
Press ESC to EXIT without saving the changes.
Saving options.
Options saved.
```

Depending on the options you have selected, the system may display the following message:

```
You must reset for these options to take effect.
```

If you entered SETUP with the hotkeys (i.e., "backspace" and "S" keys), the system will reboot automatically.

SETUP example

The following example configures a system with no memory test, 9600 baud, and booting from C:

```
                OCTAGON SYSTEMS CORPORATION
                  60xx SETUP UTILITY Vx.x
          (c) Phoenix Technologies, Ltd. 1985, 1995
```

```
  (Press SPACE to CHANGE, ENTER to ACCEPT, ESC to EXIT)

Serial Console on COM1:       ENABLED
COM1 Console Baud Rate:       9600
Power on memory test:         DISABLED
Boot Sequence:                C: ONLY
Parallel (LPT) Port:          ENABLED
Parallel Port Mode:           Bidirectional Printer Port
Number of floppy drives:      1
Floppy drive 1 size           3.5", 1.44 MB
Number of hard drives         1
Auto Drive Configuration:     ENABLED
SETUP Entry via Hotkey:       ENABLED
Power Management:             DISABLED
Shadow Video BIOS Area:       DISABLED
Shadow C8000h-CFFFFh:         DISABLED
Shadow D0000h-D7FFFh:         DISABLED
Shadow D8000h-DFFFFh:         DISABLED

Press ENTER to SAVE the changes or
Press ESC to EXIT without saving the changes.
Options Saved.
You must reset for these options to take effect.
60xx C:\>
```

Note Executing SETUP /D will change all setup parameters to default values.

Note Power management should be disabled when using CAMBASIC.

≡ SETSSD

SETSSD allows the user to set or change the PICO FA drive (SSD) order. PICO FA drives are "simulated" hard drives. They can exist before or after any IDE drives and can appear in any order. By setting the order, the SSDs may be accessed as C:, D:, etc. For example,

- To set SSD0 first and SSD2 second, enter the following command:

  60xx C:\> **SETSSD SSD0 SSD2**

If there are other hard drives on the system, add the **/before** option to place the order of the SSDs before the hard drives, or add the **/after** option to place the SSDs after the hard drives. For example,

- To set SSD0 as the first drive, SSD2 as the second drive, and an IDE drive as the third drive, enter the following command:

  60xx C:\> **SETSSD SSD0 SSD2 /before**

- To set the IDE drive as first in order and SSD0 as second, enter the following command:

  C:\> **SETSSD SSD0 /after**

In the last example, the IDE drive is C:, SSD2 is D: and SSD0 is E:. Other drive letter designations may be added by device drivers (such as VDISK.SYS), which are in the CONFIG.SYS file on the boot drive.

The boot drive is based upon the drive order set by the SETSSD command and by SETUP's "boot sequence" option. If the boot sequence is set to "A: THEN C:," the system will look for a floppy disk in drive A:. If a diskette is not installed, or a floppy is not defined, the boot drive will be the first drive specified in the SETSSD command. If the boot sequence is set to "C: ONLY," the check for a disk is bypassed.

Note The SETSSD parameters may also be overwritten by removing the USESETUP jumper from the "S" position at W1 and resetting the system. If the parameters specified at the PICO FA first/second drive prompt are different from the previous SETSSD command, and you answered "No" to the "Save" prompt, the SETSSD output will not be accurate. Therefore, we recommend that you answer "Yes" to the save option to prevent confusion.

Note After you run SETSSD and the drive order has changed, the new parameters will take effect after a reset.

Note The drive order affects the number entered at the PFORMAT H*n* command.

≡ PMISETUP

PMISETUP allows the user to customize the power management features of the PC Microcontroller. Refer to the *CPU power management* chapter. See also the *Software utilities* chapter for details.

Chapter 4: Save and run programs

≡ Save and run your programs on the PC Microcontroller

Once you have written, tested, and debugged your application, you can then save it to flash memory in SSD0. When you reboot the PC Microcontroller, your program can automatically load into DOS memory and execute. As shipped from the factory, SSD0 already contains a bootable ROM-DOS.

This chapter describes the following:

- Saving an application program to SSD0
- Autoexecuting the program from the PC Microcontroller
- Overriding autoexecution of your program.

The information in this chapter assumes you will be using ROM-DOS in your application. Some Microsoft programs make undocumented DOS calls. With ROM-DOS, an error will be returned when an undocumented DOS call is made, causing your program to operate erratically. We recommend booting from SSD0 and using your own DOS, when using programs with undocumented DOS calls. Refer to the *Adding operating system startup files* section in this chapter for more information on saving and autoexecuting programs.

This chapter also assumes you will be using the PC Microcontroller without a video card/monitor. If you are using these devices, refer to the *Video* chapter for more information on transferring and saving programs.

≡ Saving program and support files

By default, SSD0 comes from the factory preformatted, loaded with Datalight's ROM-DOS startup files and with an example demo program. To replace the demo program on SSD0 with your own, see *Adding your application* section in this chapter.

Formatting SSD0

This section describes how to format SSD0.

1. Define the SSD order with the SETSSD command. Since the command input varies depending upon the parameters you would need to enter, see the SETSSD command in the *Software utilities* chapter.

2. To begin formatting SSD0, execute PFORMAT as follows:

   60xx C:\> **PFORMAT H***n*

   where *n* is the hard drive sequence number. This number includes IDE drives and SSDs.

   For example, if you have 0 IDE drives and SETSSD shows:

   [hdd] SSD0 SSD2

   then enter:

   60xx C:\> **PFORMAT H0**

   On the other hand, if you have 1 IDE drive, enter:

   60xx C:\> **PFORMAT H1**

Note If the drive has not been previously formatted, reset the system before accessing the drive. This allows DOS to recognize the drive and add a letter designation to it.

Note PFORMAT.EXE must be downloaded from the PC Microcontroller utility disk. This file is located in the \UTILS directory.

After formatting the drive and resetting the system, you may access it as a normal DOS drive.

Adding operating system startup files (using SYS)

To add the system files, issue the following operating systems command:

C:\> **SYS** *x:*

where *x:* specifies the drive letter.

For example, if your system has 1 IDE drive, and SETSSD shows "[hdd] SSD0 SSD2," then SSD0 should be drive D:. To SYS this drive, use the "SYS D:" command.

Note If you are adding the ROM-DOS operating system, SYS.COM must be downloaded from the PC Microcontroller utility disk. This file is located in the \DOS directory.

Note If you are adding the MS-DOS operating system, you must first boot from an MS-DOS bootable device (floppy or hard drive).

Note If you are not booting from ROM-DOS, and wish to SYS ROM-DOS back to the drive, the SYS command requires the access of the following ROM-DOS files: COMMAND.COM, ROM-DOS.SYS and SYS.COM.

Adding your application

To add your application to your SSD, do the following:

1. Three methods of copying your application to the SSD are available. Do one of the following:

   a. From a local drive to the PC Microcontroller, issue the COPY command.

   b. From a host drive, download your application by issuing the TRANSFER command when using PC SmartLINK. Refer to the section, *Transferring files between the PC Microcontroller and your PC* in the *Quick start* chapter.

   c. To establish a remote drive and copy from it, issue the REMDISK and REMSERV commands. Refer to the section, *Transferring files between the PC Microcontroller and your PC* in the *Quick start* chapter.

2. Add or remove any device drivers from your application. Remember to add these drivers to your drive as well.

3. To autoexecute your application, add your application name to the AUTOEXEC.BAT file. This method is the same in any DOS environment.

   For instructions on downloading files using TRANSFER, REMDISK, REMSERV, and PC SmartLINK, see the sections *Transferring files between the PC Microcontroller and your PC* and *Downloading files from the PC Microcontroller* in the *Quick start* chapter. In addition, the *Software utilities* chapter provides usage instructions for REMDISK, REMSERV, and TRANSFER.

Autoexecuting your application

This section describes how to autoexecute your application.

1. To autoexecute your application in SSD0, use the SETSSD command to define your SSD as the boot device. Since you need to define the order of SSD0 as the first of the SSDs (and before any IDE drives), enter the following command:

   ```
   60xx C:\> SETSSD SSD0 SSD2 /before
   ```

2. Reset the system. SSD0 is now drive C: and your application should begin execution.

Note If the SETUP option "Boot Sequence" is set to "A: THEN C:", remove any floppy in drive A: before resetting the system.

Note The SETSSD options are not used when USESETUP ("S" position at W1) is not jumpered.

Overriding the autoexecution of your application

1. Remove the jumper from the "S" position at W1 (USESETUP).
2. Reset the system. This will force the system to ignore all SETUP information, including the floppy/hard drive and the SETSSD information.
3. At the prompt, "`PICO FA first drive (0=SSD0, 2=SSD2, other=no drive)`," enter "0".
4. At the prompt, "`PICO FA second drive (2=SSD2, other=no drive)`," enter "2".
5. At the prompt, "`Do you wish to save this information now? (Y/N)`," enter "Y".
6. After saving this information, reinstall the USESETUP jumper.
7. Reset the system. The system should boot from SSD0.

Chapter 5: Serial ports

≡ Description

Each PC Microcontroller in the 6000 Series has two serial ports, except for the 6030 which has 4 serial ports. These serial ports are 16C550 compatible. They can be used for interfacing to a printer, terminal, or other serial device. These ports support 5-, 6- 7-, or 8-bit word lengths, 1, 1.5, or 2 stop bits, and baud rates up to 115.2 KB.

The serial ports meet IEC1000, level 3, ESD protection specification with ±8 KV of ESD protection. Backdrive protection is also included. COM2 can be converted to optically isolated, RS-422/485 with the network interface module (NIM). NIM mounts directly onto the PC Microcontroller without the need of a cable or external power supply.

Note The Network Interface Module (NIM) is not compatible with the 6010 PC Microcontroller.

Use a VTC-9F cable to connect the ports to external serial equipment. The pinout of the connector allows you to plug the cable directly into a 9-pin PC serial connector (refer to the product-specific appendix for the connector pinout). When interfacing the PC Microcontroller to your PC, you will need to use a null modem adapter. The serial port at COM1 defaults to IRQ4 at I/O address 3F8H, which is the PC standard for COM1. Likewise, the serial port at COM2 defaults to IRQ3 at I/O address 2F8H. Refer to Table 5-1 for the connector designation of each COM port on your model in the 6000 Series.

Table 5-1 Serial port connector reference

Reference designator	6010	6020	6030	6040	6050
COM1	J3	J3	J3	J3	J3
COM2	J4	J4	J4	J4	J4
COM3	—	—	J1	—	—
COM4	—	—	J7	—	—

≡ Selecting console devices

The PC Microcontroller has two options for console devices:

1. Serial console from COM1, as selected with the SETUP program ("Serial Console on COM1: ENABLED"). A serial cable/null modem adapter plugged into a host PC running PC SmartLINK provides both input and output. The local keyboard allows input.

2. No console device (as selected with the SETUP program – "Serial Console on COM1: DISABLED") means no console output. The local keyboard allows input.

≡ COM1 as RS-232 I/O

When you have completed developing your application and programmed the PC Microcontroller, you can use COM1 as a standard RS-232 serial port for connection to a printer, modem, or other serial device. COM1 as a standard RS-232 serial port is configured at port address 3F8H. To access COM1 as standard RS-232, configure your serial port for your application or add a video card and monitor to your PC Microcontroller system. Use COM1CON.EXE to return to the serial port for console operation. Refer to the COM1CON.EXE support command in the *Software utilities* appendix.

Use a VTC-9F cable to connect the ports to external serial equipment. The pinout of the connector allows you to plug the cable directly into a 9-pin PC serial connector.

≡ Using QuickBASIC to communicate via COM1

Several programming languages including QuickBASIC assume a video card is present, and for system speed reasons write directly to the video hardware. Assuming that a video card is present can be a problem since many control applications require video output. The following discussion is directed at QuickBASIC, but the principles (not accessing the print routines which access the video memory directly) apply to many languages. There are several ways to use COM1 from QuickBASIC.

Systems with a video card

Add a video card to the system and open/close COM1 using the QuickBASIC OPEN/CLOSE commands.

Systems without a video card

WARNING!

The system will lock up if you use commands such as PRINT or PRINT USING. Because QuickBASIC writes directly to video memory, these commands are usually displayed on a monitor.

Method 1

The system display will not appear over COM1 while the BIOS boots.

1. Run SETUP to disable the "COM1 as console" option.
2. Use QuickBASIC's OPEN/CLOSE/PRINT/INPUT commands to access COM1. The following is an example program using these commands:

```
OPEN "COM1:9600,N,8,1,BIN" FOR RANDOM AS #1
CRLF$=CHR$(13)+CHR$(10)
PRINT #1, "INPUT A STRING" + CRLF$
INPUT #1, A$
PRINT #1, CRLF$ + A$
CLOSE #1
```

Note All PRINT/PRINT USING/INPUT . . . commands **must** use the COM*x* device number, where *x* represents the COM port used.

Method 2

1. Run SETUP to enable the "COM1 as console" option.
2. Use QuickBASIC's OPEN/CLOSE/PRINT/INPUT commands to access COM1. After closing the device, manually restore the serial parameters. The following example assumes 9600, N, 8, and 1 parameters:

```
OPEN"COM1:9600,N,8,1,BIN" FOR RANDOM AS #1
CRLF$ = CHR$(13) + CHR$(10)
PRINT #1, "INPUT A STRING" + CRLF$
INPUT #1, A$
PRINT #1, CRLF$ + A$
CLOSE #1
```

Note All PRINT/PRINT USING/INPUT . . . commands **must** use the COM1 device number.

3. Restore the serial parameters by using a batch file specifying your program's name as the first line of the file and COM1CON as the last line of the file.

   For example, TEST.BAT may include the following to execute a user application named USECOM1:

```
USECOM1
COM1CON
```

   Execute TEST.BAT.

   COM1 will be used as a communication port by USECOM1, then COM1 is restored to a console port by COM1CON.

Note COM1CON is located on the PC Microcontroller utility disk.

Method 3

1. Run SETUP to enable the "COM1 as console" option.
2. Use the PRINTS, PRINTSL, KEYHIT$, INKEY2$ commands as found in the DEMO.BAS and DSQBTEST.BAS programs (included on the PC Microcontroller utility disk). Unformatted string output and string input must be done manually.

Note Programs written in this manner will also work with a video card present and therefore systems can be "debugged" on your PC.

Method 4

1. Use an off-the-shelf communications library.
2. This may require restoring the COM1 parameters similar to Method 2, if the console video is expected after the QuickBASIC program terminates.

Method 5

1. Use COM2 instead of COM1. This is similar to Method 1, but you will still get the system displays over COM1.

Using Turbo C

If you need to restore the serial parameters after executing a C program, refer to the file COMTEST.CPP. This file can be downloaded from the Octagon Bulletin Board at (303) 427-5368 using 14400 baud, 8 data bits, no parity, and 1 stop bit.

≡ COM2

Operation

There are two modes of operations for COM2:

- PC mode
- Network mode

The "N" position at W1 distinguishes the COM2 mode on powerup. PC mode ("N" position at W1 jumpered, default) configures COM2 as a standard RS-232 port. Network mode ("N" position at W1 not jumpered) configures COM2 to communicate at 38.4 KB, respond to Optomux type commands, respond to Octagon commands, and automatically perform network housekeeping functions.

PC mode/network mode

On powerup, the BIOS extension reads the "N" position at W1 to determine which COM2 mode to select.

Table 5-2 COM2 mode select

"N" position at W1	Mode	Description
Jumpered	PC mode	Use default configuration for COM2 of 2400 baud, 8 data bits, 1 stop bit, and no parity.
Not jumpered	Network mode	Install IRQ3 vector.
		Change default baud rate to 38.4 KB.
		Read serial EEPROM bytes 120h,121h to determine if an ID has been previously established. If it has, use the existing ID, if not, use FFh.
		Discard messages addressed to other nodes. Selectively respond to messages addressed to node.
		Await INT 17H BIOS calls to collect messages.

COM2 as RS-232 I/O

COM2 is a standard RS-232 serial port, default configured at port address 2F8H.

The "N" position at W1 distinguishes the COM2 mode on powerup. PC mode ("N" position at W1 jumpered, default) configures COM2 as a standard RS-232 port.

COM2 as RS-422/485

The PC Microcontrollers feature a predefined, easy-to-use software interface for using COM2 as an RS-422/485 port. This software interface supports Optomux type message-passing as well as additional Octagon messages. Up to 32 nodes are supported at a default baud rate of 38.4 KB. This built-in feature provides a simple, low cost, and effective method of rapidly implementing an RS-422/485 network. An Octagon network interface module and an opto-isolated RS-232 to RS-422/485 converter (Octagon P/N 4820), is required to convert RS-232 signals to RS-422/485.

Network mode ("N" position at W1 not jumpered) configures COM2 to communicate at 38.4 KB, respond to Optomux type commands, respond to Octagon commands and automatically perform network housekeeping functions.

Up to 32 nodes with valid ID range from 0 to FF are supported. ID 0 is reserved for the host. ID FF is reserved for a new node that connects to the network and has not yet been assigned an ID.

Both input and output ring buffer size is 2 KB.

Host/remotes

An application may implement a node as either the "host" node or as a "remote" node in an RS-422/485 network. There can be up to 32 nodes without any bus repeaters in the network. A "host" is referred to as the node that initiates a communication; while a "remote" is referred to as a node that is addressed by the host.

The host is responsible for initiating communication, maintaining network registration, and providing housekeeping tasks with other nodes. There can only be one network host.

Remotes cannot initiate a communication. They can only respond to messages that are addressed to them from the host.

While there can be many remotes, all remotes initially respond to FFh as the ID before the ID is assigned or recognized by the host. To avoid conflict, **only one** new node at a time shall be added to the network. Other unregistered nodes must not be powered up while the new node is being registered. This allows assigning each node a unique node ID. Once a node has been added to the network and its ID stored in serial EEPROM, any node can thereafter attach to the network in any powerup sequence. Periodically, the host shall try to communicate to all the existing nodes in the network, plus the potential new node with the ID FFh.

Network interface module (NIM)

The Octagon network interface module (NIM) is designed for easy installation onto COM2 of the PC Microcontrollers. The NIM supports four-wire RS-422 and two-wire RS-485 configurations. Power is supplied to the NIM via the COM2 connector on the PC Microcontroller. For more information about the network interface module, see the *NIM product sheet*.

Note The network interface module is not compatible with the 6010 model.

Figure 5-1 Network interface module RS-485 two-wire example

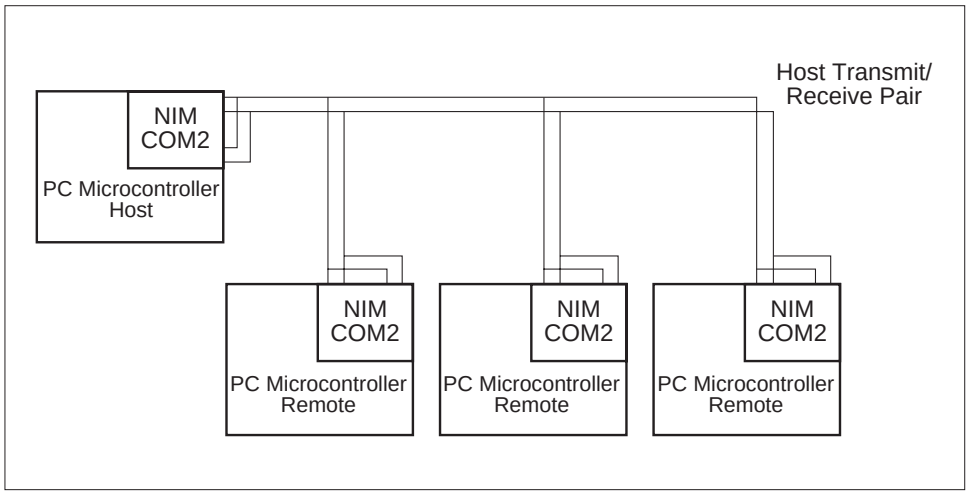
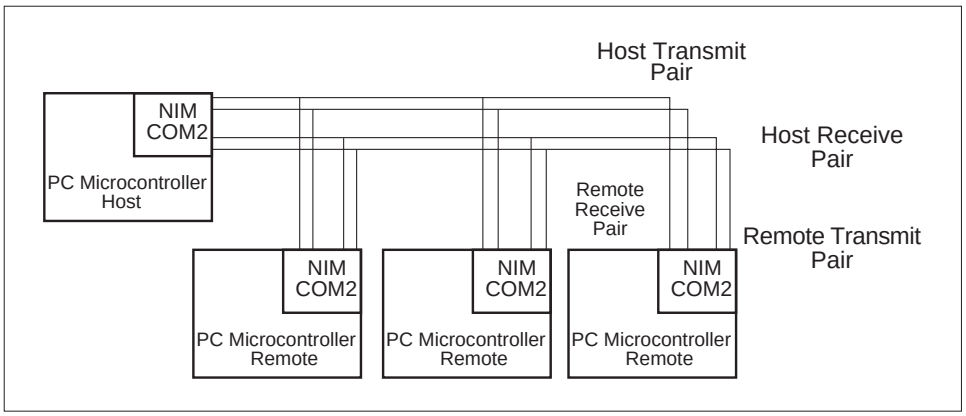


Figure 5-2 Network interface module RS-422 four-wire example



Refer to Octagon application notes *AN-0047*, *AN-0048*, and *AN-0049* for additional information in setting up an RS-485 network. Contact Octagon Systems Technical Support , Customer Service, or Octagon's web site at www.octagonsystems.com for this information.

RS-422/485 support functions

This section provides definitions for the following INT 17h BIOS routine functions pertinent to RS-422/485 support functions.

- Initialization
- Send message
- Receive message

- Get receiver status
- Get transmitter status
- Get ID
- Set ID
- Get incoming message buffer pointer
- Get outgoing message buffer pointer
- Set incoming message buffer pointer
- Set outgoing message buffer pointer
- Set roll call response
- Set state wish response
- Set internal state response

Function 00 – Initialization

On entry: AH = 0FAh = RS-485 function signature
AL = 00h = RS-485 sub-function
DX = 0ffffh
On exit: AL = status = 0 -> ok
= Not 0 -> error

Function 01 – Send message

On entry: AH = 0FAh = RS-485 function signature
AL = 01h = RS-485 sub-function
DX = 0ffffh
ES:BX = Transmit buffer pointer
On exit: AL = status = 0 -> ok
= Not 0 -> error

Function 02 – Receive message

On entry: AH = 0FAh = RS-485 function signature
AL = 02h = RS-485 sub-function
DX = 0ffffh
ES:BX = Receive buffer pointer
On exit: AL = status = 0 -> message available
= Not 0 -> message not collected yet

Function 05 – Get receiver status

On entry: AH = 0FAh = RS-485 function signature
AL = 05h = RS-485 sub-function
DX = 0ffffh
On exit: AX = incoming message status
BX = incoming message count

Function 06 – Get transmitter status

On entry: AH = 0FAh = RS-485 function signature
AL = 06h = RS-485 sub-function
DX = 0ffffh
On exit: AX = outgoing message status
BX = outgoing message count

Function 07 – Get ID

On entry: AH = 0FAh = RS-485 function signature
AL = 07h = RS-485 sub-function
DX = 0ffffh
On exit: AX = our current ID

Function 08 – Set ID

On entry: AH = 0FAh = RS-485 function signature
AL = 08h = RS-485 sub-function
BX = desirable ID
DX = 0ffffh
On exit: AL = status = 0 -> ok
=Not 0 -> error

Function 09 – Get incoming message buffer pointer

On entry: AH = 0FAh = RS-485 function signature
AL = 09h = RS-485 sub-function
DX = 0ffffh
On exit: ES:BX = incoming message buffer pointer

Function 0a – Get outgoing message buffer pointer

On entry: AH = 0FAh = RS-485 function signature
AL = 0Ah = RS-485 sub-function
DX = 0ffffh
On exit: ES:BX = outgoing message buffer pointer

Function 0b – Set incoming message buffer pointer

On entry: AH = 0FAh = RS-485 function signature
AL = 0Bh = RS-485 sub-function
DX = 0ffffh
ES:BX = incoming message buffer pointer
On exit: AL = status = 0 -> ok
= Not -> error

Function 0c – Set outgoing message buffer pointer

On entry: AH = 0FAh = RS-485 function signature
AL = 0Ch = RS-485 sub-function
DX = 0ffffh
ES:BX = outgoing message buffer pointer
On exit: AL = status = 0 -> ok
= Not -> error

Function 0d – Set roll call response

On entry: AH = 0FAh = RS-485 function signature
AL = 0Dh = RS-485 sub-function
DX = 0ffffh
BX = roll call response code
(See roll call reply message format)
On exit: AL = status = 0 -> ok
= Not -> error

Function 0e – Set state wish response

On entry: AH = 0FAh = RS-485 function signature
AL = 0Eh = RS-485 sub-function
DX = 0ffffh
BX = state wish response code
(See state wish reply message format)
On exit: AL = status = 0 -> ok
= Not -> error

Function 0f – Set internal state response

On entry: AH = 0FAh = RS-485 function signature
AL = 0Fh = RS-485 sub-function
DX = 0ffffh
BX = internal state response code
(See internal state reply message format)
On exit: AL = status = 0 -> ok
= Not -> error

Octagon's command set

This section provides definitions for the following Octagon RS-485 network commands:

Table 5-3 Definitions list for Octagon RS-485 network commands

From host	From remote
Roll Call (Are you there?) **>zzA**.**	Reply to Roll Call **>00Zxxyy**.** xx=my ID yy=status=00->doing fine, no request =01->ask for ID request =02->tell me to disconnect =03->ask for internal state
State Wish (What ID do you want?) **>zzB**.**	Reply to State Wish **>00Yxxzz**.** xx=my existing ID zz=new ID I want to be
Assign ID (Your new ID is xx.) **>zzCnn**.**	Reply to Assign ID **>00Xxxzz**.** xx=my existing ID zz=my new ID
Report State (Report internal state.) **>zzD**.**	Reply to Report State **>00Wxxyy**.** xx=my ID yy=user defined state response

> = start character
zz = intended listener's ID field
** = checksum field
. = end message character

Checksum field

The checksum field of Octagon's command set is computed by adding the ID field to the original Optomux type checksum. Note that by providing the checksum in this way, Optomux type equipment treats Octagon's add-on commands as invalid messages while Octagon's equipment gains a unique set of commands.

Examples

Full C code examples are included in the \EXAMPLES directory on the PC Microcontroller utility disk. The following examples are for concept only.

Example 1:

The following is a description of how Roll Call is implemented:

Host sends: (Dear node #1, are you there?)

```
>01AA3.
;>          ;message start character
; 01         ;intended listener is ID 01
;   A        ;command code A (roll call)
;     A3     ;checksum = uchar ('0'+'1'+'A'+0x01) = 0xA3
;        .   ;message end character
```

Remote replies: (Dear 00: 01 is here. I have no special request.)

```
>00Z01007B.
;>          ;message start character
; 00         ;intended listener is ID 00 (host)
;   Z        ;command code Z (reply to roll call)
;     01     ;01 = my ID
;       00   ;00 = status = no special request
;         7B;checksum = uchar ('0'+'0'+'Z' +'0'+'1' +'0'+'0') = 0x7B
;            .;message end character
```

Host sends: (Dear node #2, are you there?)

```
>02AA5.
;>          ;message start character
; 02         ;intended listener is ID 02
;   A        ;command code A (roll call)
;     A5     ;checksum = uchar ('0'+'2'+'A'+0x02) = 0xA5
;        .   ;message end character
```

Remote replies: (Dear 00: 02 is here. I have no special request.)

```
>00Z02007C.
;>          ;message start character
; 00         ;intended listener is ID 00 (host)
;   Z        ;command code Z (reply to roll call)
;     02     ;02 = my ID
;       00   ;00 = status = no special request
;         7C;checksum = uchar ('0'+'0'+'Z' +'0'+'2' +'0'+'0') = 0x7C
;            .;message end character
```

The host continues with the roll call until all nodes have been queried. Not all of the 32 possible nodes need to be queried, only the known nodes. When the last known node has been queried, then the host queries for an unknown node.

Host sends: (Dear FF, are you there?)

```
>FFACC.
;>              ;message start character
;  FF           ;intended listener is ID FF
;     A         ;command code A (roll call)
;       CC      ;checksum = uchar ('F'+'F'+'A'+0xff) = 0xCC
;          .    ;message end character
```

Remote replies: (Dear 00: FF is here. I have no special request.)

```
>00ZFF00A6.
;>              ;message start character
; 00             ;intended listener is ID 00 (host)
;    Z          ;command code Z (reply to roll call)
;      FF       ;FF = my ID
;         00    ;00 = status = no special request
;            A6;checksum = uchar ('0'+'0'+'Z' +'F'+'F' +'0'+'0') = 0xA6
;               .;message end character
```

Example 2:

The following is a description of how an ID can be assigned to a new remote node:

Host sends: (Dear FF: are you there?)

>FFACC.

```
; >              ;message start character
;   FF           ;intended listener is ID FF
;      A         ;command code A (roll call)
;        CC      ;checksum = uchar ('F'+'F'+'A'+0xff) = 0xCC
;           .    ;message end character
```

Remote replies: (Dear 00: FF is here. I have no special request.)

>00ZFF00A6.

```
; >                ;message start character
;  00              ;intended listener is ID 00 (host)
;     Z            ;command code Z (reply to roll call)
;       FF         ;FF = my ID
;          00      ;00 = status = no special request
;             A6 ;checksum  = uchar ('0'+'0'+'Z'+'F'+'F'+'0'+'0') = 0xA6
;                .;message end character
```

Host sends: (Dear FF: your new ID shall be 05.)

>FFC0533.

```
; >              ;message start character
;  FF            ;intended listener is ID FF
;     C          ;command code C (assign ID)
;       05       ;new ID
;          33 ;checksum = uchar ('F'+'F'+'C'+'0'+'5'+0xff)= 0x33
;             .;message end character
```

Remote replies: (Dear 00: FF acknowledges my new ID to be 05.)

```
 >00XFF05A9.
; >              ;message start character
;  00            ;intended listener is ID 00 (host)
;    X           ;command code X (reply to assign ID)
;      FF        ;FF = my ID
;        05      ;05 = my new ID
;          A9;checksum = uchar ('0'+'0'+'X'+'F'+'F'+'0'+'5') = 0xA9
;            . ;message end character
```

Example 3:

The following is a description of how a remote (of ID 02) can notify the host of a state change:

1. The application program sets internal state using INT 17h function 0fh.
2. The application program sets roll call reply status to 03 (ask for Report).
3. Since a remote cannot initiate a communication, it must wait until it is spoken to at this point.

Host sends: (Dear 02: are you there?)

```
 >02AA5.
; >            ;message start character
;  02          ;intended listener is ID 02
;    A         ;command code A (roll call)
;      A5      ;checksum = uchar ('0'+'2'+'A'+0x02) = 0xA5
;        .     ;message end character
```

Remote replies: (Dear 00: 02 is here. Ask for my internal state.)

```
 >00Z02031F.
; >            ;message start character
;  00          ;intended listener is ID 00 (host)
;    Z         ;command code Z (reply to roll call)
;      02      ;02 = my ID
;        03    ;03 = status = Ask for a report of internal state
;          1F;checksum = uchar ('0'+'0'+'Z'+'0'+'2'+'0'+'3') = 0x1F
;            .;message end character
```

Host sends: (Dear 02: What is your internal state?)

```
 >02DA8.
; >            ;message start character
;  02          ;intended listener is ID 02
;    D         ;command code D (Internal state query)
;      A8      ;checksum = uchar ('0'+'2'+'D'+0x02) = 0xA8
;        .     ;message end character
```

Remote replies: (Dear 00: 02 internal state = 47.)
>00W024784.

```
; >           ;message start character
;  00         ;intended listener is ID 00 (host)
;     W       ;command code W (reply to internal state query)
;       02    ;02 = my ID
;         47  ;47 = my internal state
;            84;checksum = uchar ('0'+'0'+'W'+'0'+'2'+'4'+'7') = 0x84
;               .;message end character
```

The application program interprets the message and then responds accordingly. In this case, state 47 would have been defined in the host application as a specific response from a Remote with a user-defined meaning.

≡ 6030

COM3/COM4

The 6030 PC Microcontroller has two additional serial ports. COM3 uses IRQ12 at I/O address 3E8H. COM4 uses IRQ11 at I/O address 2E8H. Both COM ports have 4 RS-232 signals available: RxD, TxD, RTS, and CTS. DTR is pulled high. Refer to the *6030 technical data* appendix for pinout information.

Chapter 6: EZ I/O

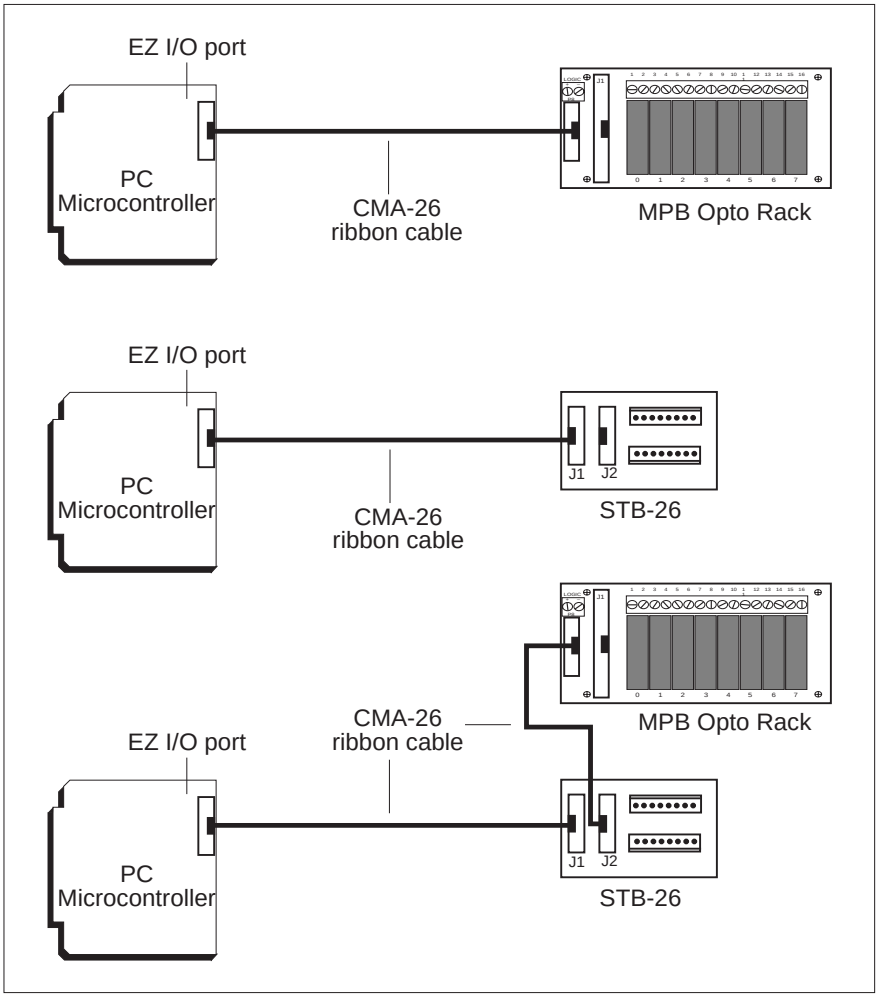
Note EZ I/O is available on the 6020, 6040, and 6050 PC Microcontrollers.

≡ Digital I/O lines

Several PC Microcontroller models feature the Octagon EZ I/O digital I/O chip. Each EZ I/O chip supplies 24 I/O lines which can be individually programmed as 5V input or 5V output. Each line can sink or source 15 mA.

EZ I/O lines can be used to sense switch closures, turn on lamps and LEDs, and interface with other devices that have TTL input or output such as printers and scales. The EZ I/O port can drive the Octagon MPB series opto-isolation module racks directly, controlling AC and DC loads to 240V at 3A. CAMBASIC has several commands to support the EZ I/O port when working on bit, BCD, byte or word bases. Figure 6-1 shows typical EZ I/O configurations.

Figure 6-1 Typical EZ I/O configurations



WARNING!

Apply power to the PC Microcontroller before applying an input voltage to the digital I/O lines. This prevents excessive currents from flowing and damaging input devices.

The following chart specifies PC Microcontroller cards with EZ I/O capability.

Table 6-1 PC Microcontrollers with EZ I/O

PC Microcontroller model	6010	6020	6030	6040	6050
Number of EZ I/O chips	none	2	none	1	1
EZ I/O digital lines	—	48	—	24	24
High current drivers	—	—	—	—	8

EZ I/O is located at the J1 connector for the 6020, 6040, and 6050. An additional EZ I/O port is located at J7 on the 6020. Refer to the product-specific appendix for its associated jumper setting. Each EZ I/O connector is configured below:

Table 6-2 EZ I/O connector: J1 (6020, 6040, 6050) and J7 (6020 only)

Pin	Function	Pin	Function	Pin	Function
	Port A		**Port B***		**Port C**
19	bit 0	10	bit 0	13	bit 0
21	bit 1	8	bit 1	16	bit 1
23	bit 2	4	bit 2	15	bit 2
25	bit 3	6	bit 3	17	bit 3
24	bit 4	1	bit 4	14	bit 4
22	bit 5	3	bit 5	11	bit 5
20	bit 6	5	bit 6	12	bit 6
18	bit 7	7	bit 7	9	bit 7
2	+5 VDC Safe				
26	Gnd				

*Port B can only be configured as output on the 6050. The output level is inverted from input. This is due to the inverted-output, high-current driver used on the 6050. Consider these factors when using and programming this port.

≡ Model 6020

Each EZ I/O port has 24 I/O lines available, which makes a total of 48 lines. The 24 I/O lines are divided into three groups of 8 with 10K resistors that can be connected to ground or +5V. Each of the 48 lines

can be individually programmed as 5V input or 5V output. Each line can sink or source 15 mA.

6020 — Pulling the I/O lines high or low

Jumper block W3 pulls ports A, B, and C of EZ I/O 1 high or low.
Jumper block W4 pulls ports A, B, and C of EZ I/O 2 high or low.

Note For the location of W3 and W4, refer to the component diagram in the *6020 technical data* appendix.

Table 6-3 6020 pull-down/pull-up EZ I/O configuration

Configuration	Description
W3[2-4]	All lines in Port A are pulled to Gnd through 10K Ohm
W3[4-6]*	All lines in Port A are pulled to +5V through 10K Ohm
W3[7-9]	All lines in Port B are pulled to Gnd through 10K Ohm
W3[7-8]*	All lines in Port B are pulled to +5V through 10K Ohm
W3[1-3]	All lines in Port C are pulled to Gnd through 10K Ohm
W3[3-5]*	All lines in Port C are pulled to +5V through 10K Ohm

* = default, pins jumpered

Table 6-4 6020 pull-up/pull-down EZ I/O 2 configuration

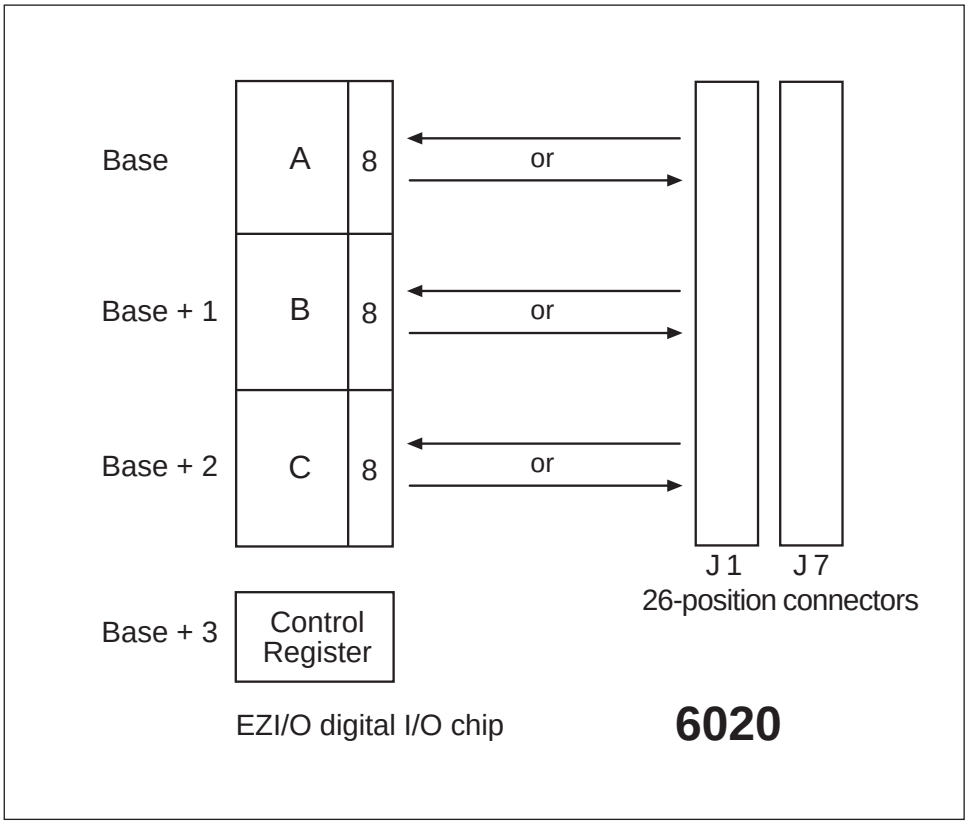
Configuration	Description
W4[2-4]	All lines in Port A are pulled to Gnd through 10K Ohm
W4[4-6]*	All lines in Port A are pulled to +5V through 10K Ohm
W4[7-9]	All lines in Port B are pulled to Gnd through 10K Ohm
W4[7-8]*	All lines in Port B are pulled to +5V through 10K Ohm
W4[1-3]	All lines in Port C are pulled to Gnd through 10K Ohm
W4[3-5]*	All lines in Port C are pulled to +5V through 10K Ohm

* = default, pins jumpered

6020 — Organization of ports

The two EZ I/O digital ports have 24 I/O lines connected to J1 and 24 lines connected to J7. Each of the 24 lines are configured into three groups consisting of 8 lines each. Any of the lines at ports A, B, or C can be configured individually as inputs or outputs. Immediately after reset, each I/O line becomes an input.

Figure 6-2 Location of EZ I/O in the 6020



See Table 6-9 for the 6020 EZ I/O base address selection.

≡ Model 6040

The 24 I/O lines are divided into three groups of 8 with 10K resistors that can be connected to ground or +5V. The 24 I/O lines can be individually programmed as 5V input or 5V output. Each line can sink or source 15 mA.

6040 — Pulling the I/O lines high or low

Jumper block W2 pulls ports A and C high or low. Likewise, jumper block W4 pulls port B high or low. The default pulls all of the I/O lines high.

Note For the location of W2 and W4, refer to the component diagram in the *6040 technical data* appendix.

Table 6-5 Pull-up/pull-down EZ I/O: 6040

Configuration	Description
W2[2-4]*	All lines in Port A are pulled to +5V through 10K Ohm
W2[4-6]	All lines in Port A are pulled to Gnd through 10K Ohm
W4[1-2]*	All lines in Port B are pulled to +5V through 10K Ohm
W4[1-3]	All lines in Port B are pulled to Gnd through 10K Ohm
W2[1-3]*	All lines in Port C are pulled to +5V through 10K Ohm
W2[3-5]	All lines in Port C are pulled to Gnd through 10K Ohm

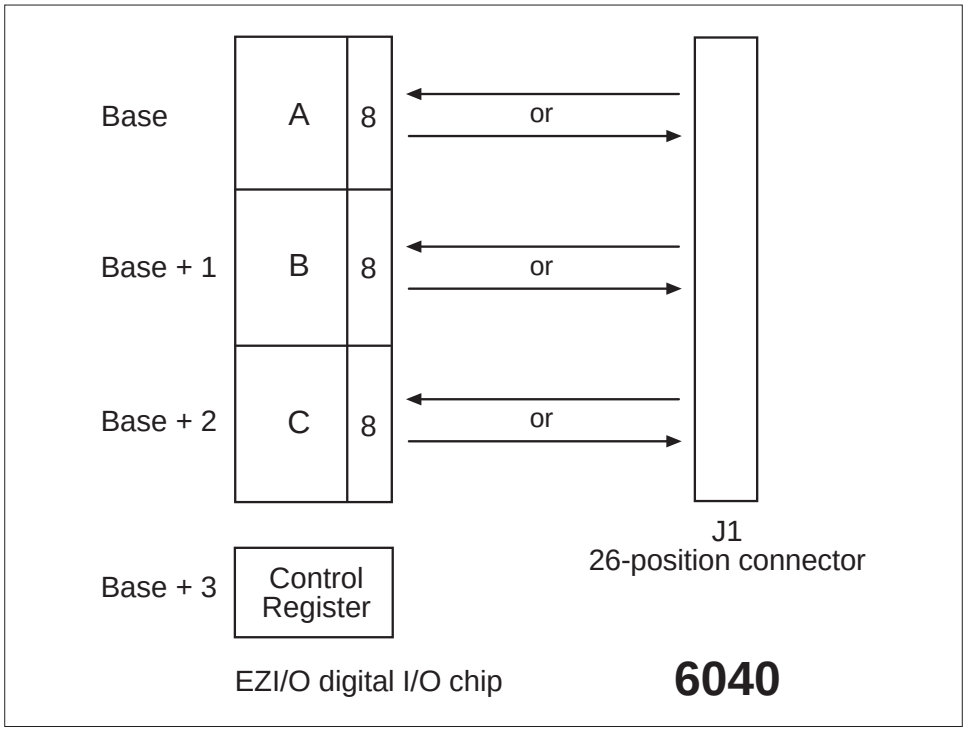
*=default, pins jumpered

6040 — Organization of ports

The EZ I/O digital port has a total of 24 I/O lines connected to J1. The lines are configured into three groups: ports A, B and C, each group consisting of 8 bits. Any of the lines at ports A, B or C can be configured individually as inputs or outputs. Immediately after a reset, each I/O line becomes an input.

Note For the location of J1, refer to the component diagram in the *6040 technical data* appendix.

Figure 6-3 Location of EZ I/O in the 6040



See Table 6-10 for the 6040 EZ I/O base address selection.

≡ Model 6050

Sixteen of the 24 lines can be individually programmed as inputs or outputs. These are divided into two groups of 8 lines with 10K resistors that can be pulled to ground or +5V. As output lines, they can sink and source 15 mA.

The remaining 8 lines are dedicated high current outputs, using a ULN2804 high current Darlington array. The outputs are open collectors and are capable of driving loads up to 100 mA at 50V.

6050 — Pulling the I/O lines high or low

Jumper block W2 pulls the I/O lines at ports A and C high or low. The default pulls all of the I/O lines high.

Note For the location of W2, refer to the component diagram in the *6050 technical data* appendix.

Table 6-6 6050 pull-up/pull-down EZ I/O

Configuration	Description
W2[2–4]*	All lines in Port A are pulled to +5V through 10K Ohm
W2[4–6]	All lines in Port A are pulled to Gnd through 10K Ohm
W2[1–3]*	All lines in Port C are pulled to +5V through 10K Ohm
W2[3–5]	All lines in Port C are pulled to Gnd through 10K Ohm

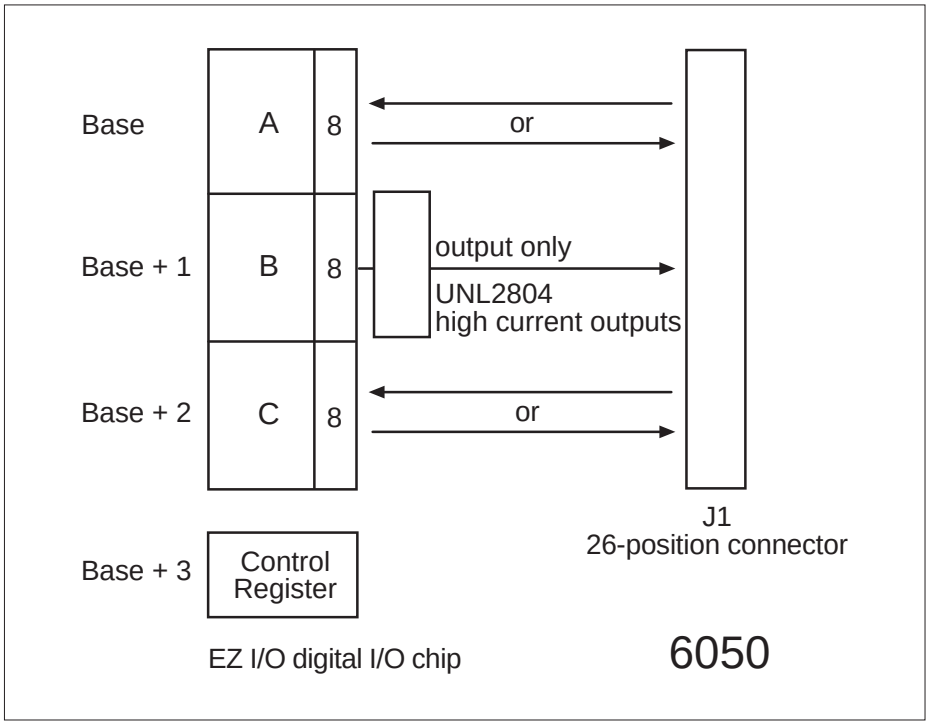
* = default, pins jumpered

Note Port B of model 6050 is dedicated as a high current output port and is not affected by the position of W2.

6050 — Organization of ports

The EZ I/O digital port has a total of 24 I/O lines connected to J1. The lines are configured into three groups: port A, port B, and port C, each consisting of 8 bits. Any of the lines at ports A or C can be configured individually as inputs or outputs. Port B is dedicated as the high current port and can only be configured as outputs. Immediately after a reset, each I/O line on ports A and C becomes an input, and port B drivers are off.

Figure 6-4 Location of EZ I/O in the 6050



See Table 6-10 for the 6050 EZ I/O base address selection.

Note For the location of J1, refer to the component diagram in the *6050 technical data* appendix.

6050 high current port

The high current port is used as dedicated outputs to drive relays, LEDs, solenoids, and similar devices. The port includes eight I/O lines at J1, port B. These outputs switch loads to ground.

On powerup, all high current driver inputs are pulled LOW. This forces all high current outputs OFF. The user program must configure port B as outputs and then control the state of each bit of the port. The outputs of port B are inverted. A written logic 1 switches the current driver to ON and switches current to ground. A written logic 0 opens the switch and the outputs are pulled high.

Note When ON, the saturation voltages are incompatible with TTL logic levels and should not be used to drive other logic devices.

Considerations for high current outputs

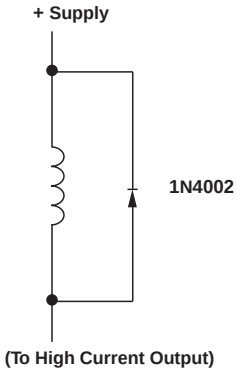
- Each of the high current outputs can sink 500 mA at 50V. However, the package dissipation will be exceeded if all outputs are used at the maximum rating. The following conservative guidelines assume the number of outputs are on simultaneously. The following derating is based upon an ambient temperature of 70° C.

Table 6-7 6050 high current outputs

# of Outputs	Max current per output
1	500 mA
2	410 mA
3	310 mA
4	260 mA
5	210 mA
6	190 mA
7	160 mA
8	150 mA

- Since the thermal time constant of the package is very short, the number of outputs that are on at any one time should include those that overlap even for a few milliseconds.
- Incandescent lamps have a "cold" current of 11 times that of their "hot" current. It is recommended that lamps requiring more than 50 mA not be used.
- When inductive loads are used, protection diodes or other schemes must be used. Refer to Figure 6-4.

Figure 6-5 Inductive load protection circuitry

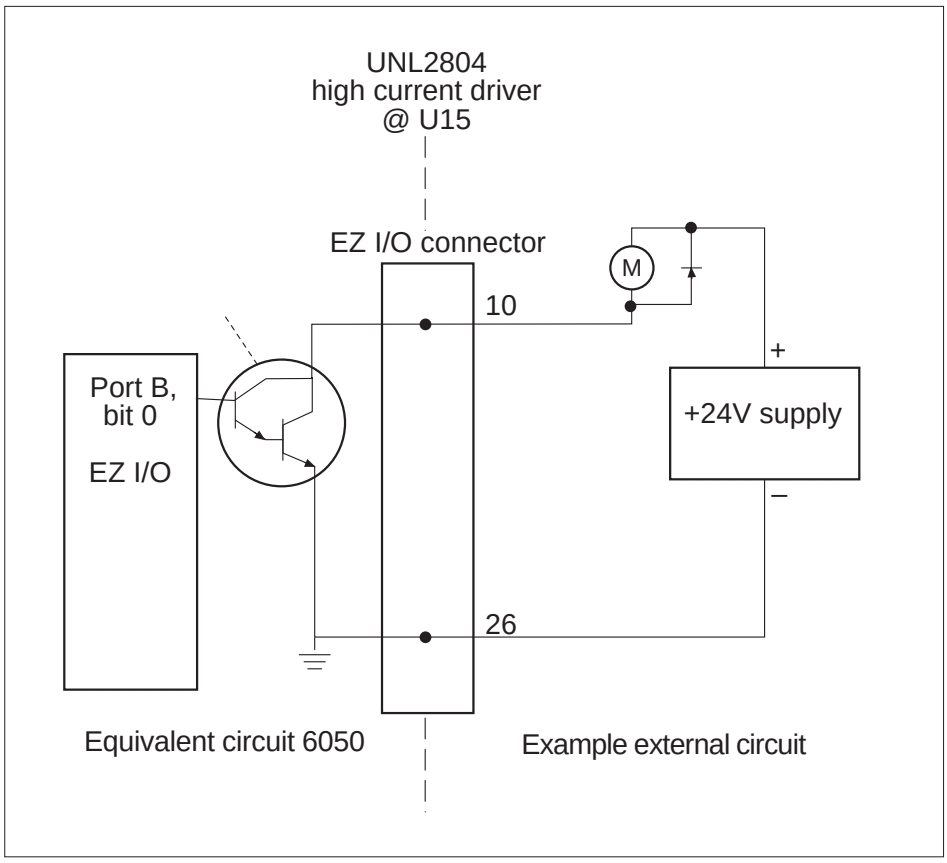


- Configuring outputs in parallel for higher drive is NOT recommended and could result in damage since the outputs will not share current equally.

WARNING!

If external devices, such as 24 VDC relays, are driven, the ground of the external 24V supply must be connected to J1, pin 26 and NOT the power ground. Failure to do so will produce aground loop within the PC Microcontroller and can cause erratic operation.

Figure 6-6 High current output hookup



≡ Opto-module rack interface

You can interface digital I/O lines to an 8-, 16-, or 24-position opto-

module rack. One end of the CMA-26 cable plugs into the EZ I/O connector and the other plugs into an MPB-8, MPB-16, or MPB-24 opto rack. Refer to the *MPB opto racks product sheet* for more information.

You can also use a CMA-26 cable to connect the EZ I/O port to an STB-26 terminal board and then to the opto rack. The STB-26 has two 26-pin connectors, one of which connects to the EZ I/O port, the other connects to the opto rack.

For either configuration, run a separate power line to +5V and ground on the opto rack.

Figure 6-7 Opto rack hookup

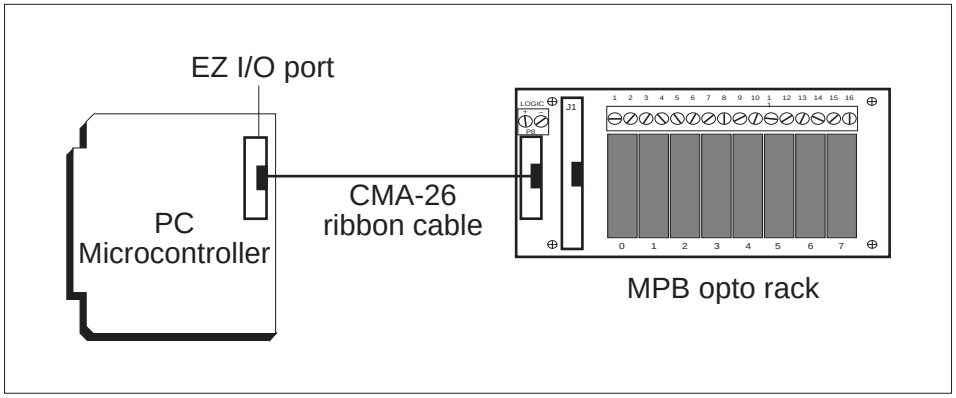
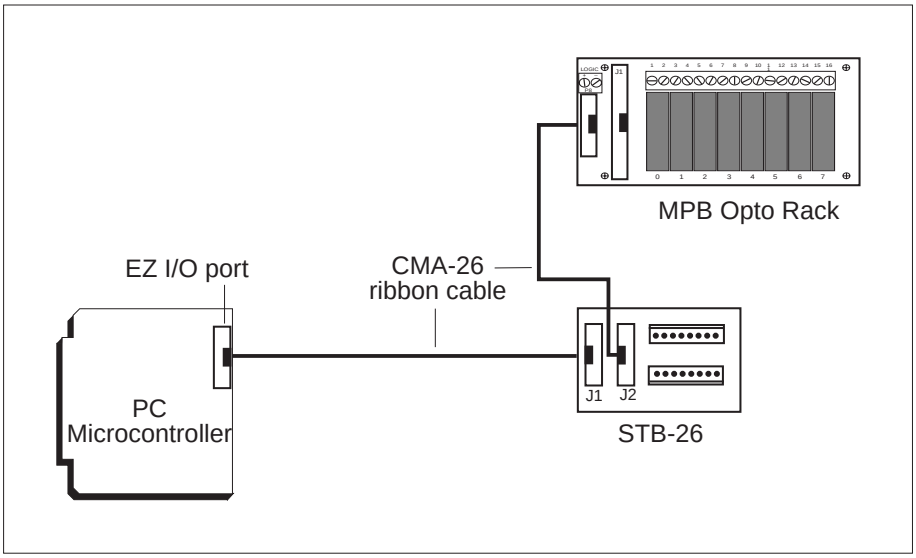


Figure 6-8 Optional EZ I/O opto rack configuration



Use the following table to determine the corresponding opto channel for a particular port:

Table 6-8 EZ I/O opto-rack interface

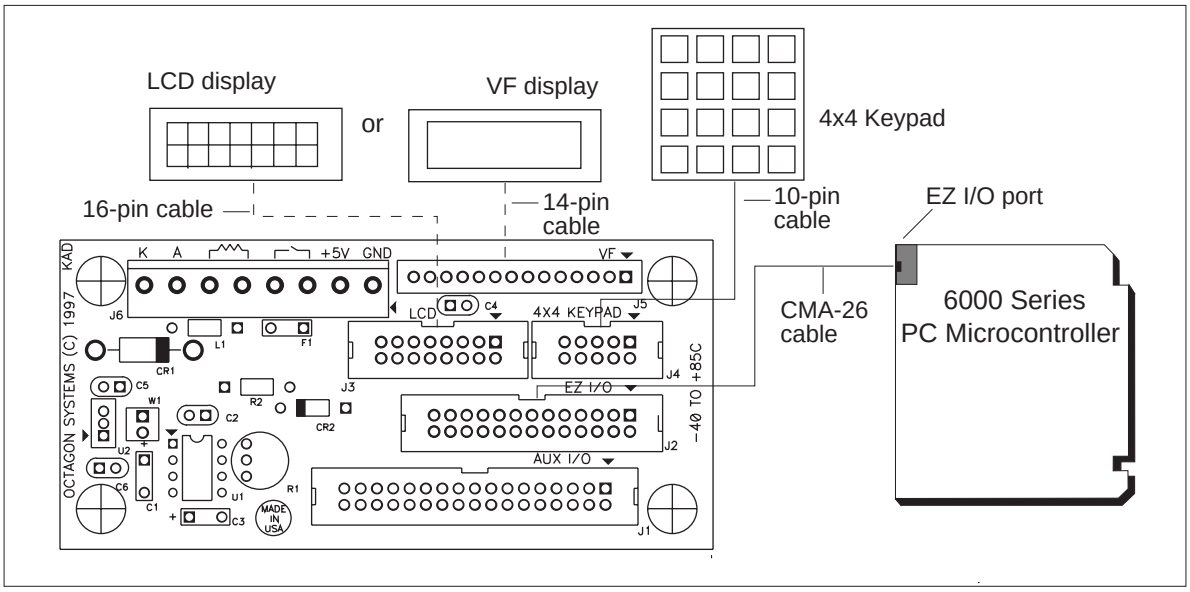
MPB opto rack		EZ I/O port	Connector pin
Opto–module position		**Port C**	
0		bit 0	13
1		bit 1	16
2		bit 2	15
3	**MPB–08**	bit 3	17
4		bit 4	14
5		bit 5	11
6		bit 6	12
7		bit 7	9
Opto–module position		**Port A**	
8		bit 0	19
9		bit 1	21
10		bit 2	23
11	**MPB–16**	bit 3	25
12		bit 4	24
13		bit 5	22
14		bit 6	20
15		bit 7	18
Opto–module position		**Port B***	
16		bit 0	10
17		bit 1	8
18		bit 2	4
19	**MPB–24**	bit 3	6
20		bit 4	1
21		bit 5	3
22		bit 6	5
23		bit 7	7

**Note*: Port B on the 6050 can only be used with output opto modules. Also, the output is inverted from the input. Consider these factors when using and programming this port.

≡ Keypad and display interface

Through the EZ I/O port, you may connect a keypad and display board (KAD) to your PC Microcontroller. One end of the CMA-26 cable plugs into the EZ I/O connector on the PC Microcontroller and the other plugs into the KAD. Refer to the *Keypad and display board (KAD)* section in the *AUX I/O* chapter of this manual or refer to the *Keypad and display product sheet* for more information.

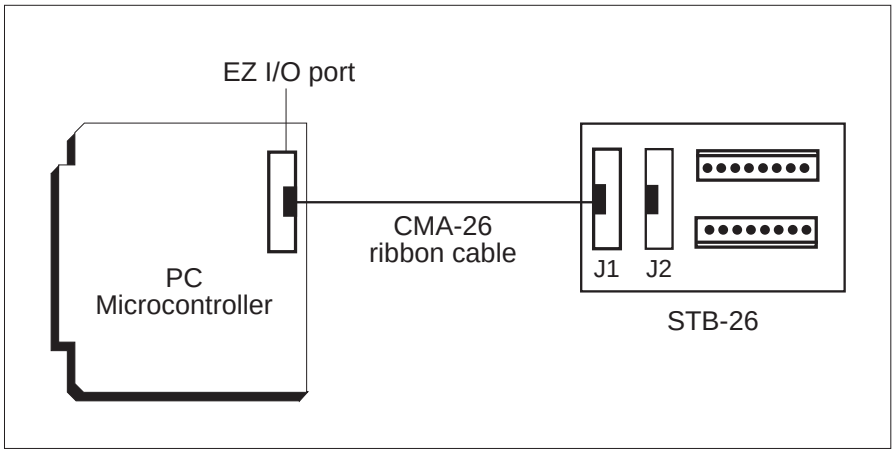
Figure 6-9 Keypad and display board hookup



≡ Interfacing to switches and other devices

The STB-26 terminal board provides a convenient way of interfacing switches or other digital I/O devices to the EZ I/O digital port. I/O lines at the EZ I/O connector can be connected to an STB-26 with a CMA-26 cable. Parallel I/O devices are then connected to the screw terminals on the STB-26. Refer to the *STB-26 product sheet* for more information.

Figure 6-10 PC Microcontroller interfacing with an STB-26



≡ Configuring and programming the EZ I/O ports

On powerup and software or hardware reset, all digital I/O lines are reset as inputs.

Each digital I/O connector has an Octagon EZ I/O digital chip associated with it. Each has three ports with eight parallel I/O lines (bits) per port. The address of the port is determined by jumper settings as follows:

Table 6-9 EZ I/O base address selection: 6020

IA: W2[7-8]	IB: W1[9-10]	J1: EZ I/O 1 address	J7: EZ I/O 2 address	CTC: I/O address	Gate address & bit
not jumpered	not jumpered	320H	328H	330H	0xA8, bit 4
jumpered	not jumpered	120H	128H	130H	0xA8, bit 4
not jumpered	jumpered	340H	348H	350H	0xA8, bit 4
jumpered*	jumpered*	140H*	148H*	150H*	0xA8, bit 4

* = default, pins jumpered

Note Selecting a different EZ I/O address for the 6020 PC Microcontroller also selects a different I/O address for the CTC (Counter Timer Controller). For information on the CTC, refer to the *Description* section in the *Counter timer controller c*hapter.

Table 6-10 EZ I/O base address selection: 6040 and 6050

IA: W2[7-8]	IB: W1[9-10]	I/O address: J1
not jumpered	not jumpered	320H
jumpered	not jumpered	120H
not jumpered	jumpered	340H
jumpered*	jumpered*	140H*

* = default, pins jumpered

On the 6040 PC Microcontroller, ports A, B and C can be programmed as all inputs, all outputs or individually as inputs or outputs. On the 6050 PC Microcontroller, port B can only be programmed as outputs, while ports A and C can be programmed as inputs or outputs. You can alter which bits are inputs or outputs by writing a control command to the control register in the EZ I/O. When a line is configured as an output, it can sink a maximum of 15 mA at 0.4V or can source 15 mA at 2.4V.

Table 6-11 EZ I/O port addressing

Port	I/O address
A	Base address
B	Base address + 1*
C	Base address + 2
Control register	Base address + 3

*Port B can only be configured as output on the 6050. The output level is inverted from input. This is due to the inverted-output, high-current driver used on the 6050. Consider these factors when using and programming this port.

Programming EZ I/O

Program the EZ I/O chip as follows:

1. Configure the bit directions.
2. Write to port A, B, or C with the desired level, or read the bit level from the desired port.

Configuring EZ I/O

Configure the EZ I/O chip as follows:

1. Write a "2" to the control register (base address+3). This places the I/O chip into the "direction" mode:

   ```
   OUT 143H, 2    (control register)
   ```

2. Set the direction of each bit. A "0" bit to the corresponding line indicates an output. A "1" bit indicates an input. Each bit corresponds to the equivalent I/O line.

Table 6-12 EZ I/O port byte

EZ I/O port byte								EZ I/O port
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	I/O line
x								7
	x							6
		x						5
			x					4
				x				3
					x			2
						x		1
							x	0

For example, writing 00011100 to port C (base address+2) will configure port C I/O lines 0, 1, 5, 6, and 7 to be inputs and lines 2, 3, and 4 to be outputs:

```
OUT 142H, 1CH  (00011100 binary = 1C  hexadecimal)
```

3. Write a "3" to the control register (base register+3). This places the I/O chip back into "operation" mode:

```
OUT 143H, 3    (control register)
```

Writing and reading from EZ I/O

Writing to or reading from the desired EZ I/O port is accomplished with single program statements:

1. To write a bit pattern to the desired EZ I/O port:

```
OUT 142H, FFH
```

All bits of port C go high; all input bits are unaffected.

2. To read a bit pattern from the desired EZ I/O port:

```
PORTC = INP(142H)
```

The byte read from port C is assigned to variable port C.

EZ I/O output program examples

To configure ports A, B, and C as all outputs, issue the command:

```
OUT 143H, 2     'Direction' Mode
OUT 140H, FFH   'Port A'
OUT 141H, FFH   'Port B'
OUT 142H, FFH   'Port C'
OUT 143H, 3     'Operation' Mode
```

Note With CAMBASIC, you can also accomplish the same configuration and outputs with one statement. Enter:

```
CONFIG EZIO &140, &0, &FF, &0, &FF, &O, &FF
```

Syntax

The CAMBASIC syntax is as follows:
`CONFIG EZIO` *`address, dirA, initA, dirB, initB, dirC, initC`*

Parameters

Parameters are defined as follows:

- *address* specifies the base address of the Octagon EZ I/O parallel I/O device in use.
- *initA*, *initB*, and *initC* specify the logic state of portA, port B, and port C, respectively, when this statement is executed. The value range is 0 to 255.
- *dirA*, *dirB*, and *dirC* are the directions of port A, port B, and port C, respectively. The value 0 of an individual bit specifies output and the value 1 specifies input.

Note Usually, once the chip is configures with the CONFIG EZ IO statement, there is no reason to reconfigure this statement again

Ports A, B, and C will now output all "1"s after issuing the following commands:

```
OUT 140H, FFH  (port A)
OUT 141H, FFH  (port B)
OUT 142H, FFH  (port C)
```

or all "0"s after:

```
OUT 140H, 0    (port A)
OUT 141H, 0    (port B)
OUT 142H, 0    (port C)
```

Note The outputs of port B on model 6050 are inverted due to the ULN2804 high-current Darlington array.

EZ I/O input program examples

To configure ports A and C as inputs and port B as outputs, issue the following command:

```
OUT 143H, 2    'Direction Mode'
OUT 140H, 0
OUT 141H, FF
OUT 142H, 0
OUT 143H, 3    'Operation Mode'
```

To read ports A and C, issue the following commands:

```
PORTA = INP(140H)    (port A)
PORTC = INP(142H)    (port C)
```

Note Port B is used as output on the 6050 PC Microcontroller.

≡ Enhanced INT17H function definitions

This section provides definitions for the following functions: Initialize EZ I/O (1), Write EZ I/O (1), Read EZ I/O (1), Initialize EZ I/O (2), Write EZ I/O (2), and Read EZ I/O (2).

Initialize EZ I/O (1)

Function: efh
Subfunction: 00h

Purpose: To set the directions and to program the initial values of an EZ I/O port.

Calling registers:
AH efh
AL 00h
DI Port A configuration
xxxxxxxx xxxxxxxxB
xxxxxxxx Initial data for port A

		xxxxxxxxB	direction; 1->output, 0->input
	BX	Port B configuration	
		xxxxxxxx xxxxxxxxB	
		xxxxxxxx	Initial data for port B
		xxxxxxxxB	direction; 1->output, 0->input
	CX	Port C configuration	
		xxxxxxxx xxxxxxxxB	
		xxxxxxxx	Initial data for port C
		xxxxxxxxB	direction; 1->output, 0->input
	DX	ffffh	

Return registers: Carry flag cleared if successful

Carry flag set if error
AL Error code

Comments: This function is used to initialize the first EZ I/O (i.e., the EZ I/O that has the lower I/O address when two EZ I/O chips are present on a board) before normal use.

Programming example:

```
/* Inline assembly code for Borland C++ 3.1 */
asm {
  mov ax,0ef00h
  mov di,00ffh /*port A all outputs, init data=all 0's */
  mov bx,55ffh /*port B all outputs, init data=55h*/
  mov cx,0000h /*port C all inputs*
  mov dx,0ffffh
  int 17h
     }
```

Write EZ I/O (1)

Function: efh
Subfunction: 01h

Purpose: To write a value of an EZ I/O port.

Calling registers:	AH	efh	
	AL	01h	
	DI	Port A mask and data	
		xxxxxxxx xxxxxxxxB	
		xxxxxxxx	Mask for port A; 1->bit to be changed
		xxxxxxxxB	Data for port A
	BX	Port B mask and data	
		xxxxxxxx xxxxxxxxB	
		xxxxxxxx	Mask for port B; 1->bit to be changed
		xxxxxxxxB	Data for port B
	CX	Port C mask and data	
		xxxxxxxx xxxxxxxxB	
		xxxxxxxx	Mask for port C; 1->bit to be changed

xxxxxxxxB Data for port C
DX ffffh

Return registers: Carry flag cleared if successful

Carry flag set if error
AL Error code

Comments: This function is used to write to the first EZ I/O (i.e., the EZ I/O that has the lower I/O address when two EZ I/O chips are present on a board).

Programming example:

```
/* Inline assembly code for Borland C++ 3.1 */
asm {
  mov  ax,0ef01h
  mov  di,00ffh /*port A: no change */
  mov  bx,8000h /*port B: bit 7=0, other bits unchanged*/
  mov  cx,0202h /*port C: bit 1=1, other bits unchanged*
  mov  dx,0ffffh
  int  17h
     }
```

Read EZ I/O (1)

Function: efh
Subfunction: 02h

Purpose: To read from an EZ I/O port.

Calling registers: AH efh
AL 02h
DX ffffh

Return registers: Carry flag cleared if successful
AL Port A data
AH Port B data
BL Port C data

Carry flag set if error
AL Error code

Comments: This function is used to read from the first EZ I/O (i.e., the EZ I/O that has the lower I/O address when two EZ I/O chips are present on a board).

Programming example:

```
/* Inline assembly code for Borland C++ 3.1 */
unsigned char aData, bData, cData;
asm {
    mov   ax,0ef02h
    mov   dx,0ffffh
    int   17h
    mov   aData,al
```

```
mov   bData,ah
mov   cData,bl
 }
```

Initialize EZ I/O (2)

Function: efh
Subfunction: 03h

Purpose: To set the directions and to program the initial values of an EZ I/O port.

Calling registers:

AH efh
AL 03h
DI Port A configuration

xxxxxxxx	xxxxxxxxB	
xxxxxxxx		Initial data for port A
	xxxxxxxxB	direction; 1->output, 0->input

BX Port B configuration

xxxxxxxx	xxxxxxxxB	
xxxxxxxx		Initial data for port B
	xxxxxxxxB	direction; 1->output, 0->input

CX Port C configuration

xxxxxxxx	xxxxxxxxB	
xxxxxxxx		Initial data for port C
	xxxxxxxxB	direction; 1->output, 0->input

DX ffffh

Return registers: Carry flag cleared if successful

Carry flag set if error
AL Error code

Comments: This function is used to initialize the second EZ I/O (i.e., the EZ I/O that has the higher I/O address when two EZ I/O chips are present on a board) before normal use.

Programming example:

```
/* Inline assembly code for Borland C++ 3.1 */
asm {
  mov  ax,0ef03h
  mov di,00ffh /*port A all outputs,init data=all 0's */
  mov  bx,55ffh /*port B all outputs, init data=55h*/
  mov  cx,0000h /*port C all inputs*
  mov  dx,0ffffh
  int  17h
     }
```

Write EZ I/O (2)

Function: efh
Subfunction: 04h

Purpose: To write a value to an EZ I/O port.

Calling registers: AH efh
AL 04h
DI Port A mask and data
xxxxxxxx xxxxxxxxB
xxxxxxxx Mask for port A; 1->bit to be changed
xxxxxxxxB Data for port A
BX Port B mask and data
xxxxxxxx xxxxxxxxB
xxxxxxxx Mask for port B; 1->bit to be changed
xxxxxxxxB Data for port B
CX Port C mask and data
xxxxxxxx xxxxxxxxB
xxxxxxxx Mask for port C; 1->bit to be changed
xxxxxxxxB Data for port C
DX ffffh

Return registers: Carry flag cleared if successful
Carry flag set if error
AL Error code

Comments: This function is used to write to the second EZ I/O (i.e., the EZ I/O that has the higher I/O address when two EZ I/O chips are present on a board).

Programming example:

```
/* Inline assembly code for Borland C++ 3.1 */
asm {
  mov  ax,0ef04h
  mov  di,00ffh /*port A: no change */
  mov  bx,8000h /*port B: bit 7=0, other bits unchanged*/
  mov  cx,0202h /*port C: bit 1=1, other bits unchanged*
  mov  dx,0ffffh
  int  17h
    }
```

Read EZ I/O (2)

Function: efh
Subfunction: 05h

Purpose: To read from an EZ I/O port.

Calling registers: AH efh
AL 05h
DX ffffh

Return registers: Carry flag cleared if successful
AL Port A data
AH Port B data
BL Port C data
Carry flag set if error
AL Error code

Comments: This function is used to read from the second EZ I/O (i.e., the EZ I/O that has the higher I/O address when two EZ I/O chips are present on a board).

Programming example:

```
/* Inline assembly code for Borland C++ 3.1 */
unsigned char aData, bData, cData;
asm {
    mov   ax,0ef05h
    mov   dx,0ffffh
    mov   17h
    mov   aData,al
    mov   bData,ah
    mov   cData,bl
     }
```

Chapter 7: AUX I/O

≡ Description

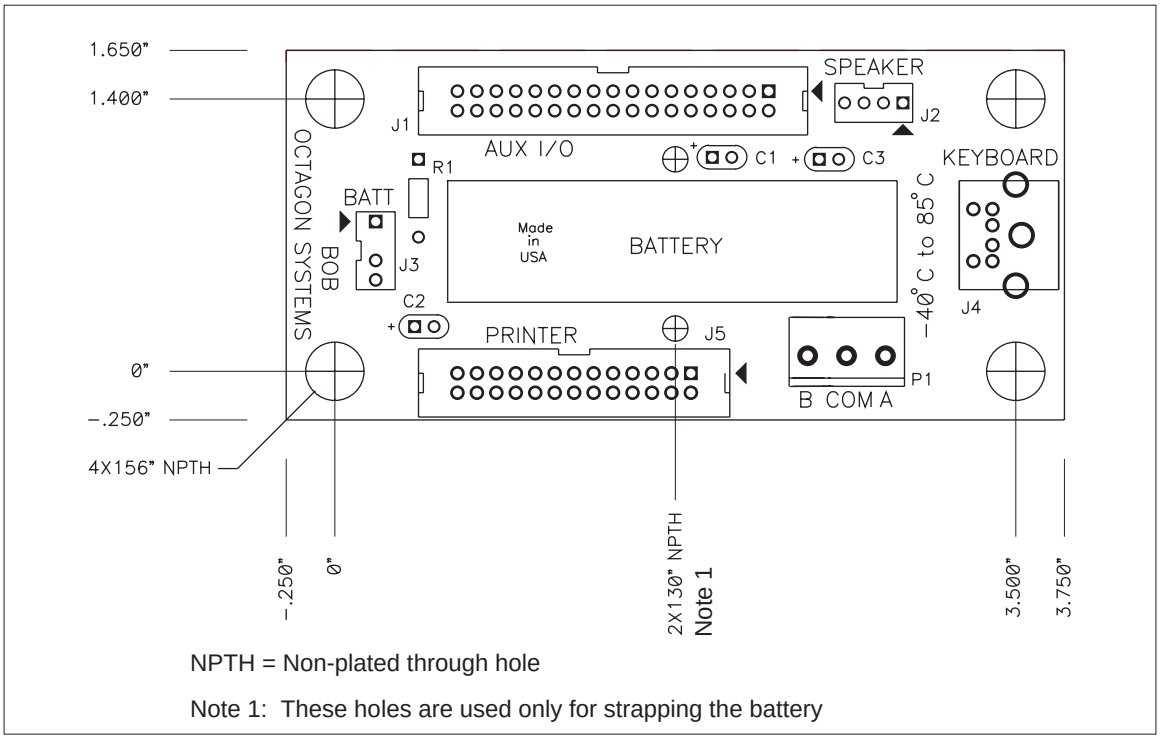
The AUX I/O port is a 34-pin connector at J2 which incorporates the parallel printer, speaker and keyboard ports, two optically isolated interrupts, and the AT battery connection. An alphanumeric display, matrix keypad, or floppy drive also interface through this port. These features are easily accessed through the use of the breakout board or through the construction of a breakout cable. See the product-specific appendix for the AUX I/O connector pinout.

≡ Breakout board (BOB)

The breakout board (BOB) is designed for use with all 6000 Series PC Microcontrollers. Keyboard, printer, speaker, optically isolated interrupt and reset, and an optional AT battery, are connected from the breakout board to the PC Microcontroller through the 34-pin AUX I/O header. The AUX I/O header provides a convenient and quick method of disconnecting these external devices from the PC Microcontroller during maintenance.

Note The AUX I/O port supports either a printer, an MPB-16PC opto-rack, a floppy drive, or can interface to a keypad and alphanumeric display, but not to all at the same time.

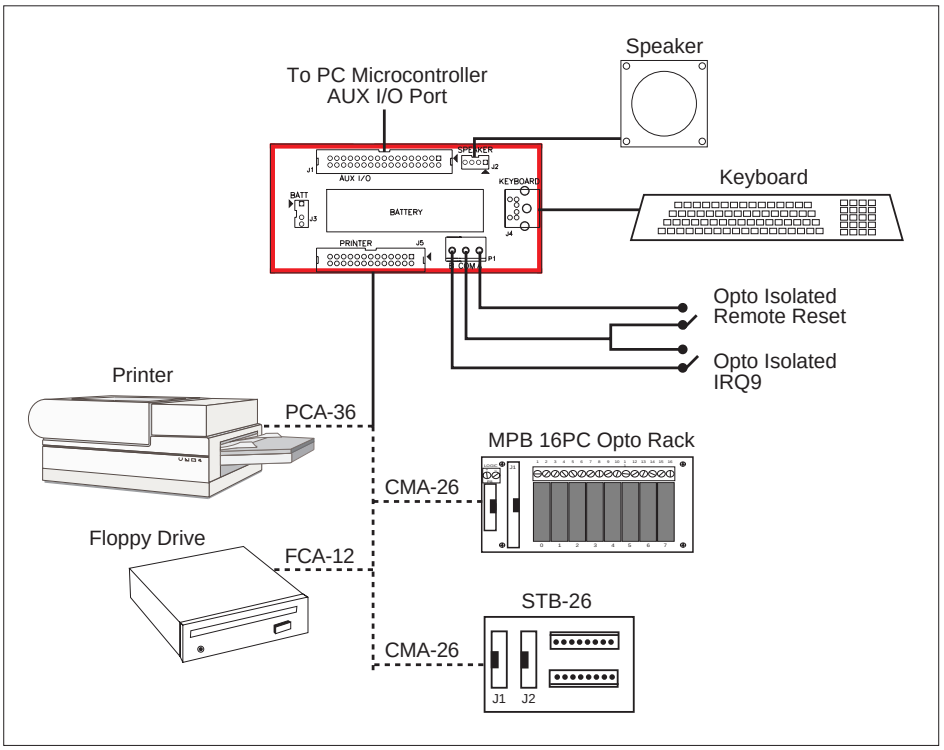
Figure 7-1 BOB component and dimensions diagram



NPTH = Non-plated through hole

Note 1: These holes are used only for strapping the battery

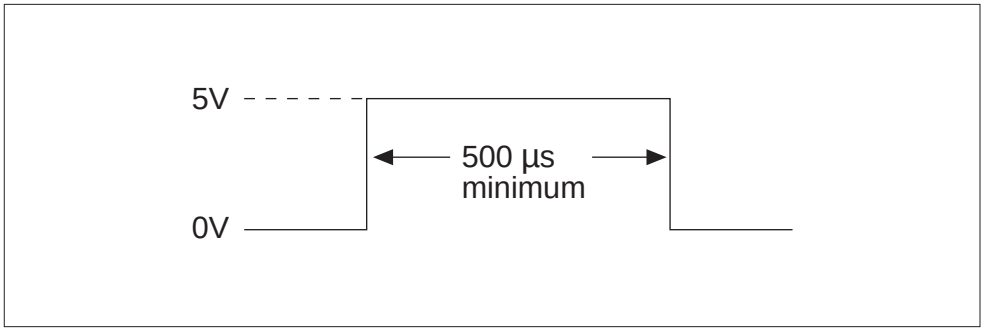
Figure 7-2 Breakout board hookup diagram



Opto-isolated inputs

Pin 2 of P1 on the breakout board is the opto-isolated return pin common to both opto-isolated A and B inputs. Octagon recommends that these input sources have a common ground point established that is tied to pin 2. See Figure 7-3 for recommended timing usage.

Figure 7-3 Recommended timing usage



Refer to the *Breakout board product sheet* for more information.

Parallel printer port

The parallel printer interface supports standard (unidirectional), bidirectional, enhanced parallel port (EPP), extended capabilities port (ECP), and floppy drive modes. The default I/O address is 378H using interrupt IRQ5. A number of devices are supported including a PC compatible printer, an opto rack with opto-isolated digital I/O modules, a multiline alphanumeric display, a matrix keypad, and a floppy drive. This interface is located at J5 on the breakout board. See the *Breakout board product sheet* for the printer interface pinout at J5.

Installing a printer

To install a printer:

1. Remove power from the PC Microcontroller.
2. Connect a CMA-34 cable from the breakout board AUX I/O connector to the PC Microcontroller AUX I/O port.
3. Connect a PCA-36 cable from J5 on the breakout board to the printer.
4. Power on the PC Microcontroller and make certain that the LPT1 port is in standard or bidirectional mode. The LPT1 port mode is configured in SETUP.

Opto rack

The Octagon MBP-16PC opto rack interfaces directly to the parallel printer port and can control high voltage/high current G4 opto-isolated modules. Of the available 16 positions, 8 can be either input or output, 4 are dedicated as inputs and 4 are dedicated as outputs. Refer to the *MPB-16PC opto module rack product sheet* for more information.

Installing an opto rack

To install an MPB-16PC opto rack:

1. Remove power from the PC Microcontroller.
2. Connect a CMA-34 cable from the breakout board AUX I/O connector to the PC Microcontroller AUX I/O port.
3. Connect a CMA-26 cable from J5 on the breakout board to the MPB-16PC.
4. Power on the PC Microcontroller and make certain that the LPT1 port is in standard or bidirectional mode. The LPT1 port mode is configured in SETUP.

Keyboard

A PS-2 style keyboard can be used with the PC Microcontroller. This interface is located at J4 on the breakout board.

Installing a keyboard

To install a keyboard:

1. Remove power from the PC Microcontroller.
2. Connect a CMA-34 cable from the AUX I/O port on the breakout board to the AUX I/O port on the PC Microcontroller.
3. Connect a PS-2 style keyboard to J4 on the breakout board.
4. Power on the PC Microcontroller.

Refer to the *Breakout board product sheet* for the keyboard interface connector pinout at J4.

Speaker

The speaker is interfaced via a 4-pin connector at J2 on the breakout board. An external speaker from 8 to 50 ohms can be used. If an amplifier/speaker is used, Speaker Data, +5V and Gnd are supplied for the amplifier. If only a speaker is used, attach the speaker directly to Speaker Data and +5V.

Installing a speaker

To install a speaker:

1. Remove power from the PC Microcontroller.
2. Connect a CMA-34 cable from the breakout board AUX I/O connector to the PC Microcontroller AUX I/O port.
3. Connect a speaker to J2 on the breakout board.
4. Power on the PC Microcontroller.

Refer to the *Breakout board product sheet* for the speaker interface pinout at J2.

Floppy disk drive

The parallel port on the breakout board can be used as a floppy disk drive port. The following section provides instructions for installing a floppy disk drive. Table 7-1 provides the pinouts to wire the AUX I/O connector to a floppy drive.

Installing a floppy disk drive

To install a floppy disk drive:

1. Remove power from the PC Microcontroller.
2. Connect a CMA-34 cable from the AUX I/O port on the breakout board to the AUX I/O port on the PC Microcontroller.

3. Connect an FCA-12 cable from the printer port on the breakout board to the floppy drive. See the *Breakout board product sheet* for an LPT1 to floppy drive cable pinout.
4. Connect an external power cable to the floppy drive.
5. Power on the PC Microcontroller and make certain that the LPT1 port is in floppy disk mode. The LPT1 port mode is configured in SETUP.

Table 7-1 AUX I/O connected to a standard 3.5" floppy disk drive

AUX I/O port 34–pin connector, female	**Function**	**DB–34 IDC connector, female (floppy port)**	**Function**
1	–OPTOA, B	NC	NC
2	+OPTOB	NC	NC
3	Pwr Gnd	NC	NC
4	+OPTOA	NC	NC
5	Keyboard Data	NC	NC
6	Keyboard Clock	NC	NC
7	+Battery	NC	NC
8	Speaker	NC	NC
9	+5VDC Safe	NC	NC
10	STB	12	DS0*
11	AFD	N/C	DenSel
12	Data0	8	Index*
13	Err	32	HDSel*
14	Data1	26	Trk0*
15	Init	18	Dir*
16	Data2	28	WP*
17	SLIN	20	Step*
18	Data3	30	RData*
19	Gnd	29	Gnd
20	Data4	34	DskChg*
21	Gnd	31	Gnd
22	Data5	N/C	Msen0
23	Gnd	17	Gnd
24	Data6	16	Mtr0*
25	Gnd	19	Msen1
26	Data7	N/C	Msen1
27	Gnd	27	Gnd
28	Ack	14	DS1*
29	Gnd	33	Gnd
30	Busy	10	Mtr1*
31	Gnd	21	Gnd
32	PE	22	WData*
33	Gnd	23	Gnd
34	SLCT	24	WGate*

* = active low

Note: The AUX I/O and floppy drive connectors are 3M 3414 series connectors or Thomas and Betts, 609–3430.

Note The DB connectors are the 3M D891xx series connectors. The AUX I/O connector is a 3M 3414 series connector or Thomas and Betts, 608–3430. A wiremount male connector can be used to connect a VTC10–IBM cable.

AT battery

The PC Microcontroller is shipped with an on–board battery for backing the real time clock and the SRAM SSD2.

There are three options for battery backup of the real time clock and SRAM SSD2 for the PC Microcontrollers.

1. The PC Microcontrollers are shipped with an on–board battery.
2. An external AT battery is added to the J6 connector on the PC Microcontroller. If an external AT battery is used, then the on–board battery can remain on–board or be removed.
3. An AT style battery is added to the break–out board (BOB). The on–board battery can remain on–board or be removed.

Installing an AT battery on the breakout board

A 3.6V AT battery (Octagon P/N 3186) can be installed on the breakout board to provide backup for the real time clock and the SRAM SSD2.

To install the AT battery:

1. Remove power from the PC Microcontroller.
2. Position the AT battery on the breakout board so that the 4-position battery connector faces the same direction as J3 on the breakout board. Secure the battery with a tie-wrap using the holes provided.
3. Connect the 4-position battery connector onto J3.
4. Connect a CMA-34 cable between the breakout board AUX I/O connector and the PC Microcontroller AUX I/O port.
5. Power on the PC Microcontroller.

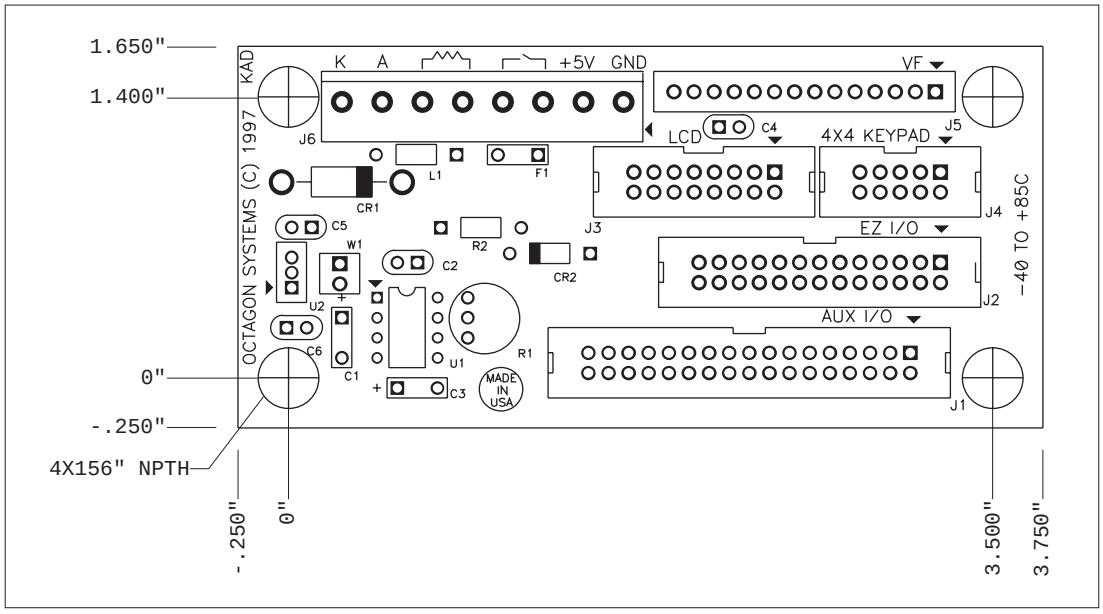
≡ Keypad and display board (KAD)

You can easily add a 16-position keypad and either a 2 or 4 line display to the system. The keypad and display boards connects to either the EZ I/O port or the AUX I/O port on the PC Microcontroller.

Note When the breakout board is used with the PC Microcontroller, the AUX I/O port becomes unavailable to the keypad and display board. Hence, you must connect the keypad and display board to the PC Microcontroller's EZ I/O port.

The keypad and display board plugs into the EZ I/O port on the PC Microcontroller using a CMA-26 cable. Refer to the *EZ I/O* chapter for interfacing to the EZ I/O port. The keypad and display board plugs into the AUX I/O port on the PC Microcontroller using a CMA-34 cable. Refer to the *AUX I/O* chapter for interfacing to the AUX I/O port.

Figure 7-4 KAD component and dimensions diagram



Alphanumeric display

To interface a VF-2 x 20, a VF-4 x 20, or an LCD 4 x 40 alphanumeric display to the PC Microcontroller, use the keypad and display board. The program DISPLAY.EXE (found on the PC Microcontroller utility disk) provides an easy method to use the display. Refer to the file DISPLAY.DOC on the PC Microcontroller utility disk for information on initializing and using the display.

Installing an alphanumeric display

To install an alphanumeric display:

1. Remove power from the PC Microcontroller.
2. If you are using a breakout board with the PC Microcontroller, connect a CMA-26 cable from the EZ I/O port on the PC Microcontroller to the EZ I/O port on the keypad and display board.

   If you are **not** using a breakout board with the PC Microcontroller, you may use either the EZ I/O port or the AUX I/O port. To use the EZ I/O port, follow the instructions described above. To use the AUX I/O port,

connect a CMA-34 cable from the AUX I/O port on the PC Microcontroller to the AUX I/O port on the keypad and display board.

3. Supply +5V to the keypad and display board.
4. Connect the selected display, either VF-2 x 20, VF-4 x 20 or LCD 4 x 40 display to the appropriate connector on the keypad and display board.

Note Do not connect both VF and LCD displays to the keypad and display board simultaneously.

5. Power on the PC Microcontroller and make certain that the LPT1 port is in standard or bidirectional mode. The LPT1 port mode is configured in SETUP.

   Refer to the *Keypad and display board product sheet* for the KAD VF display and the KAD LCD display interface pinouts at J5 and J3, respectively.

Keypad

To interface a 4 x 4 matrix keypad to the PC Microcontroller, use the keypad and display board. The program DISPLAY.EXE (found on the PC Microcontroller utility disk) provides an easy method to use the keypad. Refer to the file DISPLAY.DOC on the utility disk for information on initializing and using the keypad.

Installing a 4 x 4 keypad

To install an alphanumeric display:

1. Remove power from the PC Microcontroller.
2. If you are using a breakout board with the PC Microcontroller, connect a CMA-26 cable from the EZ I/O port on the PC Microcontroller to the EZ I/O port on the keypad and display board.

   If you are **not** using a breakout board with the PC Microcontroller, you may use either the EZ I/O port or the AUX I/O port with the keypad and display board. To use the EZ I/O port, follow the instructions described above. To use the AUX I/O port, connect a CMA-34 cable from the AUX I/O port on the PC Microcontroller to the AUX I/O port on the keypad and display board.
3. Supply +5V to the keypad and display board.
4. Connect the keypad to the J4 connector on the keypad and display board.
5. Power on the PC Microcontroller and make certain that the LPT1 port is in standard or bidirectional mode. The LPT1 port mode is configured in SETUP.

   Refer to the *Keypad and display board product sheet* for the KAD keypad interface pinout at J4.

Chapter 8: Analog I/O

Note Analog I/O is only available on the 6040 PC Microcontroller.

≡ Description

The 6040 has eight input channels and two analog output channels, all with 12 bits of resolution. It can read and write data at 100,000 samples per second.

The range of each input channel is independently software selectable for ±10V, ±5V, 0 to 10V, or 0 to 5V. An adjustment potentiometer is provided to adjust the selected input voltage range by +5%. The input multiplexer is fault protected to ±16.5V. The input resistance is 10M Ω.

The output ranges are individually jumperable for ±5V, 0 to 10V, or 0 to 5V. Both the analog input and analog output lines are located at J7.

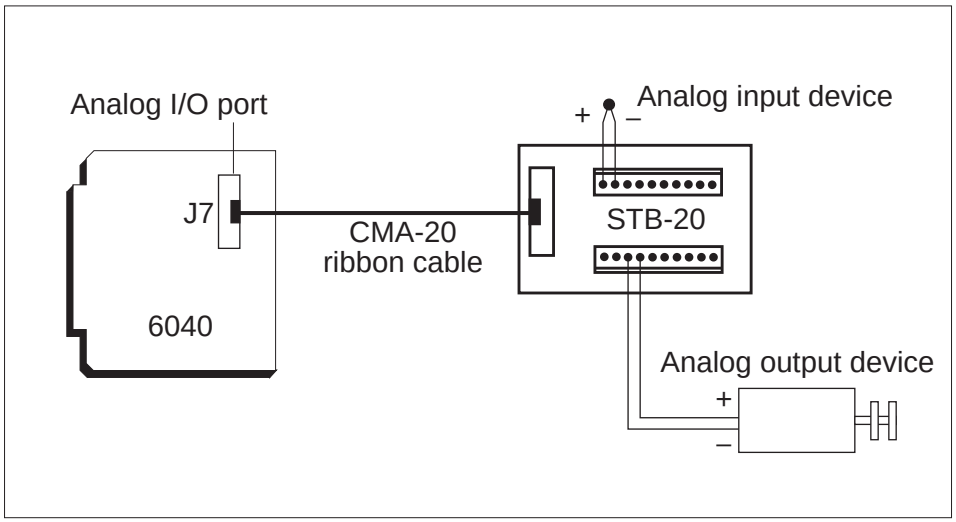
WARNING!

The analog output channels come up in an undefined state until they are configured in your software. Critical systems should be disabled until the analog output channels are initialized to a known state.

≡ Analog I/O interface

To interface analog I/O devices to J7 of the 6040, use an STB-20 terminal board and a CMA-20 cable. See the following diagram.

Figure 8-1 Interfacing analog I/O devices to the 6040



≡ Configuring and programming the analog I/O port

Configuring and reading from analog input with CAMBASIC

To configure the 6040 for analog input, use CAMBASIC's CONFIG AIN command. For more details regarding CONFIG AIN, refer to your *CAMBASIC user's manual.*

Example

An analog input program example using CAMBASIC's AIN command is provided below.

```
10 CONFIG AIN 0,0: 'Config A/D channel 0 to 0 to 5V
   input range
20 CONFIG AIN 1,1: 'Config A/D channel 1 to -5 to 5V
   input range
30 CONFIG AIN 2,2: 'Config A/D channel 2 to 0 to 10V
   input range
```

```
40 CONFIG AIN 3,3: 'Config A/D channel 3 to -10 to 10V
   input range
50 CONFIG AIN 4,0: 'Config A/D channel 4 to 0 to 5V
   input range
60 CONFIG AIN 5,0: 'Config A/D channel 5 to 0 to 5V
   input range
70 CONFIG AIN 6,0: 'Config A/D channel 6 to 0 to 5V
   input range
80 CONFIG AIN 7,0: 'Config A/D channel 7 to 0 to 5V
   input range
100 FOR X=0 TO 5
110 C(X) = AIN(0): 'Assign analog input readings from
    channel 0 to array C
120 NEXT X
```

Reading numbers less than zero

Do the following to read numbers less than zero:

1. Subtract 65535 (FFFF), then
2. Apply the multiplier.

Configuring analog output

Refer to Table 8-1 to configure for analog output on the 6040 PC Microcontroller.

Table 8-1 6040 digital to analog output range select: W3

Output range	Channel A	Channel B
0V to 10V	W3[6-8]	W3[3-5]
0V to 5V	W3[8-10]	W3[1-3]
-5V to +5V	W3[7-8]*	W3[3-4]*

* = default, pins jumpered

Note The 12–bit digital–to–analog converters (DACs) can be jumpered for different ranges. For example, for a 0 to 10V range, x = 0 implies 0.00V output; x = 4095 implies 10V output. This means there are 10/4095 = 0.002442 volts per count.

Writing to analog output with CAMBASIC

An analog output program example using CAMBASIC's AOT statement is provided below.

```
10 'Assume that DAC jumper is configured to generate
   0 to 10V
```

```
20 AOT 0,2048: 'Output approximately 5V to channel 0
30 AOT 1,1024: 'Output approximately 2.5V to channel 1
```

Table 8-2 Analog specifications

Analog input	Specifications
Channels:	8 single-ended
Resolution:	12-bit
Input voltage ranges:	±10V, ±5V, 0 to 10V, or 0 to 5V
Gain:	x1
Overload protection:	±16.5V
Input impedance:	unipolar: 21 kW; bipolar: 16 kW
Conversion time:	10 µs
MUX settling time:	3 µs track to hold acquisition time
Throughput:	100 ksps

Analog output	Specifications
Channels:	2 independent
Resolution:	12-bit
Output voltage ranges:	±5V, 0 to 10V, or 0 to 5V
Output current:	5 mA
Throughput:	max. setting time = 10 µs (for data to stabilize)

Configuring and reading from analog input and output with INT17H functions

The analog input can also be determined through the use of built-in INT17H functions. For more information, refer to the section below, *Enhanced INT17H function definitions*.

≡ Enhanced INT17H function definitions

This section provides definitions for the following functions: Analog to Digital Conversion and Digital to Analog Conversion.

Analog to digital conversion

Function: f8h
Subfunction: 00h

Purpose: To perform an analog to digital conversion at a specified A/D channel. This function will perform averaging based on the last setting done using subfunction 2.

Calling registers:
AH f8h
AL 00h
BL A/D channel number (0 to 7)
BH range and polarity selection
0 -> 0 to +5V
1 -> -5V to +5V
2 -> 0 to +10V
3 -> -10V to +10V
DX ffffh

Return registers:
Carry flag cleared if successful
AX 12-bit data corresponding to input voltage or the average of multiple readings.

Carry flag set if error
AL Error code

Programming example:

```
unsigned int atod0Data;
/* Inline assembly code for Borland C++ 3.1 */
asm {
  mov ax,0f800h
  mov dx,0ffffh
  mov bl,0     /*A/D channel 0 */
  mov bh,1     /*input range -5V to +5V */
  int 17h
  mov atodData, ax
     }
print("Data from A/D channel 0 = %04x.\n",atod0Data);
```

Digital to analog conversion

Function: f8h
Subfunction: 01h

Purpose: To perform a digital to analog conversion at a specified D/A channel.

Calling registers:
AH f8h
AL 01h
BL D/A channel number (0 to 1)
CX 12-bit digital input
DX ffffh

Return registers: Carry flag cleared if successful

Carry flag set if error
AL Error code

Programming example:

```
unsigned int dtoa0Data;
asm {
  mov ax,0f801h
  mov bl,1     /*D/A channel 1 */
  mov cx,0800h /*D/A output at about ½ way of full range
*/
  mov dx,0ffffh
  int 17h
     }
```

Analog to digital average sample size select

Function: f8h
Subfunction: 02h

Purpose: To set the number of samples to average for following Subfunction 00h calls. This affects all channels, however, this can be interspersed between A to D reads, giving different samplings per channel. The default is 1.

Calling registers: AH f8h
AL 02h
CX number of samples (1,2,4,8,16)
DX ffffh

Return registers: Carry flag cleared if successful
AH 00 success

Carry flag set if error
AL Error code

Programming example:

```
/* Inline assembly code for Borland C++ 3.1 */
asm {
  mov ax,0f802h
  mov dx,0ffffh
  mov cx,4     /* set to 4 samples on following */
  int 17h      /* A to D conversions */
       }
print("Number of samples set to %d.\n",4);
```

≡ 6040 analog input reference adjustment

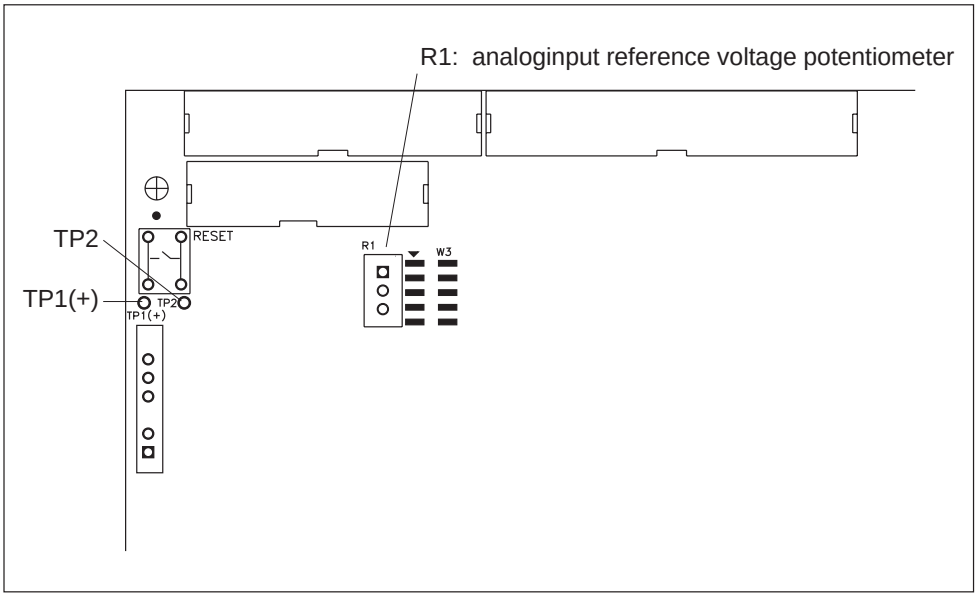
The analog input reference voltage is adjusted at the factory and normally will not require adjustment. If necessary, this reference adjustment can be readjusted to the factory setting or can also be offset to measure up to a 5% over range input. If adjustment is required, proceed with the following:

1. Attach a digital voltmeter between TP1(+) and TP2, connecting the positive lead to TP1(+).
2. For standard factory adjustment, adjust potentiometer R1 until a reading of 4.096V is attained.
3. For over range input adjustment, adjust potentiometer R1 to the following table:

Table 8-3 Over range input adjustment

Over range %	Voltmeter reading
1%	4.137V
2%	4.178V
3%	4.219V
4%	4.260V
5%	4.301V

Figure 8-2 Analog input reference voltage potentiometer



Chapter 9: SSDs, DRAM, and battery backup

Before you can save and boot your application from the PC Microcontroller, this chapter describes how to configure the system for your particular application requirements. The following topics are discussed:

- SSD0
- SSD2
- DRAM
- Real time clock
- Battery backup for SSD2 and real time calendar/clock

≡ SSD0

SSD0 contains the BIOS and ROM-DOS 6.22 in flash ROM. It reserves 128 KB for BIOS and 896 KB for a drive area. SSD0 is a DOS-compatible read/write drive.

Your application programs can be saved to flash using the PICO FA driver which makes the flash memory a read/write disk on your PC Microcontroller. Saving your application programs onto the read/write disk allows you to update them at least 100,000 times. These devices are erased automatically during the programming process.

SSD0 can be accessed directly as a read/write DOS drive with the PICO FA driver in the BIOS extension. Also, it can be accessed directly as a read/write DOS drive when the PICOFA.SYS driver is loaded. While this is convenient for product development, the flash, however, has a limited number of writes allowed. Therefore, Octagon does not recommend SSD0 be used as a data logging device. Refer to the *Software utilities* chapter for information on supported flash memory and a description of PICO FA.

≡ SSD2

SSD2 contains 128 KB of SRAM. SSD2 can be accessed directly as a read/write DOS drive with the PICO FA BIOS extension. SSD2 is generally used for data logging.

≡ DRAM

The PC Microcontrollers are shipped with 2 or 4 MB of fast page DRAM surface mounted on-card.

≡ Real time clock

The PC Microcontroller has a built-in AT style, real time calendar/clock. The clock may be read either through DOS or CAMBASIC.

≡ Battery backup for SSD2 and real time calendar/clock

The PC Microcontroller has an on-board AT battery for battery backup of the SSD2 SRAM files. In addition to backing up the SRAM, the AT battery also backs up the CMOS real time calendar/clock.

Chapter 10: External drives

≡ Description

You can use your PC Microcontroller with one or two floppy disk drives and/or a hard disk drive. This chapter includes installation and operation instructions for each device. Also, refer to the instruction manuals included with each device.

Note The 6010 PC Microcontroller has an on-board floppy drive interface at J8 and a hard drive interface at J7. See the sections *Floppy disk drive interface on the 6010* and the *Hard disk drive interface on the 6010* in this chapter for more information.

For each of the devices below, you must first install the PC Microcontroller into the Micro PC backplane.

Note Use the on-board IDE BIOS when using a 5815 disk drive card with a 6050, 6040, 6030, or 6020 PC Microcontroller.

Note The 5815 is not compatible with the 6010 PC Microcontroller.

≡ Floppy disk drives

You can add one 1.44 MB floppy drive with the 5815 Disk Drive Card (the 5815 also supports a 2.5" IDE hard drive) or use the on-card multifunctional parallel port at the AUX I/O port. The multifunctional parallel port is brought out to the breakout board through the AUX I/O port. Refer to the *AUX I/O* chapter for setting up and using the parallel port and a floppy drive with the PC Microcontroller.

Installing a floppy disk drive

1. Install the PC Microcontroller.
2. When adding an off-card floppy disk drive, install the 5815 Disk Drive Card. Follow the instructions included with this product.

   When adding an on-card floppy disk drive, install the disk drive via the AUX I/O port on the PC Microcontroller. (See the *AUX I/O* chapter for more information.)
3. Plug the card cage power cable into an AC outlet. Turn on the power supply. When using the on-card floppy drive, you must route external power for the floppy drive.
4. Run SETUP to set the LPT mode to "Floppy disk", the number of floppy drives to "1", and set the type (i.e., size) of the floppy.

Note Two drive designators (A: and B:) will be assigned regardless of how many drives you specify in SETUP.

5. If, in SETUP, you entered 0 drives, access to either A: or B: will cause the PC Microcontroller to return an error message.

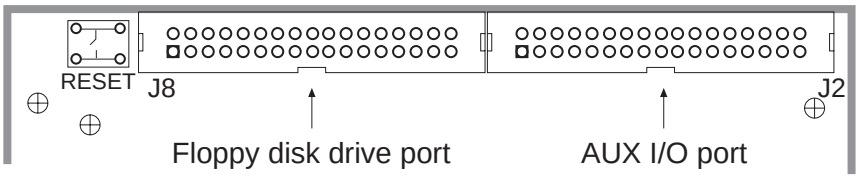
   If you want to boot from the floppy disk using your own DOS or a full ROM-DOS refer to the section, *Adding operating system startup files*, in the *Save and run programs* chapter.

≡ Floppy disk drive interface on the 6010

The 6010 PC Microcontroller supports one or two 3.5" or 5.25" floppy drives via a 34-pin IDC connector at J8. Both floppy drives use DMA channel 2.

WARNING!

J8 and J2 are 34-pin IDC connectors and may be mistaken for each other due to their physical similarities. Do not connect the floppy disk drive into J2, the AUX I/O port, or severe damage will occur to the floppy disk drive. Be certain that you connect the floppy disk drive to the interface at J8.



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Installing a floppy disk drive with the 6010 on-board FDD interface

1. Install the 6010 PC Microcontroller.
2. Connect the floppy disk drive cable to J8 on the 6010.
3. Floppy disk drives requiring +5V (for example, Octagon's 5814), are powered directly from the floppy port. W2[2–4] must be enabled to supply internal +5V to a 5V only floppy drive. Floppy drives requiring +12V must use an external power supply. **Do not** install W2[2–4] if external power is supplied to the floppy drive.

≡ Hard disk drive

The PC Microcontroller supports the 5800A and 5815 Floppy/Hard Disk Drive Cards which support IDE type hard drives. The hard drive BIOS is also included in the PC Microcontroller BIOS. Instructions for installing either type of hard drive is explained below.

The PC Microcontroller supports the latest EIDE BIOS. We highly recommend that this BIOS is used rather than the 5800A or 5815 BIOS.

Before you begin installing an off-card hard drive, see the *SETSSD* section in the *Setup programs* chapter. The *SETSSD* section provides instructions for setting the disk drive designation.

You may use one of two methods to configure the system for a 5815. Both methods are described below.

Disabling 5815 or 5800A BIOS and using the PC Microcontroller IDE BIOS

This method allows the use of an IDE controller, such as the 5815 or 5800A. It involves disabling the 5815 or 5800A BIOS and using the PC Microcontroller IDE BIOS. The procedure is as follows:

For the 5815:

1. Using SETUP, configure the PC Microcontroller for one hard drive by running SETUP and setting the appropriate options.
2. Configure the 5815 to disable the on-card BIOS. See the *5815 product sheet* for the proper jumper settings on the 5815.

Note Bus IRQ5 is redirected to CPU IRQ14.

For the 5800A:

1. Using HDSETUP.COM, configure the 5800A to have 0 hard drives. See the *5800A product sheet* for more information.
2. Using SETUP, configure the PC Microcontroller for one hard drive by running SETUP and setting the appropriate options.

Table 10-1 Hard drive setup

No. of drives in HDSETUP (5800A/5815)	IRQ setting in HDSETUP	No. of drives in CPU SETUP
1 or 2	IRQ14	0
0	N/A	1 or 2

Using the hard drive controller BIOS and disabling the PC Microcontroller BIOS

This method applies when using a 5815 or 5800A. It involves using the hard drive controller BIOS and disabling the PC Microcontroller BIOS.

1. Using SETUP, configure the PC Microcontroller for "0" hard drives.
2. Run HDSETUP, provided with the 5815 or 5800A, to configure the hard drive controller card for the proper hard drive parameters. Also, set the IRQ to IRQ14.
3. If using the 5815, verify that the jumper setting enables the on-card BIOS. See the *5815 product sheet* for proper jumper positions.

≡ Hard disk drive interface on the 6010

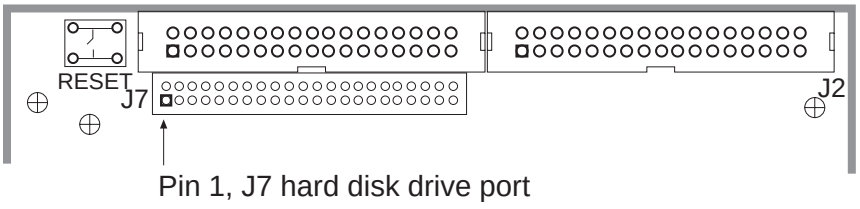
The 6010 PC Microcontroller supports one standard EIDE or standard IDE hard drive via a 44-pin connector at J7.

Installing a hard disk drive with the 6010 on-board HDD interface

1. Install the 6010 PC Microcontroller.
2. Connect the Octagon hard disk drive cable (P/N 4080) to J7 on the 6010.

WARNING!

Failure to properly orient the hard drive cable may damage the 6010, hard drive, and cable.



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Chapter 11: Video

≡ Description

You can use a video card with a monitor and a keyboard with the PC Microcontroller instead of using your PC keyboard and monitor over a serial communications link. The keyboard and speaker lines are brought out to the breakout board for setting up and using a keyboard and speaker with the PC Microcontroller. Any PS-2 compatible keyboard may be used.

≡ Using a video monitor and keyboard

You will need the following equipment (or equivalent) to use your PC Microcontroller with a video and keyboard:

- PC Microcontroller
- Breakout board
- Micro PC card cage
- Power supply
- 5420 video card and VGA monitor
- AT compatible keyboard with PS-2 type connector
- VTC-9F cable
- Null modem adapter

1. Install the 5420 video card into the card cage.
2. Install the keyboard using the breakout board with the PC Microcontroller. Refer to the section, *Installing a keyboard* in the *AUX I/O* chapter.
3. Install the PC Microcontroller into the card cage.
4. Connect the video monitor to the video card.
5. Power on the PC Microcontroller. The BIOS messages should appear on your video monitor.

Saving a program to the PC Microcontroller

The following options detail the procedures for transferring files to the PC Microcontroller and programming the flash memory in SSD0.

- If you have setup a floppy drive on the PC Microcontroller system, you can copy the files directly from the floppy to SSD0.
- If a local floppy drive is not available, you must use TRANSFER.EXE or REMDISK/REMSERV to transfer files from a remote system via COM1 or COM2, as detailed in the next section and in the *Software utilities* chapter.

Transferring files to the PC Microcontroller

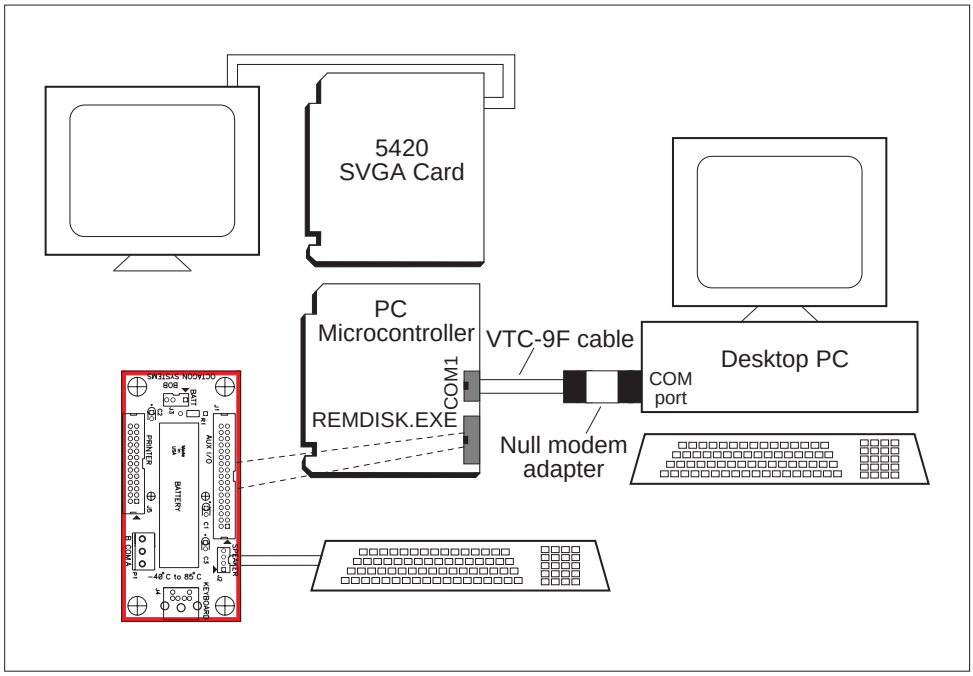
The following steps detail the procedures for transferring files from your PC to the virtual drive on the PC Microcontroller. In order to transfer files from your PC to the PC Microcontroller, you must execute the TRANSFER program from both the PC Microcontroller and your PC. This procedure can be used to transfer files to any writeable drive (including SSD0) in your PC Microcontroller system.

Hardware and software requirements:

- Desktop PC, running REMSERV connected by a VTC-9F cable and a null modem adapter to COM1 or COM2 of the PC Microcontroller.
- A PC Microcontroller system, a breakout board including a keyboard, a 5420 SVGA video card and VGA monitor, running REMDISK from COM1 or COM2.

1. Connect the equipment as shown in the following figure.

Figure 11-1 Downloading files to a PC Microcontroller with a video card installed



2. Execute the TRANSFER program from the PC Microcontroller to receive a file from your PC.

   60xx C:\> **TRANSFER /COM1 /R /V <drive>*filename.ext***

   <drive> is the virtual drive on the PC Microcontroller where the file is transferred.

   filename.ext is the name of the file on the PC Microcontroller which you receive from your PC.

   /V enables "R" characters upon receiving a block and "T" upon transferring a block.

3. Execute the TRANSFER program from your PC to send a file to the PC Microcontroller.

   C:> **TRANSFER /COM1 /S /V <drive><path>*filename.ext***

   filename.ext is the name of the file on the PC which you send to the PC Microcontroller.

Note Transfer will timeout if the program has not been started after approximately 40 seconds. It displays the following message:

```
Failed to receive <drive>filename.ext!
Deleting <drive>filename.ext
```

Also, you may speed up the transfer using the /Bnnnn switch to increase the baud rate, for example, /B57600.

Transferring files from the PC Microcontroller

In order to transfer files from the PC Microcontroller to your PC, you must execute the TRANSFER program from both the PC Microcontroller and your PC.

1. Connect the equipment as shown in Figure 11-1.

2. Execute the TRANSFER program from the PC Microcontroller to send a file to your PC.

   60xx C:\> **TRANSFER /COM1 /S /V *filename.ext***

   filename.ext is the name of the file on the PC Microcontroller which you send to your PC.

   /V enables "R" characters on receiving a block and "T" on transferring a block.

3. Execute the TRANSFER program from your PC to receive a file from the PC Microcontroller.

   C:> **TRANSFER /COM1 /R /V *filename.ext***

   filename.ext is the name of the file on the PC which you receive from the PC Microcontroller.

Note Transfer will timeout if the program has not been started after approximately 40 seconds. It displays the following message:

```
Failed to receive <drive>filename.ext!
Deleting  <drive>filename.ext
```

Also, you may speed up the transfer using the /Bnnnn switch to increase the baud rate, for example, /B57600.

Using REMDISK/REMSERV

1. Connect the equipment as shown in Figure 11-1.
2. On the PC Microcontroller system, execute REMDISK.EXE by entering:

   60xx C:\> **REMDISK**

   The following message is displayed on the PC Microcontroller monitor:

```
Remote Disk v1.0
Copyright (c) 1990-1994 Datalight, Inc.
All rights reserved.

Installed as Drive F:     /COM1 /B115+     /T10
```

Note REMDISK assigns the remote drive as the last drive in the system. In this case, drive F: was assigned.

3. Execute REMSERV.EXE on the desktop PC:

   C:\> **REMSERV C:**

   The following message is displayed on the PC:

```
REMSERV v1.0
Copyright (c) 1990-1994 Datalight, Inc.
All rights reserved.

Using COM1 at 115+ baud.  Accessing Drive C:
Time-out is 9 seconds
Press <Esc> to Exit.(There may be a delay before exit
occurs)
```

4. Files are transferred to the PC Microcontroller read/write drives by using the DOS COPY or XCOPY commands. From the PC Microcontroller system, enter:

```
60xx C:\> COPY F:\MPC\60xx\DEMO.EXE D:
60xx C:\> DIR D:
60xx C:\> D:DEMO.EXE
```

   The DEMO program displays a message on the PC Microcontroller monitor.

   In this case, drive F: is the remote PC disk drive, and D: is the read/write SSD flash memory on the PC Microcontroller. Files are easily copied between the drives.

5. When finished, on the PC Microcontroller, execute:

   60xx C:\> **REMDISK /U**

   This unloads REMDISK from the PC Microcontroller.

6. On the desktop PC, press <ESC> to exit REMSERV.

Chapter 12: IRQ routing and opto IRQs

≡ Interrupt routing

The PC Microcontroller provides routing of several interrupts that originate from the 8-bit ISA bus to use additional AT interrupts. This interrupt routing provides flexibility to the interrupt structure, allowing the lower-ordered XT bus interrupts to be connected to the unused higher-ordered AT interrupts.

The 8-bit bus interrupts that are routed are:

- Bus IRQ3 to IRQ10
- Bus IRQ4 to IRQ11
- Bus IRQ5 to IRQ14

The dedicated on-card interrupts are:

- IRQ3-COM2
- IRQ4-COM1
- OPTO A-remote reset
- OPTO B-IRQ9

Table 12-1 6000 Series interrupt map

Interrupt	Description
IRQ0	System timer
IRQ1	Keyboard
IRQ2	Unavailable
IRQ3	COM2 serial port
IRQ4	COM1 serial port
IRQ5	LPT1
IRQ6	Floppy disk controller (available and connected to BIRQ6 or FDC)
IRQ7	Available and connected to BIRQ7
IRQ8	RTC alarm
IRQ9	User-configurable (connected to OPTO B)
IRQ10	Available and connected to BIRQ3
IRQ11	BIRQ4 on 6010, 6040, 6050; CTC on 6020; COM4 on 6030
IRQ12	PC/104 connector on 6010; CTC on 6020; COM3 on 6030; A/D on 6040; unavailable on 6050
IRQ13	Floating point unit
IRQ14	Available and connected to BIRQ5 (HDC/BIRQ5 on 6010)
IRQ15	Power management interrupt

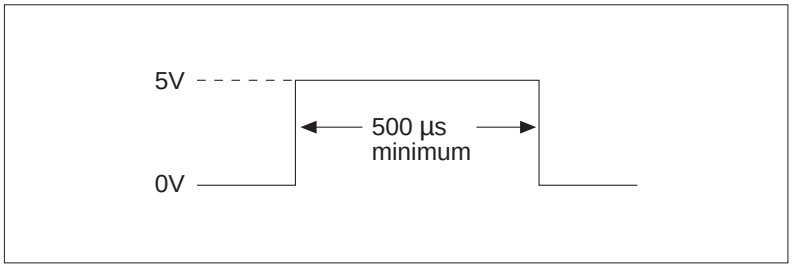
Optically isolated inputs

The PC Microcontroller provides two remote, isolated inputs. The first input OPTO A+, OPTO COM on the AUX I/O connector, resets the CPU when a voltage input between 4.0V to 6.0 VDC is applied. The second input, OPTO B+, OPTO COM on the AUX I/O connector, activates an IRQ9.

Pin 2 of P1 on the breakout board is the opto-isolated return pin common to both optically isolated A and B inputs. Octagon recommends that these input sources have a common ground point established that is tied to pin 2 on P1. See the following figure for recommended timing usage.

The optical isolators provide 300 VDC of isolation between the optically isolated inputs and the card.

Figure 12-1 Recommended timing usage



Refer to the *Breakout board product sheet* for more information.

Chapter 13: LED signaling and "beep" codes

≡ Description

The PC Microcontroller has the bicolor LED that is used by the BIOS to signal system status and CPU speed.

Immediately after the PC Microcontroller powers on, both LEDs are lit and display an orange color. Upon completion of the boot sequence, the yellow LED turns off and the green LED remains on.

If a failure occurs during the boot sequence, visual beep codes are displayed to the LEDs. The visual beep codes are defined in the following table.

The bicolor LED also indicates system suspend status. Upon entering suspension, the green LED turns off and the yellow LED begins to blink. On a resume condition, the yellow LED turns off and the green LED turns on.

Table 13-1 Phoenix BIOS beep codes

Diagnostic port output	Beep codes	Description of test or failure
01h		80286 register test in-progress
02h	1-1-3	CMOS write/read test in-progress or failure
03h	1-1-4	BIOS ROM checksum in-progress or failure
04h	1-2-1	Programmable interval timer test in-progress or failure
05h	1-2-2	DMA initialization in-progress or failure
06h	1-2-3	DMA page register write/read test in-progress or failure
08h	1-3-1	RAM refresh verification in-progress or failure
09h		1st 64K RAM test in-progress
0Ah	1-3-3	1st 64K RAM chip or data line failure multi-bit
0Bh	1-3-4	1st 64K RAM odd/even logic failure
0Ch	1-4-1	1st 64K RAM address line failure
0Dh	1-4-2	1st 64K RAM parity test in-progress or failure

Table 13-1 Phoenix BIOS beep codes (cont’d)

Diagnostic port output	Beep codes	Description of test or failure
10h	2-1-1	1st 64K RAM chip or data line failure-bit 0
11h	2-1-2	1st 64K RAM chip or data line failure-bit 1
12h	2-1-3	1st 64K RAM chip or data line failure-bit 2
13h	2-1-4	1st 64K RAM chip or data line failure-bit 3
14h	2-2-1	1st 64K RAM chip or data line failure-bit 4
15h	2-2-2	1st 64K RAM chip or data line failure-bit 5
16h	2-2-3	1st 64K RAM chip or data line failure-bit 6
17h	2-2-4	1st 64K RAM chip or data line failure-bit 7
18h	2-3-1	1st 64K RAM chip or data line failure-bit 8
19h	2-3-2	1st 64K RAM chip or data line failure-bit 9
1Ah	2-3-3	1st 64K RAM chip or data line failure-bit A
1Bh	2-3-4	1st 64K RAM chip or data line failure-bit B
1Ch	2-4-1	1st 64K RAM chip or data line failure-bit C
1Dh	2-4-2	1st 64K RAM chip or data line failure-bit D
1Eh	2-4-3	1st 64K RAM chip or data line failure-bit E
1Fh	2-4-4	1st 64K RAM chip or data line failure-bit F
20h	3-1-1	slave DMA register test in-progress or failure
21h	3-1-2	master DMA register test in-progress or failure
22h	3-1-3	master interrupt mask register test in-progress or failure
23h	3-1-4	slave interrupt mask register test in-progress or failure
25h		interrupt vector loading in-progress
27h	3-2-4	keyboard controller test in-progress or failure
28h		CMOS power-fail & checksum checks in-progress
29h		CMOS config info validation in-progress
2Bh	3-3-4	screen memory test in-progress or failure
2Ch	3-4-1	screen initialization in-progress or failure
2Dh	3-4-2	screen retrace tests in-progress or failure
2Eh		search for video ROM in-progress
30h		screen believed operable

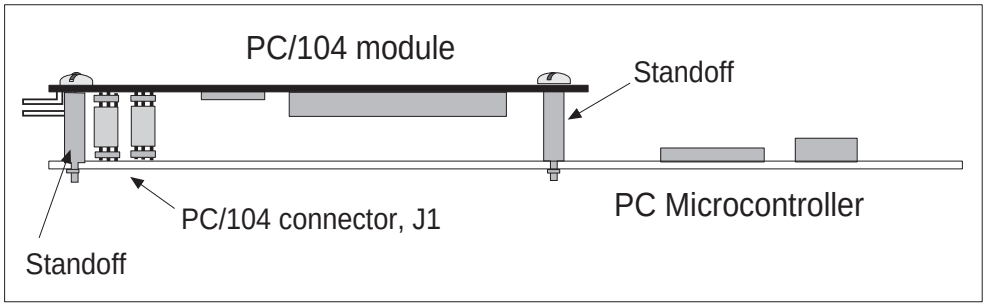
Chapter 14: PC/104 expansion

Note The PC/104 connector is not available on all cards.

≡ Description

This connector allows you to interface to one or two PC/104 form factor modules including hard disks, A/D converters, digital I/O, serial ports, etc. The PC Microcontroller supports 8- and 16-bit, 5V modules. These modules can be stacked on top of the PC Microcontroller to form a highly integrated control system. Refer to the *6010 technical data* appendix for the PC/104 connector pinout.

Figure 14-1 Typical PC/104 module stack



WARNING!

When installing any PC/104 module, avoid excessively flexing the PC Microcontroller board. Mate pins correctly and use the required mounting hardware.

Chapter 15: Counter timer controller

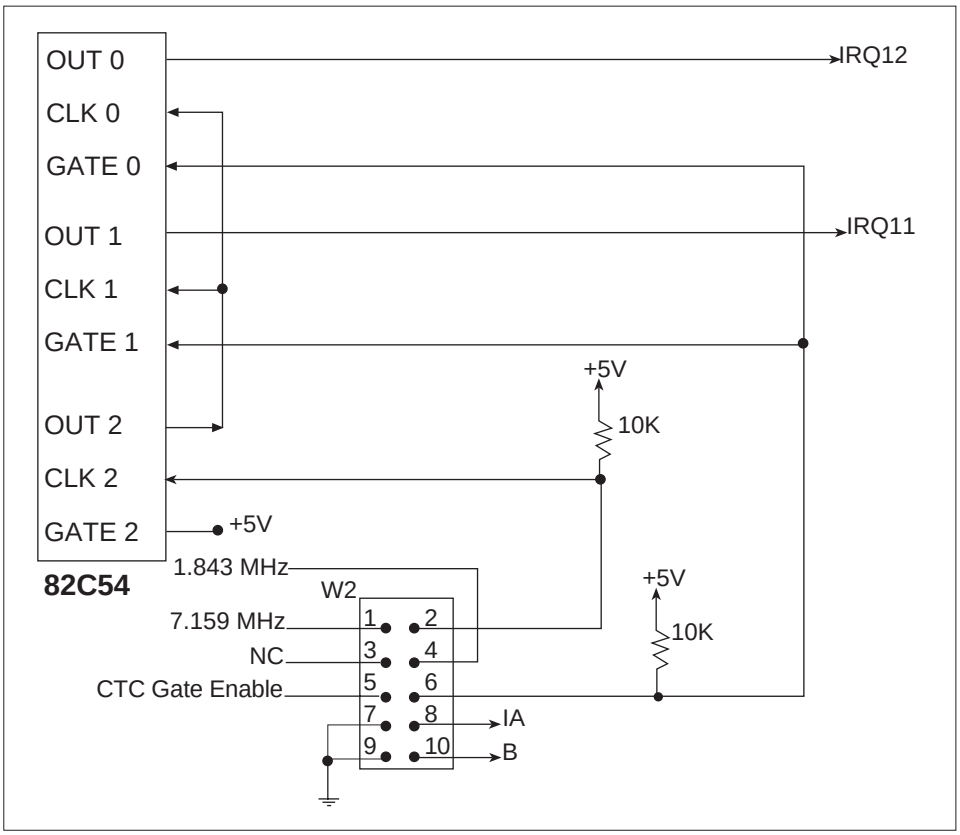
Note The counter timer controller is only available on the 6020 PC Microcontroller.

≡ Description

The 6020 has an 82C54 counter timer controller (CTC) to provide periodic interrupts to the CPU for time related I/O events such as data logging. Two time bases are available: 1.8 MHz and 7.2 MHz. These time bases are jumper selectable through W2. Refer to Table 15-1.

The CTC chip consists of three counter/timer circuits. Counter 2, which has either a clock input of 1.843 MHz or 7.159 MHz, acts as a pre-scalar for counters 0 and 1. The output of counter 2 is routed to the clock inputs of both counters 0 and 1. Gate inputs to counters 0 and 1 are tied together and are either pulled high or controlled by the control signal, CTC Gate Enable. The outputs of counters 0 and 1 then provide IRQ12 and IRQ11, respectively, to the CPU.

Figure 15-1 Counter timer controller diagram



Note The 82C54 is an extremely versatile component which has six modes of operation, a Read Back command, and a Counter Latch command. The primary intent, however, is to use the 6020 CTC for providing periodic interrupts to the CPU and **not** to discuss all functions associated with the CTC. For further information, refer to the *Intel peripheral 82C54 data sheet* or the *NEC 71054 data sheet*.

This section provides an overview of the 6020 CTC. A programming example, 6020_CTC.CPP, is included on the 6020 utility disk, which demonstrates using CTC counters 0 and 1 to generate periodic interrupts.

To adequately explain the counter timer controller, the 6020 CTC is presented in three functional sections:

- Address mapping
- Interrupts
- Counter /timers

≡ Address mapping

The base address of the CTC is jumper selectable. Refer to Table 15-1 for the base address selection.

Table 15-1 CTC base address selection: 6020

IA: W2[7-8]	IB: W2[9-10]	J1: EZ I/O 1 address	J7: EZ I/O 2 address	CTC I/O address
not jumpered	not jumpered	320H	328H	330H
jumpered	not jumpered	120H	128H	130H
not jumpered	jumpered	340H	348H	350h
jumpered*	jumpered*	140H*	148H*	150H*

* = default, jumpers on

Note Selecting a different CTC I/O address also selects a different I/O address for the EZ I/O digital ports. For information on EZ I/O, refer to the *EZ I/O* section in the *EZ I/O* chapter.

It is important that no other devices in the system be set for access at the same I/O locations as the 6020 CTC or EZ I/O ports. The CTC mapped locations consist of four separate I/O addresses.

The following addresses each access a different function of the CTC:

- Base+0 = CTC counter 0
- Base+1 = CTC counter 1
- Base+2 = CTC counter 2
- Base+3 = CTC control register

Refer to the *Counter/timers* section for details on each I/O location and their functions.

≡ Interrupts

The outputs of CTC counters 0 and 1 are used to provide periodic interrupts to the 6020 CPU. The output of counter 0 is routed to IRQ 12, and the output of counter 1 is routed to IRQ11.

≡ Counter/timers

The CTC has three separate counter/timers included in one package. Three data registers are associated with the control register. After powerup, the state of the 82C54 is undefined because the mode and count value of all counters have not been defined. The operation of each counter is determined after it is programmed. Each counter must be programmed before it can be used. Unused counters, however, do not need to be programmed.

Note Since the CTC mainly functions as an interrupt generating device, it is important to disable interrupts prior to programming the CTC and then re-enable the interrupts.

The following define each section of each counter/timer:

CTC CLOCK inputs	Any negative transition on the CLOCK input will decrement the numeric value of the count registers.
CTC GATE inputs	The GATE input, when true, allows the CLOCK signal to decrement the value of the count.
CTC outputs	Depending on the mode, the OUT signal will either toggle or pulse when the count value reaches 0.

Each of the above counter/timer counters can operate in one of six different modes. For more information on the different modes, refer to the *Counter/timer modes* section.

Programming the counter/timers

Each counter must be programmed with the desirable mode and then with an initial count before it can be used. This is accomplished by writing a control word and then an initial count. The control word is written in the form of a formatted byte to the CTC control register (Base+3).

Example

OUT &153, &76 Writes a 76h as a control word to the CTC control register and configures a selected counter.

OUT &150, &AA Writes the count value of AAH to the counter. The counter is determined in the 76h control word.

Examples of a CTC control word:

00111010 = 3A hex

Select Counter = Counter 0
RW = Least significant byte then most significant byte
Mode = Mode 5 hardware triggered strobe
BCD = Binary counter 16 bits

01110110 = 76 hex

Select Counter = Counter 1
RW = Least significant byte then most significant byte
Mode = Mode 3 square wave generator
BCD = Binary counter 16 bits

10110100 = B4 hex

Select Counter = Counter 2
RW = Least significant byte then most significant byte
Mode = Mode 2 rate generator
BCD = Binary counter 16 bits

Examples of the count value

A count value is then loaded after the counter has been configured. &4800 is equal to 18432 decimal. If the 1.843 MHz clock is divided by this value, the result will be 100. Therefore, if counter 2 is loaded with this count, the OUTPUT will cycle every 1/100 of a second or 100Hz. &64 is equal to 100 decimal. If this value is loaded into counter 0 and since the 100 Hz output of counter 2 is routed to counter 0 CLOCK, the output generated from counter 0 will cycle once every second or 1 Hz. The selected counter may then require the GATE to change states before counting begins. How the OUTPUT appears (Square Wave, Strobe, etc.) will depend on how the counter was configured. Refer to the *Control word definition section* .

A programming example, 6020_CTC.CPP, is included on the 6020 utility disk, which demonstrates the use of CTC counters 0 and 1 to generate periodic interrupts.

Control word definition

The control word sets the counter/timer to a specific mode of counting. In addition to the various counting modes, the setup in Table 15-2 should be considered:

Table 15-2 Control word setup

D7	D6	D5	D4	D3	D2	D1	D0
SC1	SC0	RW1	RW0	M2	M1	M0	BCD

Table 15-3 Control word setup and description

Setup	Description
D7 - SC1	Select counter bit 1
D6 - SC0	Select counter bit 0
D5 - RW1	Read/write bit 1
D4 - RW0	Read/write bit 0
D3 - M2	Mode bit 2
D2 - M1	Mode bit 1
D1 - M0	Mode bit 0
D0 - BCD	Binary coded decimal enable bit

Select counter bits

Bit SC0 and bit SC1 select the correct counter for the control word. When SC0 and SC1 select a specific counter, the remaining bits of the control word apply to that counter.

Table 15-4 Select counter bits: SC0 and SC1

SC1	SC0	Description
0	0	Select counter 0
0	1	Select counter 1
1	0	Select counter 2
1	1	Read back command

Note For additional information on the read back command, refer to the *Intel peripheral 82C54 data sheet* or the *NEC 71054 data sheet*.

Read/write bits

During a control word write, bit RW1 and RW0 are used to determine the format for the data that is either read from or written to the counters. The initial count must follow the count format specified by the RW bits. Least significant byte only, most significant byte only, or least significant byte and then most significant byte are the formats that can be specified.

Table 15-5 Read /write bits: RW1 and RW0

RW1	RW0	Description
0	0	Counter latch command
0	1	Read and write least significant byte only
1	0	Read and write most significant byte only
1	1	Read and write least and then most significant byte

Note For additional information on the counter latch command, refer to the *Intel peripheral 82C54 data sheet* or the *NEC 71054 data sheet*.

Counter/timer modes

There are six different modes for the counter/timers.

Table 15-6 Counter timer modes

M2	M1	M0	Description
0	0	0	Mode 0 – Terminal count
0	0	1	Mode 1 – Hardware retriggerable one shot
X	1	0	Mode 2 – Rate generator
X	1	1	Mode 3 – Square wave generator
1	0	0	Mode 4 – Software triggered strobe
1	0	1	Mode 5 – Hardware triggered strobe

Binary coded decimal (BCD) bit

The binary coded decimal enable bit is used to set the counter into BCD or binary counter decimal modes.

Table 15-7 Binary counter modes

BCD	Description
0	Binary counter 16-bits
1	Binary Coded Decimal (BCD) Counter (4 decades)

Definition of CTC modes

To begin counting, several CTC modes require the GATE to toggle. Modes 1, 4, and 5 require control of the GATE. The GATE address is always 0xA8, bit 4. The GATE of the 6020 counter 2 is always enabled, therefore only Modes 0, 2, and 3 are effective for counter 2. The GATEs for counter 0 and counter 1 are tied together and are either pulled high or enabled by CTC Gate Enable so all modes can be used for these counters. Since the primary purpose of the 6020 CTC design is to

generate periodic interrupts, modes 2 and 3 will be most effective. The programming example, 6020_CTC.CPP, demonstrates the use of modes 2 and 3.

Mode 0 – Terminal count

The terminal count mode is generally used to count external events. Because the 6020 CTC is not accessed externally, this mode will not be discussed.

Mode 1 – Hardware retriggerable one shot

To make this mode useful, load a count into either counter 0 or counter 1, or both, and then start the count by enabling the GATE. Once the count has been reached, an interrupt will be generated from the associated counter. This mode requires control of the GATE and, therefore, cannot be used for the counter 2 pre-scaler.

After the control word is written, OUT goes HIGH. A count value N is written to the counter and the one shot is now armed. Any positive transition of the GATE signal is latched and the next positive transition of the CLOCK signal enables the one shot. The OUT signal will go LOW on the next negative CLOCK transition and remain LOW for N negative transitions of the CLOCK signal. When the COUNT value N reaches a value 0, OUT will return HIGH. The ONE SHOT is retriggerable and any positive transition on the GATE input will reload the ONE SHOT time, which keeps OUT low for another N intervals of CLOCK transitions.

Mode 2 – Rate generator

The rate generator mode generates an output pulse at a periodic rate. This mode is often used for counter 2, which is the pre-scalar for counters 0 and 1. Since the GATE of counter 2 is always enabled, counter 2 operates in this mode. Once the count has been reached, an output will be generated.

The OUT signal is set HIGH after the control word is written. After the COUNT value N is written, the counter is loaded and begins to decrement on CLOCK cycles. When the COUNT value reaches 0, OUT will go LOW for one CLOCK period and then return HIGH. The N value is automatically reloaded into the counter and is decremented on subsequent CLOCK pulses.

The GATE input is HIGH, which enables the counter. If the GATE input is LOW then counting is inhibited. If GATE goes LOW during an OUT pulse, OUT is immediately returned to a HIGH. On the rising edge of GATE the initial N value reloads on the next CLOCK pulse. The value decrements on subsequent CLOCK pulses.

Note A COUNT value of "1" is illegal in Mode 2.

Because the interrupts are typically edge triggered, the interrupt is not generated until OUT goes low and then high again (CLOCK count +1).

Mode 3 – Square wave mode

This mode is useful when it is necessary to generate a Square Wave output. This mode will be used most often for counter 2, which is the pre-scalar for counters 0 and 1. Since the GATE of counter 2 is always enabled, counter 2 will operate in this mode. Counters 0 and 1 can also use this mode to further divide the output of counter 2. The OUT signal is HIGH after the control word is written. After the COUNT value of N is written, the OUT signal will go LOW on the negative edge of the next CLOCK cycle. If N is an EVEN number, OUT will remain LOW for N/2 CLOCK cycles, if N is an ODD number, OUT is LOW for N/2 + 1 CLOCK cycles. OUT then goes HIGH and remains HIGH until N equals 0. The value N is then automatically reloaded into the counter and the period repeats.

The GATE input being HIGH enables the counter. If GATE input is LOW then counting is inhibited. If GATE goes LOW while OUT is LOW, OUT will go HIGH immediately. The positive transition of GATE will reload the count value of N into the counter on the next CLOCK cycle. The COUNT value will then be decremented on subsequent CLOCK cycles.

Because interrupts are typically positive edge triggered, the interrupt will not be generated until OUT goes low and then high again (CLOCK count +1).

Mode 4 - Software triggered strobe

This mode can be useful when no external events are needed or provided to generate an interrupt by the CTC. Once the count at counter 0 or counter 1 has been reached an interrupt will be generated. This mode requires control of the GATE and, therefore, cannot be used for the counter 2.

This mode is useful in order to generate a one CLOCK pulse width OUTPUT after a COUNT value of N has expired. The OUT signal is HIGH after the control word is written. After the COUNT value of N is written, the value is loaded into the counter on the next CLOCK cycle. The value is not decremented on this cycle. The OUT signal remains HIGH until the counter reaches a 0 value. OUT then cycles LOW for one CLOCK period. OUT will then remain HIGH after this cycle until a COUNT value is rewritten to the counter.

GATE input equal to 1 enables the counter.

GATE input equal to 0 inhibits the counter.

The GATE input does not effect the OUT signal in any other way.

Because interrupts are typically positive edge triggered, the interrupt will not be generated until OUT goes low and then high again (CLOCK count +1).

Mode 5 – Hardware triggered strobe

This mode can be useful by loading a count into counter 0 or counter 1 and then starting the count by enabling the GATE. Once the count has been reached an interrupt will be generated. This mode requires control of the GATE and, therefore, cannot be used for the counter 2 pre-scaler.

This mode is useful in order to generate a one CLOCK cycle width OUTPUT triggered by GATE, after a COUNT value of N has expired. The OUT signal is HIGH after the control word is written. The COUNT value of N is then written. A POSITIVE transition on the GATE input is then required. The next CLOCK cycle loads the COUNT value into the counter, and subsequent CLOCK cycles decrement the counter. When the counter reaches a value of 0 the OUT cycles LOW for one CLOCK period. GATE does not inhibit the counter or effect the OUT signal. Any POSITIVE transition of the GATE input will reload the COUNT value N into the counter and the counting will continue.

Because interrupts are typically positive edge triggered, the interrupt will not be generated until OUT goes low and then high again (CLOCK count +1).

≡ Enhanced INT 17H function definition

Initialize counter/timer chip

Purpose: To configure the 6020 on-board CTC.

Calling registers:

AH	eeh
AL	00h
BL	Channel 2 timebase 0->longest possible 1->1/100 (100 Hz) (Not supported for 7.159 MHz clock rate) 2->1/1000 (1KHz) 3->1/10,000 (10 KHz)
BH	Channel 2 input clock frequency 0->1.843 MHz [W2 2-4 jumpered] 1->7.159 MHz [W2 1-2 jumpered]
CL	Channel 0 mode select 0->square wave generator 1->rate generator
CH	Channel 1 mode select 0->square wave generator 1->rate generator
Sl	Channel 0 count, c0cnt channel 0 period = timebase * c0count
Dl	Channel 1 count, c1cnt channel 1 period = timebase * c1count

Return registers: Carry flag cleared if successful

Carry flag set if error
AL Error code

Comments: This function shall be used to initialize CTC.

Programming example:

```
/* Inline assembly code for Borland C++ 3.1 */
/* To configure channel 0 to generate IRQ 12
   interrupt every 1s */
/* To configure channel 1 to generate IRQ 11
   interrupt every 10s */

asm {

      mov   ax,0ee00h
      mov   bl,01h /* timebase = 1/100*/
      mov   bh,00h /* 1.8432 MHz input clock
            frequency */
      mov   cl,00h /* channel 0 used as square
            wave generator */
      mov   ch,01h /* channel 1, used as rate
            generator */
      mov   si,100 /* channel 0 period =
            (1/100)*100 = 1s */
      mov   di,1000 /*  channel 1 period =
            (1/100)*1000 = 10s */
      mov   dx,0ffffh
      int   17h

     }
```

Error code definition:

Error code	Meaning
ffh	Unknown error
01h	Function not implemented
02h	Defective serial EEPROM
03h	Illegal access
04h	EZ I/O data out of range
05h	CTC data out of range

Note Refer to the \CTC directory on the 6020 utility disk for programming examples.

≡ CAMBASIC

CAMBASIC can program the CTC with the INT 17H commands. Refer to the \CTC directory in the 6020 utility disk for CAMBASIC programming examples.

Chapter 16: Watchdog timer, reset, and remote reset

Watchdog timer

The watchdog timer is a fail-safe against program crashes or processor lockups. It times out every 1.6 seconds (1.6 sec. typical, 1.00 sec. min., 2.25 sec. max.) unless it is disabled or strobed by the software. The watchdog timer can be controlled through the enhanced INT 17H interface which is a built-in function on the PC Microcontroller.

Enhanced INT 17H function definitions

This section provides definitions for the following functions: Enable Watchdog, Strobe Watchdog, and Disable Watchdog.

Enable watchdog

Function: fdh

Subfunction: 01h

Purpose: To enable the watchdog.

Calling registers: AH fdh

AL 01h

DX ffffh

Return registers: None

Comments: This function enables the watchdog. Once the watchdog is enabled, it has to be strobed at a period of not less than 1.6 seconds or until the watchdog is disabled. Otherwise, a system reset will occur.

Programming example:

```
/* Inline assembly code for Borland C++ 3.1 */
asm {
     mov   ax,0fd01h
     mov   dx,0ffffh
     int   17h
    }
```

Strobe watchdog

Function: fdh

Subfunction: 02h

Purpose: To strobe the watchdog.

Calling registers: AH fdh
AL 02h
DX ffffh

Return registers: None

Comments: This function strobes the watchdog. Once the watchdog is enabled, it has to be strobed at a period of not less than 1.6 seconds or until the watchdog is disabled. Otherwise, a system reset will occur.

Programming example:

```
/* Inline assembly code for Borland C++ 3.1 */
    asm {
          mov   ax,0fd02h
          mov   dx,0ffffh
          int   17h
        }
```

The watchdog timer can also be strobed by reading address 20CH. This may be faster than strobing the watchdog timer with an interrupts function call, for example:

```
A=INP(20Ch)
```

Disable watchdog

Function: fdh

Subfunction: 03h

Purpose: To disable the watchdog.

Calling registers: AH fdh

AL 03h

DX ffffh

Return registers: None

Comments: This function disables the watchdog. Once the watchdog is enabled, it has to be strobed at a period of not less than 1.6 seconds or until the watchdog is disabled. Otherwise, a system reset will occur.

Programming example:

```
/* Inline assembly code for Borland C++ 3.1 */
asm {
     mov   ax,0fd03h
     mov   dx,0ffffh
     int   17h
    }
```

≡ Hardware reset

The PC Microcontroller has a button which allows you to reset the system without turning off the power. This provides a more complete reset than the <CTRL><ALT><DEL> method. The RESET command also accomplishes the same thing as the reset button.

WARNING!

When using COM1 as the console, <CTRL> <ALT> <DEL> only resets the host system. Use the RESET command to issue a hardware reset.

≡ Reset via optically isolated input

The PC Microcontroller provides an optically isolated remote input dedicated for generating a master reset to the system. This input is located at the AUX I/O connector and can also be accessed on the break-out board. See the *AUX I/O* chapter for more information about the opto-isolated input on the breakout board and for an illustration of its recommended timing usage.

Chapter 17: Serial EEPROM

≡ Description

Up to 768 words of user-definable data can be saved in the serial EEPROM. The serial EEPROM does not require battery backup to maintain the data when the system power is off. The serial EEPROM is easily accessible via software interrupts by most programming languages.

The real time calendar/clock provides the user with 512 bytes of user-defined CMOS RAM. This RAM requires battery backup to maintain data. If a battery is not desirable, this data can be stored in serial EEPROM, written to CMOS RAM on power up, changed and written back to serial EEPROM.

≡ Enhanced INT 17H function definitions

This section provides definitions for the following functions: Read Single Word from Serial EEPROM, Write Single Word to Serial EEPROM, Read Multiple Words from Serial EEPROM, Write Multiple Words to Serial EEPROM, and Return Serial EEPROM Size.

Read a single word from the serial EEPROM

Function: fch
Subfunction: 00h

Purpose: To read a single word from the on-board serial EEPROM.

Calling registers:
AH fch
AL 00h
BX Word address (zero based)
DX ffffh

Return registers:
Carry flag cleared if successful
AX Word read

Carry flag set if error
AL Error code

Error Code	Meaning
ffh	Unknown error
01h	Function not implemented
02h	Defective serial EEPROM
03h	Illegal access

Comments: This function reads a word from the user area of the serial EEPROM.

Programming example:

```
/* Read word 2 */
unsigned int seeData;
/* Inline assembly code for Borland C++ 3.1 */
asm {
 mov ax,0fc00h
 mov bx,02h     /* Read word 2 */
 mov dx,0ffffh
 int 17h
 mov seeData,ax /* store data in c environment */
    }
```

Write a single word to the serial EEPROM

Function: fch
Subfunction: 01h

Purpose: To write a single word to the on-board serial EEPROM.

Calling registers:
AH fch
AL 01h
BX Word address (zero based)
CX Data word to write
DX ffffh

Return registers: Carry flag cleared if successful

Carry flag set if error
AL Error code

Error Code	Meaning
ffh	Unknown error
01h	Function not implemented
02h	Defective serial EEPROM
03h	Illegal access

Comments: This function writes a word to the user area of the serial EEPROM.

Programming example:

```
/* Write 0x1234 to word 3*/
unsigned int seeData = 0x1234;
/* Inline assembly code for Borland C++ 3.1 */
asm {
 mov ax,0fc01h
 mov bx,03h     /* Write word 3 */
 mov cx,seeData /* Get write data from c environment */
 mov dx,0ffffh
 int 17h
    }
```

Read multiple words from the serial EEPROM

Function: fch
Subfunction: 02h

Purpose: To read multiple words from the on-board serial EEPROM.

Calling registers:

AH	fch
AL	02h
BX	Word address (zero based)
CX	Word count
DX	ffffh
ES:DI	Destination pointer

Return registers:

Carry flag cleared if successful

AX	Word read

Carry flag set if error

AL	Error code

Error Code	**Meaning**
ffh	Unknown error
01h	Function not implemented
02h	Defective serial EEPROM
03h	Illegal access

Comments: This function reads multiple words from the user area of the serial EEPROM.

Programming example:

```
/* Read 10 words starting at word 5 */
unsigned int far *seeDataPtr = new unsigned int[10];
/* Allocate storage*/
/* Inline assembly code for Borland C++ 3.1 */
asm {
    mov  ax,0fc02h
    mov  bx,05h     /* Read starts at word 5 */
    mov  cx,10      /* Read 10 words */
    mov  dx,0ffffh
    les  di,seeDataPtr
    int  17h
    }
```

Write multiple words to the serial EEPROM

Function: fch
Subfunction: 03h

Purpose: To write multiple words to the on-board serial EEPROM.

Calling registers:

AH	fch
AL	03h
BX	Word address (zero based)
CX	Word count
DX	ffffh
DS:SI	Source pointer

Return registers: Carry flag cleared if successful

Carry flag set if error

AL	Error code

Error Code	Meaning
ffh	Unknown error
01h	Function not implemented
02h	Defective serial EEPROM
03h	Illegal access

Comments: This function writes multiple words to the user area of the serial EEPROM.

Programming example:

```
/* Write 8 words starting at word 6*/
    unsigned int far *seeDataPtr = new unsigned int[8]; /*
Allocate storage*/
    unsigned int far* tmpPtr = seeDataPtr;
    for(int i=0;i<8;i++)
      *seeDataPtr = i;   /* initialize data */
/* Inline assembly code for Borland C++ 3.1 */
    asm {
         push ds
         mov  ax,0fc03h
         mov  bx,06h     /* Write starts at word 6 */
         mov  cx,8       /* Write 8 words */
         mov  dx,0ffffh
         lds  si,seeDataPtr
         int  17h
         pop  ds
        }
```

Return serial EEPROM size

Function: fch
Subfunction: 04h

Purpose: To obtain the size of the on-board serial EEPROM.

Calling registers:

AH	fch
AL	04h
DX	ffffh

Return registers: Carry flag cleared if successful

AX	Size of the serial EEPROM (in words)
BX	Size available to user (in words)

Carry flag set if error
AL Error code

Error Code	Meaning
ffh	Unknown error
01h	Function not implemented
02h	Defective serial EEPROM
03h	Illegal access

Comments: This function returns the size (in words) of the serial EEPROM. Since the user cannot access all of the serial EEPROM, this function determines how much space is available to the user. This avoids the user from accessing unavailable address.

Programming example:

```
unsigned int seeUserSize;
/* Inline assembly code for Borland C++ 3.1 */
asm {
     mov   ax,0fc04h
     mov   dx,0ffffh
     int   17h
     mov   seeUserSize,bx
    }
```

Chapter 18: CPU power management

≡ Description

The power management for the PC Microcontrollers in the 6000 Series only functions in DOS. The power demands of a system can severely limit an application due to thermal constraints or the raw power usage in a battery-operated application. To maintain speed and efficiency, a software-controlled, power management system must be tailored to the application. Even if your application is operating within specified limits, a power management system may improve the life and reliability of your system by reducing thermal stress to the CPU.

Power management can be enabled in the PC Microcontroller SETUP program and fine tuned with the PMISETUP program. DOS-supplied advanced power management (APM) programs, such as POWER.EXE are also supported. See the PC Microcontroller utility disk for a list of example programs located in the \EXAMPLES directory. For more information on using the SETUP utility, refer to the *Setup programs* chapter. For more information on using the PMISETUP utility, see the *PMISETUP* section later in this chapter.

≡ Power management overview

Power management is implemented via the software management interface (SMI) function, and provides multiple levels of management. The firmware is also capable of cooperative power management with an APM compatible driver or application, such as POWER.EXE. Cooperative power management allows power aware applications to control the power state of the system without depending on interrupts or device access to indicate that the CPU is actively executing application code. At the hardware level, the power management system cannot detect CPU activity except by monitoring bus activity such as interrupts or access to specific memory or I/O address ranges.

The hardware is capable of minimal levels of power management without interacting with the firmware at all. For example, once the IDLE timer is configured by the firmware, the IDLE timer monitors specific activities and enters the halt state after periods of inactivity. These activities are monitored constantly to determine if power management is suitable. If the specific events do not occur, the IDLE timer will eventually expire, which places the system into the SUSPEND state where devices can be optionally powered down. At the same time, the CPU is in the HALT state to conserve power. While the CPU is in the HALT state, specific events can be monitored to RESUME the system to full power.

In a stand-alone environment (no APM software active), the firmware works in conjunction with the hardware doze timer and monitoring functions to identify periods when certain devices or the entire system are inactive. Individual timers are supported for specific devices, including the hard disk. Whenever this device is not accessed for a specified period, it is powered down to reduce system power consumption. Whenever none of the monitored system devices has been accessed for a specified period of time, the performance of the system is reduced or the CPU is halted altogether to further reduce power consumption.

In a cooperative environment, devices are still controlled by the firmware, but the CPU is never halted without the consent of the APM software. Rather, the firmware notifies the software when a timer has expired or some other event has occurred which should place the system in a reduced power mode. The APM software polls the firmware for such events. Once an event has occurred, the software initiates the reduced power mode by acknowledging the event back to the firmware. The firmware then initiates the reduced power mode. The APM software can inquire "APM aware" applications to ensure that the reduced power mode is acceptable.

≡ Hardware controlled modes

The IDLE timer is configured to reset by specific events which include the keyboard, video, hard disk, line printer, serial port, floppy disk, and selected IRQ or DRQ activities. When these specific events do not occur, the system enters the SUSPEND mode. In this mode, devices such as the hard disk, floppy disk, parallel port, serial ports, video, super I/O, and peripheral chip are powered down to conserve power.

In addition to powering down these specified devices, the CPU then enters the halt state. The hard disk, parallel port, video, real time clock, IN access, DRQs, GP0 (memory access at E8000h-EFFFFh) and GP1 (I/O access at 3xxh) are specified events that are configured to resume the system from the SUSPEND state.

≡ Device power management

The hard disk is power managed on an individual basis. The firmware configures a hardware timer that is reset each time the device is accessed. If there is no access to the hard disk, the timer will eventually expire and the hard disk will then power down to conserve power. Later, when the hard disk is restored by a triggering event, such as a keystroke, the access SMI is disabled and the timer is restarted.

≡ System power management

At the system level, power management is very similar to the device level management, with a few exceptions. Cooperative management is supported, allowing an APM driver, such as POWER.EXE, to control the actual power state transitions. This is done by identifying power management events and reporting them to the APM driver via a polling mechanism. Power state transitions then occur at the request of the APM driver.

The IDLE timer can be reset by numerous sources, including device accesses and interrupts. Note that it is possible for the IDLE timer configuration to be of shorter duration than the device timers. This means that the system can be deemed IDLE even though some of the devices are still active. When this occurs, the device power states are set according to their configuration in CMOS.

Note that the APM interface prevents the system from entering SUSPEND mode directly. These modes are entered, but that occurs through the APM interface (INT15h) at the request of the APM driver.

SUSPEND mode is the lowest power state that the system can attain while still powered. The system enters the SUSPEND state when the RESUME switch is turned off. All controllable devices are powered down and the CPU halts. In the SUSPEND state, an IRQ event including a timer tick will cause the CPU to resume from halt. If the CPU determines that the only cause of resume was the IRQ event from the timer tick, then the CPU halts again. Otherwise, the CPU resumes from the SUSPEND state. The devices which are powered ON when the system RESUMEs are specified in CMOS, loaded from the .PMI file. Devices which do not have associated access SMIs, must be powered up. In addition, since the CPU was stopped, the system time must be updated. If an APM driver is operating, it has the responsibility of updating the time when notified to do so. Otherwise, the firmware will update the DOS compatible system time if configured to do so. For operating systems with DOS compatible system clocks, this function should be disabled in CMOS. Since the clock does not run in SUSPEND mode and the system is not restarted by IRQ0 to maintain the time of day, the time must be reset when the system resumes. The BIOS can read the actual time from the real time clock and restore the operating system's timer from that value. The time update can be enabled or disabled using the SETUP program. In SETUP, the option initiating the SUSPEND/RESUME with system activities, is available.

Initiating the SUSPEND/RESUME option with system activities

1. In SETUP and in a .PMI file, enable power management and select the following options:

   SETUP:

Power management:	ENABLED
Time updated after suspend:	ENABLED

2. Create a .PMI file such as TEST.PMI. Include the following commands in the TEST.PMI file:

   TEST.PMI file:

pmi enable=Y	Enables the power management
suspend delay=5	SUSPEND after 5 minutes of idling

Note The qualified activities to prevent the system from entering the SUSPEND mode are keyboard, video, hard disk, printer, COM ports, floppy drive, IRQs, and DRQs.

3. Specify the devices to be powered down in SUSPEND mode by entering the commands below:

suspend hdd=Y	Powers down the hard disk
suspend fdd=Y	Powers down the floppy disk
suspend COM2=Y	Powers down COM2

4. Specify the events to resume the system from SUSPEND mode.

keyboard resume=Y	Resumes the system from SUSPEND mode
com1 resume=Y	Resumes the system from SUSPEND mode

Note The qualified activities to resume the system from SUSPEND mode are keyboard, video, hard disk, printer, real time clock, DRQs, COM ports, and IN accesses (interrupts related to input devices).

5. When the real time clock is used to initiate RESUME from SUSPEND, enter:

   rtc resume=Y Resumes the real time clock from the SUSPEND mode

   An example program named WAKEIRQ8 is included in the \EXAMPLES directory on the PC Microcontroller utility disk. This program powers the CMOS clock to generate an IRQ8 after a 30-second delay. During the delay, the system halts. After 30 seconds, the system resumes from SUSPEND.

6. Load the .PMI file changes by including the .PMI file on the PMISETUP command line. PMISETUP is located in the \UTILS directory:

   ```
   C:\> PMISETUP TEST.PMI
   ```

7. Hardware reset the system for the PMISETUP options to take effect. The system is now under power management and is ready for SUSPEND/RESUME.

8. Once the system enters the SUSPEND mode, specified devices are powered down. Triggering the specified events will cause the system to resume.

≡ Power management configuration

The power management functions can be globally enabled or disabled in CMOS. The 60xx SETUP.EXE and PMISETUP.EXE utilities provide an option for enabling or disabling power management.

Enabling power management

Whichever utility, SETUP or PMISETUP, is configured and saved (or loaded) last, that configuration is used for enabling or disabling power management. In other words, if the power management option is disabled in SETUP and then later a .PMI file which shows pmi enable = Y is loaded with PMISETUP, the power management option in SETUP will now show power management as being enabled.

In 60xx SETUP, the power management options can be enabled or disabled. The fine-tuning of the power management is done through a PMISETUP with a .PMI file. All supported options are described in the subsequent sections and are represented by the | symbol. For example, "pmi enable = YES | NO" can either mean "pmi enable = YES" or "pmi enable = NO" as the valid settings. In abbreviated terms, "Y" is also accepted for "YES" and "N" for "NO".

In 60xx SETUP, the following options are available:

- Power management ENABLED | DISABLED
- Time updated after suspend: ENABLED | DISABLED

In PMISETUP, the following options are available:

- pmi enable=Y|N Enables/disables the power management
- Time updated after suspend=YES|NO Enables or disables the time updated after suspend

System timers

The system timers define the delays associated with power state transitions in the system. In addition to full on, only one managed system power mode is supported, the SUSPEND mode. It is possible to configure the suspend delay timer so that when the timer expires, the system will enter the SUSPEND mode. There is also an individual timer for hard disk power management. These timer settings are configured in the .PMI file of the PMISETUP program as follows:

suspend delay=xx	Sets delay time before system SUSPENDs (xx=0-31 minutes)
hdd delay=xx	Sets delay time before hard drive suspends, xx=0-31 minutes

IDLE timer resets

The IDLE timer monitors system activity to prevent the system from entering SUSPEND mode if bus activity indicates that the system is busy. Access to these devices will also cause the system to RESUME from SUSPEND mode. The bus activities that are monitored are configured in a .PMI file:

keyboard reset idle=Y|N	Enables reset of IDLE timer if Keyboard access occurs
video reset idle=Y|N	Enables reset of IDLE timer if Video access occurs
HDD reset idle=Y|N	Enables reset of IDLE timer if Hard Disk Drive access occurs
IRQ reset idle=Y|N	Enables reset of IDLE timer if IRQ access occurs
LPT reset idle=Y|N	Enables reset of IDLE timer if LPT access occurs
COM reset idle=Y|N	Enables reset of IDLE timer if COM access occurs
FDD reset idle=Y|N	Enables reset of IDLE timer if Floppy Disk Drive access occurs
DRQ reset idle=Y|N	Enables reset of IDLE timer if DRQ access occurs

Interrupts in the system can also reset the IDLE timer to prevent entry into reduced power modes. These interrupts should be enabled to reset the IDLE timer if they indicate that the system is active. The interrupts to reset the IDLE timer are configured in a .PMI file:

irq0 reset idle=Y|N	Enables reset of IDLE clock if IRQ0 occurs
irq1 reset idle=Y|N	Enables reset of IDLE clock if IRQ1 occurs
irqnmi reset idle=Y|N	Enables reset of IDLE clock if IRQNMI occurs
irq3 reset idle=Y|N	Enables reset of IDLE clock if IRQ3 occurs
irq4 reset idle=Y|N	Enables reset of IDLE clock if IRQ4 occurs
irq5 reset idle=Y|N	Enables reset of IDLE clock if IRQ5 occurs
irq6 reset idle=Y|N	Enables reset of IDLE clock if IRQ6 occurs
irq7 reset idle=Y|N	Enables reset of IDLE clock if IRQ7 occurs
irq8 reset idle=Y|N	Enables reset of IDLE clock if IRQ8 occurs
irq9 reset idle=Y|N	Enables reset of IDLE clock if IRQ9 occurs
irq10 reset idle=Y|N	Enables reset of IDLE clock if IRQ10 occurs
irq11 reset idle=Y|N	Enables reset of IDLE clock if IRQ11 occurs
irq12 reset idle=Y|N	Enables reset of IDLE clock if IRQ12 occurs
irq13 reset idle=Y|N	Enables reset of IDLE clock if IRQ13 occurs
irq14 reset idle=Y|N	Enables reset of IDLE clock if IRQ14 occurs
irq15 reset idle=Y|N	Enables reset of IDLE clock if IRQ15 occurs

If DRQ reset idle is set to YES, then the following DRQ options are specified.

drq0 reset idle=Y|N	Enables reset of IDLE clock if DRQ0 occurs
drq1 reset idle=Y|N	Enables reset of IDLE clock if DRQ1 occurs
drq2 reset idle=Y|N	Enables reset of IDLE clock if DRQ2 occurs
drq3 reset idle=Y|N	Enables reset of IDLE clock if DRQ3 occurs
drq5 reset idle=Y|N	Enables reset of IDLE clock if DRQ5 occurs
drq6 reset idle=Y|N	Enables reset of IDLE clock if DRQ6 occurs
drq7 reset idle=Y|N	Enables reset of IDLE clock if DRQ7 occurs

Suspended devices in SUSPEND mode

Certain devices need to be powered down while the system is in the SUSPEND mode. These devices are configured in the .PMI file of the PMISETUP program.

suspend HDD=Y|N	Suspends hard disk drive
suspend FDD=Y|N	Suspends floppy disk drive
suspend LPT=Y|N	Suspends LPT
suspend VIDEO=Y|N	Suspends video
suspend COM1=Y|N	Suspends COM1
suspend COM2=Y|N	Suspends COM2
suspend COM3=Y|N	Suspends COM3
suspend COM4=Y|N	Suspends COM4
suspend SIO=Y|N	Suspends SIO

Resume conditions

Once the system has entered the SUSPEND mode, certain peripheral activities can be specified to return the system to the full power mode. The access activities are configured in the .PMI file of the PMISETUP program.

VIDEO resume=Y|N	Enables resume activities if Video suspend occurs
HDD resume=Y|N	Enables resume activities if access to Hard Disk suspend occurs
LPT resume=Y|N	Enables resume activities if access to LPT suspend occurs
GP0 resume=Y|N	Enables resume activities if access to GP0 suspend occurs
GP1 resume=Y|N	Enables resume activities if access to GP1 suspend occurs
RTC resume=Y|N	Enables resume activities if access to RTC suspend occurs
DRQ resume=Y|N	Enables resume activities if access to DRQ suspend occurs
IN resume=Y|N	Enables resume activities if access to IN suspend occurs
COM1 resume=Y|N	Enables resume activities if access to COM1 suspend occurs

COM2 resume=Y|N	Enables resume activities if access to COM2 suspend occurs
keyboard resume=Y|N	Enables resume activities if access to Key board Display suspend occurs

If DRQ access resume is set to YES, then the following options are available:

drq0 event=Y|N	Enables resume from SUSPEND mode if DRQ0 occurs
drq1 event=Y|N	Enables resume from SUSPEND mode if DRQ1 occurs
drq2 event=Y|N	Enables resume from SUSPEND mode if DRQ2 occurs
drq3 event=Y|N	Enables resume from SUSPEND mode if DRQ3 occurs
drq5 event=Y|N	Enables resume from SUSPEND mode if DRQ5 occurs
drq6 event=Y|N	Enables resume from SUSPEND mode if DRQ6 occurs
drq7 event=Y|N	Enables resume from SUSPEND mode if DRQ7 occurs
IN includes irq3=Y|N	Resume from SUSPEND mode if IRQ3 occurs and IN resume is enabled
IN includes irq4=Y|N	Resume from SUSPEND mode if IRQ4 occurs and IN resume is enabled
IN includes irq12=Y|N	Resume from SUSPEND mode if IRQ12 occurs and IN resume is enabled

Chapter 19: Using PICO FA

≡ Description

Phoenix's PICO FA™ includes an extended BIOS (PICOFA.IMG), a device driver (PICOFA.SYS), and a format utility (PFORMAT.EXE).

The extended BIOS emulates two read/write hard drives using flash memory in SSD0 and SRAM in SSD2. The format utility (PFORMAT.EXE) formats (or reformats) the writeable SSDs. The device driver PFORMAT.EXE is used when booting from a floppy or hard drive and when the extended BIOS (PICOFA.IMG) is disabled.

For more information, see the *Save and run programs* chapter and the *SETSSD* section in the *Setup programs* chapter.

≡ Using PFORMAT

Formatting a drive

To format a drive, do one of the following:

- For unformatted or preformatted drives, enter the following command:

  PFORMAT H*n* [**/m**]

  where *n* is the hard drive sequence number. This number includes IDE drives and SSDs. The optional parameter **/m** specifies PICO FA is to write an MBR (master boot record). This is required for unformatted drives that are not AMD, Intel, or Sharp flash memory.

- For preformatted drives, enter the following command:

  PFORMAT D: [**/m**]

Making a drive bootable

To make a drive bootable, do one of the following:

- Use SYS.EXE, which calls ROM–DOS.SYS, to make SSD0 bootable. ROM–DOS.SYS must be on the floppy boot disk.
- Boot from an MS-DOS operating system, if you are using MS-DOS You must boot from a floppy or hard drive.

To add your application, copy the files required for your application to the drive.

Note On occasion, PICO FA does a "garbage collection" of the flash file system. You may see a performance degradation during this time.

≡ Making copies of SSD0's contents for other boards

To copy an SSD for other PC Microcontroller boards, you must make an image of the SSD by doing the following:

1. Enter:

   GETIMG SSD0 *filename*

2. Transfer *filename* to the new board.

3. Enter:

   PGMIMG *filename* **SSD0**

Note Flash memory should be the same size and type.

To program a new BIOS into SSD0, issue the following command:

PGMBIOS *filename* **SSD0**

To make your PICO FA drives before the hard drive (to allow you to boot from SSD), issue the following command:

SETSSD SSD0 /BEFORE

In order to make hard drives first and SSDs second, issue the following command:

SETSSD SSD0 /AFTER

For more information, see the *SETSSD* section in the *Setup programs* chapter.

Chapter 20: CAMBASIC

Note Power management should be disabled when using CAMBASIC.

≡ Introduction

All PC Microcontrollers in the 6000 Series are programmable in CAMBASIC™—Octagon's version of an industrial programming language specifically designed for embedded applications. CAMBASIC is a data acquisition and an industrial control language which is easy-to-use, fast, and multitasking. CAMBASIC has the ability to communicate directly to all on-card I/O including digital, analog, timing, and interrupt. This eliminates the need to write hardware drivers which means you can spend your time writing the applications software.

CAMBASIC is optimized for a 32-bit processor and supports 133 QuickBASIC compatible commands. CAMBASIC's industrial power comes from the 93 additional commands contained in this language.

CAMBASIC's major strengths include an extensive vocabulary of industrial BASIC commands along with a list of built-in help messages which makes the language self-documenting. Since the language is syntax compatible with languages like Microsoft QuickBASIC, there is no need for professional programmers. If you have any experience in writing BASIC programs, you are already considered an expert in the CAMBASIC language. Even if you have not had any previous programming experience, there are dozens of books that can teach you to program in BASIC.

≡ Major features

Below are the descriptions of the major features found in the CAMBASIC language.

Event Multitasking™

CAMBASIC uses Event Multitasking™—an efficient method that compiles tasks to machine code for fast assembly operation. During the execution of the main program, all tasks are sampled in the background at 160 times per second. Depending upon the command, the CPU type and speed, the foreground program speed ranges from 5000 to 50,000 commands per second. For example, with 32 tasks activated, the background task checking rate translates to approximately 10,000 tasks per second.

CAMBASIC task types

Event Multitasking lets you do a number of system tasks in the background while you execute your program. The following tasks are available in CAMBASIC:

- Calling subroutines every 0.01 to 655 seconds

Note Use ON TICKA and ON TICKB statements to call subroutines.

- 8 counters with an interrupt on a present count
- 8 programmable timed outputs
- 8 interrupts on changes in digital inputs
- Keypad scanning and debounce
- Capturing serial input without slowing or stopping the program
- Printing data without slowing the program.

Easy-to-write programs

CAMBASIC is termed as the "no hassle" embedded language. It only takes four simple steps to write the program and much less time than C.

1. At the C:> prompt, type CAMBASIC.
2. Write your program. CAMBASIC comes with several programming examples.
3. Debug your program.
4. Type SAVE *name.*

Keyboard mode to debug hardware

The immediate keyboard mode used to examine system components and wiring hardware can quicken system debugging. The BIT command can be used to turn on and off motors, relays, etc. Even if C or another language is used for the applications program, CAMBASIC is always in flash and remains a fast and useful tool to validate correct system operation.

Built-in help and error messages

CAMBASIC has built-in help messages for pin-pointing problems. For example, when an error occurs in a user program, the syntax of the command that caused the error is displayed.

Industrial commands

CAMBASIC has more than 93 commands, many of which are tailored to the industrial environment. CAMBASIC can do the following:

- Read switch inputs individually or in groups
- Write to lamps, relays, and opto-isolator modules one at a time or in groups
- Write analog data to motor controllers, linear actuators, and linear indicators
- Read analog data from pressure transducers, RTDs, thermocouples, and strain gauges
- Send position and velocity profile information to smart motion control cards
- Measure elapsed time and frequency and generate frequency outputs.

Downloading programs remotely

Programs in CAMBASIC can be written and changed via the communication serial ports. Even the built-in text editor is designed to operate over a serial link. A system can be reprogrammed thousands of miles away with the addition of a modem or radio link. You can also perform immediate mode commands to exercise equipment and verify operation from any distance.

Network support

CAMBASIC supports RS-485 networking with direct access to the BIOS network kernel in which 32 systems may be networked at the same time. CAMBASIC has several commands to link directly to the BIOS kernel to receive and send operation codes and packets of data.

Compatibility with other programs

Using the CALL or CALL ABSOLUTE commands to access other programs, CAMBASIC lets you combine it with C, assembly, or any compiled language. Since entry and exit conditions are well defined, few limitations are placed on the called programs.

Industrial extensions of CAMBASIC

In addition to the list of industrial commands, there is also a list of industrial extensions supported by CAMBASIC:

AUTORUN	Autoruns a CAMBASIC program
BCCF	Returns the binary check code (BCC)
BCD	Converts binary to 4-digit BCD
BIN	Converts BCD to binary
BIN$	Returns the binary representation to string form
BIT	Reads or writes specific bits at I/O addresses
CLEAR DISPLAY	Clears display
CLEAR TIMER	Clears software timer
CONFIG AIN	Selects drivers for specified A/D
CONFIG AOT	Selects drivers for specified D/A
CONFIG BAUD	Configures COM port parameters
CONFIG COM$	Configures COM port
CONFIG COUNT	Configures software counter
CONFIG DISPLAY	Configures display
CONFIG KEYPAD$	Configures keypad
CONFIG PIO	Configures 82C55 parallel port
CONFIG TIMER	Configures software timer
COUNT	Returns the count from software counter
CRC	Returns the cyclic redundancy (CRC) of a memory block
DEC	Fast decrement of a numeric variable
DELAY	Introduces delay to program flow
DEV	Returns standard deviation of an array
DINP	Inputs a 16-bit value to I/O address
DISPLAY	Prints to a display
DOSINT	Executes DOS software interrupt
DOUT	Writes to a 16-bit value to I/O address
DPEEK	Read a 16-bit value from memory
DPOKE	Writes a 16-bit value to memory
ERROR	Returns error code or simulates run time error
EXIT DO	Exits DO loop unconditionally
EXIT FOR	Exits FOR loop unconditionally
INC	Fast increment of variable
HALT	Halts processor for lowest power mode
INDENT	Declares the network identification code
KEYPAD$	Reads the keypad
MAXVAL	Returns maximum value of elements in an array
MEAN	Returns mean value of the elements in an array
NET$	Returns a string from the RS-485 network
NLIST	Lists without a line number
NLLIST	Lists to the line printer without a line number
ON COUNT	Specifies condition for branching by the state of the software counters
ON ERR	Specifies location for branching when errors occur

ON INP	Specifies condition for branching by the state of an I/O address
ON KEYPAD$	Specifies location for branching when a key is pressed at the keypad
ON TICK	Specifies condition for branching by the state of the tick timer
POLY	Returns value from a power series in an array
PRINT$	Writes a string of characters
QUIT	Exits CAMBASIC to DOS
RMS	Returns Root-Mean-Square value of an array
SUM	Sums elements of array
UNNEW	Undoes the NEW command if possible
VARSEG	Returns segment of variable

Easy-to-use programming examples

CAMBASIC comes with a number of programming examples. Below are programming examples present in CAMBASIC.

Example 1

The following exemplifies the program to write display information to Octagon DP Series and LCD Series display:

```
10 CONFIG PIO &100,0,0,0,0,0: 'Configure an 8255 at
   &100 to be output ports
20 CONFIG DISPLAY &100,0,0: 'Use 2x20 fluorescent
   display with a hidden cursor at I/O address &100
30 CLEAR DISPLAY
40 DISPLAY (2,0) "OCTAGON SYSTEMS";
50 DISPLAY (2,1) "CORPORATION";
```

Example 2

In the following example, a 16-key keypad is connected to the printer port at I/O address &378. This program returns inputs from the keypad in use.

```
20 CONFIG KEYPAD$ &378,0,8: 'Keypad type=0(16-key),
   port address=&378,debounce=80ms
30 ON KEYPAD$ GOSUB..getkey
40 ...idle
50 GOTO..idle
100 ..getkey
110 A$ = KEYPAD$ (0) : 'Get key
120 POSITION = KEYPAD$(1) : 'Get position of key
130 PRINT "Key pressed is ";A$," Key position is ";
    POSITION
```

```
140 IF A$ = "0" THEN ON KEYPAD$ GOSUB : 'Disable key
    pad if the key pressed is "0'
150 RETURN KEYPAD$
```

Chapter 21: Software utilities

≡ Introduction

The PC Microcontroller ROM-DOS and utility disk comes with the utilities listed below. Refer to the *6000 Series user's manual* for a complete description of each of the software commands.

Support commands

- COM1CON.EXE
- GETBIOS.EXE
- GETIMG.EXE
- I17HNDLR.EXE
- LPT1CON.COM
- PFORMAT.EXE
- PGMBIOS.EXE
- PGMIMG.EXE
- PMISETUP.EXE
- REMDISK.EXE
- REMQUIT.COM
- REMSERV.EXE
- RESET.COM
- SCONSOLE.EXE
- SETSSD.EXE
- SETUP.COM
- TRANSFER.EXE

Support device drivers

- HIMEM.SYS
- PICOFA.SYS
- VDISK.SYS

Note Other utilities are included from ROM-DOS and are not mentioned in this section. Refer to your ROM-DOS manual.

Chapter 22: Troubleshooting

If your system is not working properly, check the following items.

No screen activity–checking console serial communications

If you do not get the sign-on message after bootup, check the following:

- Make sure all cards except the PC Microcontroller are removed from the card cage. This ensures that other cards are not interacting with the PC Microcontroller and that a video card is not installed.
- Remove the jumper from the "S" position at W1.
- The VTC-9F serial cable turns the PC Microcontroller serial port into a 9-pin AT serial port. Make sure a null modem adapter is installed on the other end, and that the assembly is inserted into the proper serial port on the PC. Make sure the VTC-9F serial cable is connected to COM1 on the PC Microcontroller.
- Make sure your power module provides +5V (+/-0.20V) and at least 2.5A of current.
- After verifying the above conditions, you can monitor voltage levels by connecting an oscilloscope between the TxD* line on COM1 and ground. After powerup, you should see a burst of activity on the oscilloscope screen. The voltage level should switch between +/-8V.

Garbled console screen activity

If you do get activity on your console screen but the message is garbled, check the following:

- Remove the jumper from the "S" position at W1 to force 9600, N, 8, 1 for COM1.
- If you are using PC SmartLINK, make sure you have configured the software for 9600 baud and have selected the correct serial port for communicating with your PC. Refer to the PC SmartLINK manual for information on selecting the baud rate.
- If you are using communications software other than PC SmartLINK, Octagon cannot guarantee the operation. Make sure that the software parameters are set to match those of the PC Microcontroller: 9600 baud, 8 bits, 1 stop bit, and no parity.

System generates a BIOS message but locks up when booting from SSD0

1. Remove the jumper from the "S" position at W1 and reboot. When PICO FA prompts you, select SSD0 as the first drive and SSD2 as the second drive.
2. Display the directory of SSD0 and verify that all the necessary boot files exist. Copy any missing files to SSD0.
3. If no files are missing, remake SSD0 to overwrite any files which may have become corrupted. In addition, you may want to do a **PFORMAT** and **SYS** to SSD0.

PICO FA reports a drive, but issuing a DIR generates an error message

1. The SSD may not be formatted. Run either of the following:

   PFORMAT H*n*

   or

   PFORMAT H*n* **/m**

   where *n* represents the hard drive number.

   For more information, see the *Save and run programs* chapter.

PICO FA does not report the drive

1. Run SETSSD and make sure it is correct.
2. Make sure that the "X" position at W1 is jumpered or that PICOFA.SYS is in your CONFIG.SYS file of your floppy hard drive.
3. Install a jumper on the "S" position at W1.
4. Reboot your system.

System locks up on powerup; may or may not respond to reset switch

A common cause is using a non-Octagon power supply such as a PC desktop supply. Most of these PC supplies are rated at 5V at 20A or more. Switching supplies usually requires a 20% load to operate properly, that is, 4A or more. Since a typical Micro PC system takes less than 2A, the supply does not regulate properly. Output drift up to 6-7V and/or 7-8 voltage spikes have been reported. If the power supply comes up slowly (that is, longer than 50 ms), the sequencing of ICs on the board may be out of sync, thus, causing the system to lock up.

Octagon supplies are designed to ramp up fast (less than 50 ms), discharge fast on powerdown and to regulate properly under a no load condition.

System locks up after powerdown/powerup

If the power supply does not drain below 0.7V, the CMOS components on the card will act like diodes and forward bias. This is typically caused by using power supplies that have large output capacitors. Either use a different power supply that discharges faster, leave the power off until the supply has adequate time to discharge or place a 100 ohm, large wattage resistor across the output capacitor.

Octagon supplies are designed to ramp up fast (less than 50 ms), discharge fast on powerdown and to regulate properly under a no load condition.

Technical assistance

Carefully recheck your system before calling Technical Support. Run as many tests as possible; the more information you can provide, the easier it will be for the Technical Support staff to help you solve the problem.

For technical assistance, call 303-426-4521.

Appendix A: 6010 technical data

≡ Technical specifications

CPU

ALi M6117 386SX Embedded Microprocessor

Bus clock

25 MHz, 40 MHz

BIOS

AT compatible with industrial extensions

DRAM

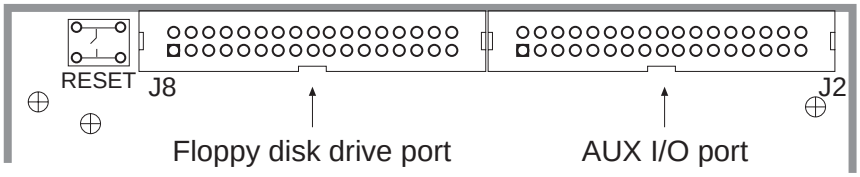
4 MB DRAM soldered on-card

Floppy drive

Floppy drive support via the LPT1 parallel port or external adapter. The 6010 has an on-board floppy drive interface at J8.

WARNING!

J8 and J2 are 34-pin IDC connectors and may be mistaken for each other due to their physical similarities. Do not connect the floppy disk drive into J2, the AUX I/O port, or severe damage will occur to the floppy disk drive. Be certain that you connect the floppy disk drive to the J8 port.



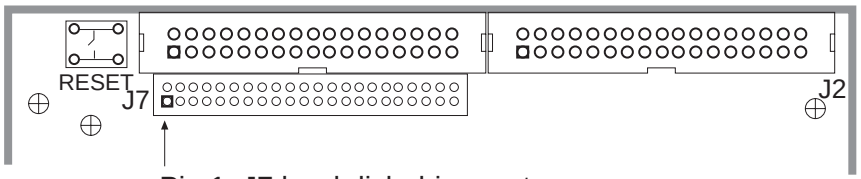
6010

Hard drive

Hard drive BIOS supported using external hard drive controller which allows extended IDE drives larger than 528 MB. The 6010 has on-board hard drive interface at J7.

WARNING!

Failure to properly orient the hard drive cable may damage the 6010, hard drive, and cable.



Pin 1, J7 hard disk drive port

6010

Solid-state disk 0

Supports a 1024 KB flash

Solid-state disk 2

Supports a 128 KB SRAM

ROM-DOS

ROM-DOS 6.22 compatible

Serial I/O

COM1 and COM2 are 16C550 compatible

Parallel port

LPT1 is PC compatible with multifunctional capability

Battery backup

On-board battery to backup real time clock and SRAM SSD2

Watchdog timer

Default time-out is 1.6 seconds (typical), software enabled and strobed. Disabled on powerup and reset. Controls are through built-in, enhanced INT17h function calls.

Bus mastering

Bus mastering is not supported

Power requirements

5V ±0.25V @ 1.0 Amp. maximum

Full 40MHz operation:	480mA typical
Suspend:	167mA typical

Environmental specifications

–40° to 85° C when operating at 25 MHz
0° to 60° C when operating at 40 MHz

Note Use of a heat sink is required to achieve the high end of the temperature range.

–55° to 90° C, nonoperating
RH 5% to 95%, noncondensing

Size

4.5 in. x 4.9 in.

Mating connectors

J1 PC/104 interface, PC/104 8/16-bit receptacle:
- For 8-bit: Samtec #ESQ-132-14-G-D
- For 16-bit: Samtec #ESQ-120-14-G-D

J2 AUX I/O port, 34-pin shrouded header:
- Receptacle: AMP #746288-8
- Strain relief: AMP #499252-6

J3 and J4 serial ports, 10-pin shrouded header:
- Receptacle: AMP #746288-1
- Strain relief: AMP #499252-5

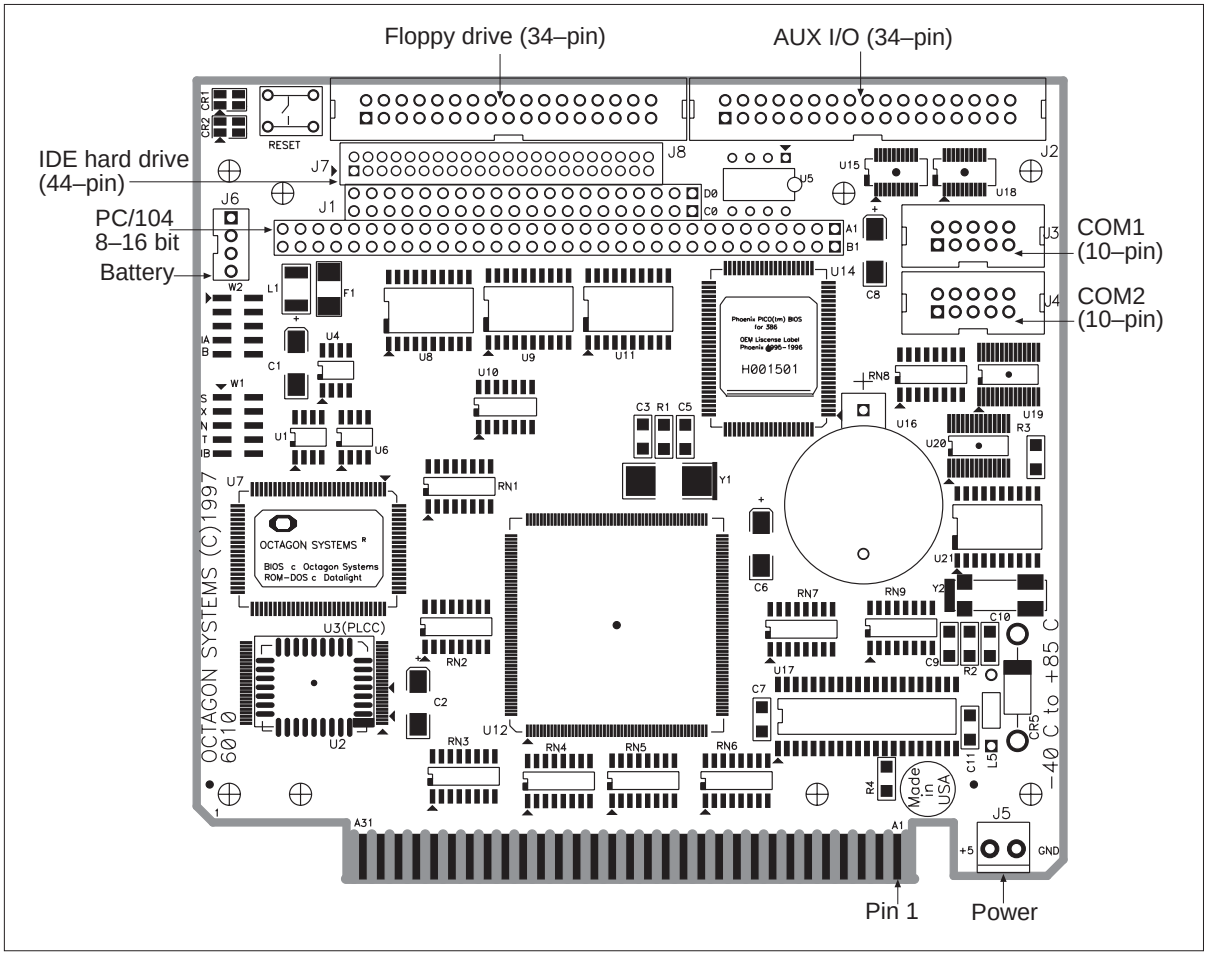
J6 battery, 4-pin in-line connector:
- Housing: DuPont BERG #746288-1
- Crimp to wire pins: DuPont BERG #499252-5

J7 IDE hard drive port, 44-position 2 mm x 2 header:
- Receptacle: AMP #111626-0

J8 floppy port, 34-pin shrouded header:
- Receptacle: AMP #746288-8
- Strain relief: AMP #499252-6

≡ Component diagram

Figure A-1 6010 component diagram



≡ Maps

Table A-1 6010 DMA map

Channel	Description
Channel 0	Reserved for bus memory refresh
Channel 1	Available/reserved for ECP parallel port
Channel 2	Floppy disk drive
Channel 3	Available
Channel 4	Slave
Channel 5	Available
Channel 6	Available
Channel 7	Available

Table A-2 6010 I/O map

Hex range	Function
000H-0A7H	System I/O functions
0A8H-0AFH	General purpose status registers
0B0H-0FFH	System I/O functions
100H-207H	Off-card I/O space
208H-20BH	System control register 0 read/write access (no SEEP CLK)
20CH-20FH	System control register 1 read/write access (watchdog IOR strobe) (no SEEP CLK)
210H-213H	System control register 0 (RO) (SEEP CLK)
214H-217H	System control register 1 (RO) (watchdog IOR strobe) (serial EEPROM read/write)
2E8H-2EFH	COM4
2F8H-2FFH	COM2
320H-327H	Digital I/O A (EZ I/O)
328H-32FH	Digital I/O B (EZ I/O) or D/A converter data
330H-337H	CTC (82C54) or D/A converter DAC load
338H-33FH	Analog to digital converter
378H-37BH	Bidirectional parallel port (LPT1)
3E8H-3EFH	COM3
3F8H-3FFH	COM1

Table A-3 6010 interrupt map

Interrupt	Description
IRQ0	System timer
IRQ1	Keyboard
IRQ2	Unavailable
IRQ3	COM2 serial port
IRQ4	COM1 serial port
IRQ5	LPT A
IRQ6	Floppy disk controller (available and connected to BIRQ6 or FDC)
IRQ7	Available and connected to BIRQ7
IRQ8	RTC alarm
IRQ9	User-configurable (connected to OPTO B)
IRQ10	Available and connected to BIRQ3
IRQ11	BIRQ4
IRQ12	PC/104 connector
IRQ13	Floating point unit
IRQ14	Available and connected to HDC/BIRQ5
IRQ15	Power management interrupt

Table A-4 6010 memory map

Address	Description
00000H-9FFFFH	System memory (640 KB base RAM)
A0000H-BFFFFH	Off-card memory (usually reserved for video memory)
C0000H-C7FFFH	Off-card memory (usually reserved for video BIOS) Shadow enable/disable option in SETUP
C8000H-CFFFFH	Off-card memory Shadow enable/disable option in SETUP
D0000H-DFFFFH	Off-card memory Shadow enable/disable option in SETUP
E0000H-E7FFFH	32 KB BIOS extension area Shadow always enabled
E8000H-EFFFFH	32 KB SSD memory paging window Shadow always disabled in this region
F0000H-FFFFFH	64 KB BIOS area Shadow always enabled
10000H-FFFFFH	16 MB addressable extended memory

≡ Jumper settings

Table A-5 6010 jumper settings: W1 and W2

Jumper position	Pins	Description
"S"	W1[1-2]*	USESETUP
"X"	W1[3-4]*	BIOS extension enable
"N"	W1[5-6]*	Network mode
"T"	W1[7-8]*	Turbo mode
"IA"	W2[7-8]*	IO RGE SEL A
"IB"	W1[9-10]*	IO RGE SEL B
"B"	W2[9-10]	BIOS device

* = default, pins jumpered

≡ Connector/jumper pinouts

Table A-6 6010 BIOS and boot option jumper pinout: W1

Pin	Function
1	Gnd
2	USESETUP (S)
3	Gnd
4	BIOS extension enable (X)
5	Gnd
6	Network mode (N)
7	Turbo mode (T)
8	+5V
9	Gnd
10	IORGESELB (IB)

Table A-7 6010 I/O range select jumper pinout: W2

Pin	Function
1	Gnd
2	FDD power
3	NC
4	+5V FDD
5	IRQ14
6	BIRQ5
7	Gnd
8	IORGESELA (IA)
9	Gnd
10	BIOSDEV (B)

Note: W2[2–4] supplies internal +5V to a +5V only floppy drive. **Do not** install W2[2–4] if external voltage is supplied to the floppy drive.

Table A-8 6010 PC/104 connector pinout: J1

Pin	Row A	Row B	Row C	Row D
0	—	—	Gnd	Gnd
1	IOCHK*	Gnd	SBHE*	MEMCS16*
2	SD7	RESETDRV	LA23	IOCS16*
3	SD6	+5V	LA22	IRQ10
4	SD5	IRQ2/9	LA21	IRQ11
5	SD4	NC (–5V)	LA20	IRQ12
6	SD3	DRQ2	LA19	IRQ15
7	SD2	NC (–12V)	LA18	IRQ14
8	SD1	0 WS**	LA17	DACK0*
9	SD0	NC (+12VDC)	MEMR*	DRQ0
10	IOCHRDY	Key	MEMW*	DACK5*
11	AEN	SMEMW*	SD8	DRQ5
12	SA19	SMEMR*	SD9	DACK6*
13	SA18	IOW*	SD10	DRQ6
14	SA17	IOR*	SD11	DACK7*
15	SA16	DACK3*	SD12	DRQ7
16	SA15	DRQ3	SD13	+5V
17	SA14	DACK1*	SD14	Master*
18	SA13	DRQ1	SD15	Gnd
19	SA12	Refresh*	Key	Gnd
20	SA11	BUSCLK	—	—
21	SA10	IRQ7	—	—
22	SA9	IRQ6	—	—
23	SA8	IRQ5	—	—
24	SA7	IRQ4	—	—
25	SA6	IRQ3	—	—
26	SA5	DACK2*	—	—
27	SA4	TC	—	—
28	SA3	BALE	—	—
29	SA2	+5V Safe	—	—
30	SA1	14 MHz	—	—
31	SA0	Gnd	—	—
32	Gnd	Gnd	—	—

* = active low
** = wait state

Table A-9 6010 AUX I/O connector pinout: J2

Pin	Function	DB–9 IDC breakout cable
1	Opto common	1
2	+OPTOB	2
3	Gnd	3
4	+OPTOA	4
5	Keyboard data	5
6	Keyboard clock	6
7	Battery	7
8	Speaker	8
9	+5 Vdc safe	9
Pin	**Function**	**DB–25 IDC breakout cable**
10	STB*	1
11	AFD*	14
12	DATA0	2
13	ERR*	15
14	DATA1	3
15	INIT*	16
16	DATA2	4
17	SLIN*	17
18	DATA3	5
19	Gnd	18
20	DATA4	6
21	Gnd	19
22	DATA5	7
23	Gnd	20
24	DATA6	8
25	Gnd	21
26	DATA7	9
27	Gnd	22
28	ACK*	10
29	Gnd	23
30	BUSY	11
31	Gnd	24
32	PE	12
33	Gnd	25
34	SLCT*	13

* = active low

Note: The DB connectors are the 3M 3414 series connector or Thomas and Betts, 608–3430. A wiremount male connector can be used to connect a VTC10–IBM cable.

Table A-10 6010 COM1 (J3) and COM2 (J4) connector pinout

Pin	COM1	COM2
1	DCD	DCD
2	DSR	DSR
3	RxD*	RxD*
4	RTS	RTS
5	TxD*	TxD*
6	CTS	CTS
7	DTR	DTR
8	RI*	RI*
9	Gnd	Gnd
10	+5 VDC Safe	+5 VDC Safe

* = active low

Table A-11 6010 power connector pinout: J5

Pin	Function
1	+5 VDC
2	Gnd

Table A-12 6010 battery pinout: J6

Pin	Function
1	+Battery
2	Keyed
3	Gnd
4	Gnd

Table A-13 6010 hard drive connector pinout: J7

Pin	Function	Pin	Function
1	HRST*	23	HIOW*
2	Gnd	24	Gnd
3	HD07	25	HIOR*
4	HD08	26	Gnd
5	HD06	27	HDCHRDY
6	HD09	28	HDALE
7	HD05	29	NC
8	HD10	30	Gnd
9	HD04	31	IRQ14
10	HD11	32	HDCS16*
11	HD03	33	HDA1
12	HD12	34	NC
13	HD02	35	HDA0
14	HD13	36	HDA2
15	HD01	37	HDCS0*
16	HD14	38	HDCS1*
17	HD00	39	HDACT*
18	HD15	40	Gnd
19	Gnd	41	+5V
20	Key	42	+5V
21	NC	43	Gnd
22	Gnd	44	NC

* = active low

Table A-14 6010 floppy drive connector pinout: J8

Pin	Function	Pin	Function
1	Gnd	18	Dir*
2	DenSel	19	Gnd
3	Key	20	Step*
4	NC	21	Gnd
5	Gnd	22	WData*
6	NC	23	Gnd
7	+5V FDD/Gnd	24	WGate*
8	Index*	25	Gnd
9	+5V FDD/Gnd	26	Trk*
10	Mtr*	27	Gnd
11	+5V FDD/Gnd	28	WP*
12	DS1*	29	Gnd
13	Gnd	30	RData*
14	DS0*	31	Gnd
15	Gnd	32	HDSel*
16	Mtr1*	33	Gnd
17	Gnd	34	DskChg*

* = active low

Table A-15 Micro PC bus "A" pinout

Pin	Description	Signal	Pin	Description	Signal
A1	I/O CH CK*	I	A17	A14	O
A2	D7	I/O	A18	A13	O
A3	D6	I/O	A19	A12	O
A4	D5	I/O	A20	A11	O
A5	D4	I/O	A21	A10	O
A6	D3	I/O	A22	A9	O
A7	D2	I/O	A23	A8	O
A8	D1	I/O	A24	A7	O
A9	D0	I/O	A25	A6	O
A10	I/O CH RDY	I	A26	A5	O
A11	AEN	O	A27	A4	O
A12	A19	O	A28	A3	O
A13	A18	O	A29	A2	O
A14	A17	O	A30	A1	O
A15	A16	O	A31	A0	O
A16	A15	O			

* = active low

Table A-16 Micro PC bus "B" pinout

Pin	Description	Signal	Pin	Description	Signal
B1	Gnd	I	B17	DACK1*	O
B2	RESET	O	B18	DRQ1	I
B3	+5V	I	B19	DACK0*	O
B4	IRQ9	I	B20	CLOCK	O
B5	NC	Not used	B21	IRQ7	I
B6	DRQ2	I	B22	IRQ6	I
B7	-12V	Not used	B23	IRQ5	I (mapped to IRQ14)
B8	Reserved	Not used	B24	IRQ4	I
B9	+12V	Not used	B25	IRQ3	I (mapped to IRQ10)
B10	Analog Gnd	Not used	B26	DACK2*	I
B11	MEMW*	O	B27	T/C	I
B12	MEMR*	O	B28	ALE	O
B13	IOW*	O	B29	Aux +5V	Not used
B14	IOR*	O	B30	OSC	O
B15	DACK3*	O	B31	Gnd	I
B16	DRQ3	I			

* = active low

Appendix B: 6020 technical data

≡ Technical specifications

CPU
ALi M6117 386SX Embedded Microprocessor

Bus clock
25 MHz, 40 MHz

BIOS
AT compatible with industrial extensions

DRAM
2 MB DRAM soldered on-card

Floppy drive
Floppy drive support via the LPT1 parallel port or external adapter

Hard drive
Hard drive BIOS supported using external hard drive controller which allows extended IDE drives larger than 528 MB

Solid-state disk 0
Supports a 1024 KB flash

Solid-state disk 2
Supports a 128 KB SRAM

ROM-DOS
DOS 6.22 compatible

Serial I/O
COM1 and COM2 are 16C550 compatible

Parallel port
LPT1 is PC compatible with multifunctional capability

Battery backup

On-board battery to backup real time clock and SRAM SSD2

Watchdog timer

Default time-out is 1.6 seconds (typical), software enabled and strobed. Disabled on powerup and reset. Controls are through built-in, enhanced INT 17h function calls.

Bus mastering

Bus mastering is not supported

Power requirements

5V ±0.25V @ 1.0 Amp maximum

Full 40MHz operation:	670mA typical
Suspend:	245mA typical

Environmental specifications

–40° to 85° C when operating at 25 MHz
0° to 60° C when operating at 40 MHz

Note Use of a heat sink may be required to achieve the high end of the temperature range.

–55° to 90° C, nonoperating
RH 5% to 95%, noncondensing

Size

4.5 in. x 4.9 in.

Mating connectors

J1 and J7 EZ I/O port, 26-pin shrouded header:
- Connector: AMP #746288-6
- Strain relief: AMP #499252-3

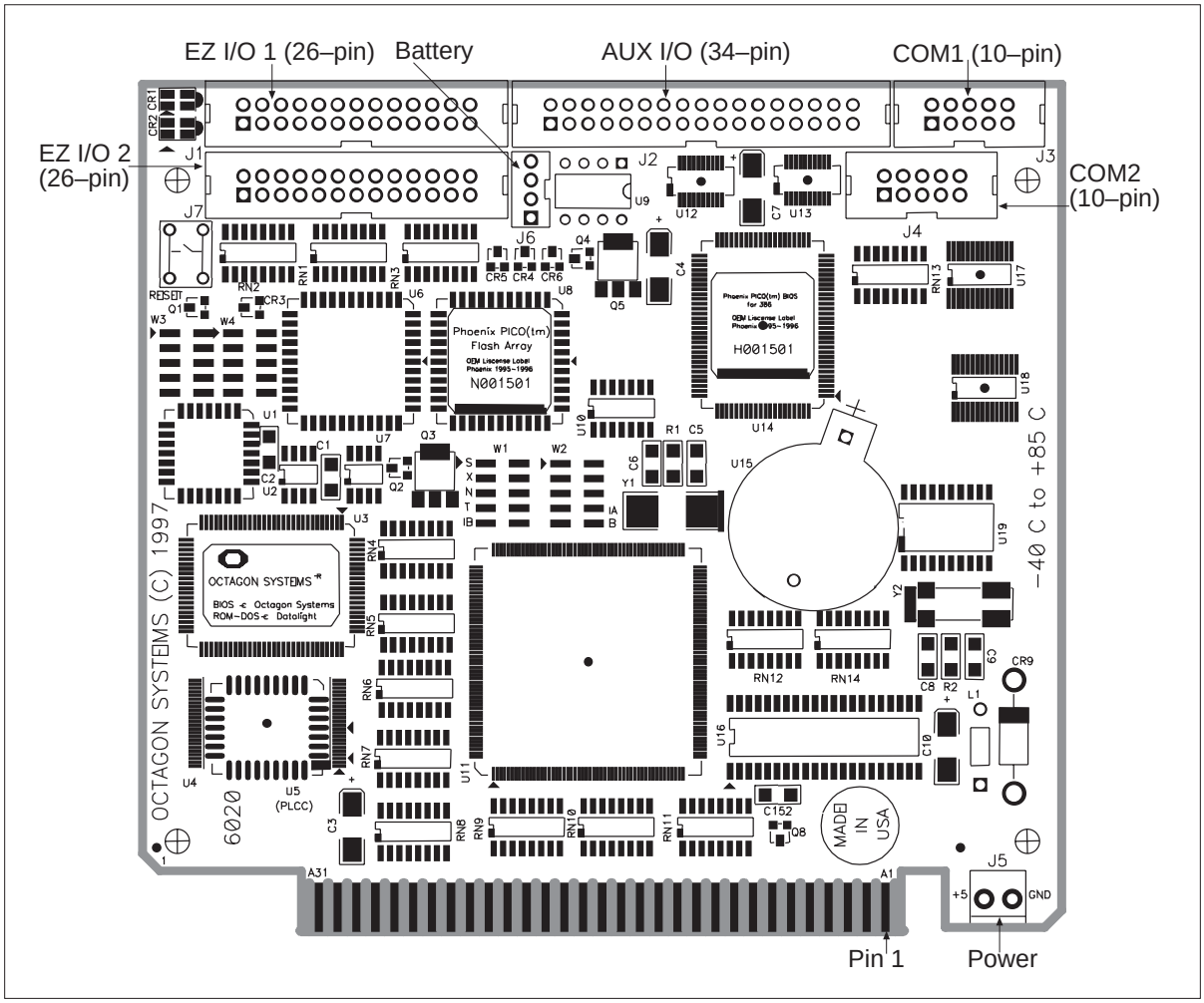
J2 AUX I/O port, 34-pin shrouded header:
- Receptacle: AMP #746288-8
- Strain relief: AMP #499252-6

J3 and J4 serial ports, 10-pin shrouded header:
- Receptacle: AMP #746288-1
- Strain relief: AMP #499252-5

J6 battery, 4-pin in-line connector:
- Housing: DuPont BERG #746288-1
- Crimp to wire pins: DuPont BERG #499252-5

≡ Component diagram

Figure B-1 6020 component diagram



≡ Maps

Table B-1 6020 DMA map

Channel	Description
Channel 0	Reserved for bus memory refresh
Channel 1	Available/reserved for ECP parallel port
Channel 2	Floppy disk drive
Channel 3	Available
Channel 4	Slave
Channel 5	Unavailable (no connection provided)
Channel 6	Unavailable (no connection provided)
Channel 7	Unavailable (no connection provided)

Table B-2 6020 I/O map

Hex range	Function
000H-0A7H	System I/O functions
0A8H-0AFH	General purpose status registers (0A8H, bit 4 is the CTC gate control)
0B0H-0FFH	System I/O functions
100H-207H	Off-card I/O space
140H-147H	EZ I/O 1 (addresses can relocate to 120H-127H, 320H-327H, and 340H-347H)
148H-14FH	EZ I/O 2 (addresses can relocate to 128H-12FH, 328H-32FH, and 348H-34FH)
150H-157H	CTC (addresses can relocate to 130H-137H, 330H-337H, and 350H-357H)
208H-20BH	System control register 0 read/write access (no SEEP CLK)
20CH-20FH	System control register 1 read/write access (watchdog IOR strobe) (no SEEP CLK)
210H-213H	System control register 0 (RO) (SEEP CLK)
214H-217H	System control register 1 (RO) (watchdog IOR strobe) (serial EEPROM read/write)
2F8H-2FFH	COM2
378H-37BH	Bidirectional parallel port (LPT1)
3F8H-3FFH	COM1

Table B-3 6020 interrupt map

Interrupt	Description
IRQ0	System timer
IRQ1	Keyboard
IRQ2	Unavailable
IRQ3	COM2 serial port
IRQ4	COM1 serial port
IRQ5	LPT 1 if selected with SETUP
IRQ6	Floppy disk controller (available and connected to BIRQ6 or FDC)
IRQ7	Available and connected to BIRQ7; also selectable with SETUP as LPT1 interrupt (default)
IRQ8	RTC alarm
IRQ9	User-configurable (connected to OPTO B)
IRQ10	Available and connected to BIRQ3
IRQ11	Used by CTC 1 output (unavailable for other devices)
IRQ12	Used by CTC 0 output (unavailable for other devices)
IRQ13	Floating point unit
IRQ14	Available and connected to BIRQ5
IRQ15	Power management interrupt

Table B-4 6020 memory map

Address	Description
00000H-9FFFFH	System memory (640 KB base RAM)
A0000H-BFFFFH	Off-card memory (usually reserved for video memory)
C0000H-C7FFFH	Off-card memory (usually reserved for video BIOS) Shadow enable/disable option in SETUP
C8000H-CFFFFH	Off-card memory Shadow enable/disable option in SETUP
D0000H-DFFFFH	Off-card memory Shadow enable/disable option in SETUP
E0000H-E7FFFH	32 KB BIOS extension area Shadow always enabled
E8000H-EFFFFH	32 KB SSD memory paging window Shadow always disabled in this region
F0000H-FFFFFH	64 KB BIOS area Shadow always enabled
10000H-FFFFFH	16 MB addressable extended memory

≡ Jumper settings

Table B-5 6020 jumper settings: W1 and W2

Jumper position	Pins	Description
"S"	W1[1–2]*	USESETUP
"X"	W1[3–4]*	BIOS extension enable
"N"	W1[5–6]*	Network mode
"T"	W1[7–8]*	Turbo mode
"IA"	W2[7–8]*	IO RGE SEL A
"IB"	W1[9–10]*	IO RGE SEL B
"B"	W2[9–10]	BIOS device
—	W2[1–2]*	Sets CTC CLK2 to 7.159 MHz
—	W2[2–4]	Sets CTC CLK2 to 1.843 MHz
—	W2[5–6]	CTC Gate Control for gates 0 and 1

* = default, pins jumpered

Table B-6 6020 EZ I/O base address selection

IA: W2[7-8]	IB: W1[9-10]	J1: EZ I/O 1 address	J7: EZ I/O 2 address	CTC: I/O address	Gate address & bit
not jumpered	not jumpered	320H	328H	330H	0xA8, bit 4
jumpered	not jumpered	120H	128H	130H	0xA8, bit 4
not jumpered	jumpered	340H	348H	350H	0xA8, bit 4
jumpered*	jumpered*	140H*	148H*	150H*	0xA8, bit 4

* = default, pins jumpered

Table B-7 6020 pull-down/pull-up EZ I/O 1 configuration: W3

Configuration	Description
W3[2-4]	All lines in Port A are pulled to Gnd through 10K Ohm
W3[4-6]*	All lines in Port A are pulled to +5V through 10K Ohm
W3[7-9]	All lines in Port B are pulled to Gnd through 10K Ohm
W3[7-8]*	All lines in Port B are pulled to +5V through 10K Ohm
W3[1-3]	All lines in Port C are pulled to Gnd through 10K Ohm
W3[3-5]*	All lines in Port C are pulled to +5V through 10K Ohm

* = default, pins jumpered

Table B-8 6020 pull-down/pull-up EZ I/O 2 configuration: W4

Configuration	Description
W4[2-4]	All lines in Port A are pulled to Gnd through 10K Ohm
W4[4-6]*	All lines in Port A are pulled to +5V through 10K Ohm
W4[7-9]	All lines in Port B are pulled to Gnd through 10K Ohm
W4[7-8]*	All lines in Port B are pulled to +5V through 10K Ohm
W4[1-3]	All lines in Port C are pulled to Gnd through 10K Ohm
W4[3-5]*	All lines in Port C are pulled to +5V through 10K Ohm

* = default, pins jumpered

≡ Connector/jumper pinouts

Table B-9 6020 BIOS and boot option jumper pinout: W1

Pin	Function
1	Gnd
2	USESETUP (S)
3	Gnd
4	BIOS extension enable (X)
5	Gnd
6	Network mode (N)
7	Turbo mode (T)
8	+5V
9	Gnd
10	IORGESELB (IB)

Table B-10 6020 BIOS and boot option jumper pinout: W2

Pin	Function
1	7.159 MHz CLK
2	CTC CLK2
3	NC
4	1.843 MHz CLK
5	CTC Gate Control
6	CTC Gates 0 and 1
7	Gnd
8	IORGESELA (IA)
9	Gnd
10	BIOSDEV (B)

Table B-11 6020 EZ I/O 1 (J1) and EZ I/O 2 (J7) connectors

Pin	Function	Pin	Function	Pin	Function
	Port A		**Port B***		**Port C**
19	bit 0	10	bit 0	13	bit 0
21	bit 1	8	bit 1	16	bit 1
23	bit 2	4	bit 2	15	bit 2
25	bit 3	6	bit 3	17	bit 3
24	bit 4	1	bit 4	14	bit 4
22	bit 5	3	bit 5	11	bit 5
20	bit 6	5	bit 6	12	bit 6
18	bit 7	7	bit 7	9	bit 7
2	+5 VDC Safe				
26	Gnd				

*Port B can only be configured as output on the 6050. The output level is inverted from input. This is due to the inverted-output, high-current driver used on the 6050. Consider these factors when using and programming this port.

Table B-12 6020 AUX I/O connector pinout: J2

Pin	Function	DB–9 IDC breakout cable
1	Opto common	1
2	+OPTOB	2
3	Gnd	3
4	+OPTOA	4
5	Keyboard data	5
6	Keyboard clock	6
7	Battery	7
8	Speaker	8
9	+5 Vdc safe	9
Pin	**Function**	**DB–25 IDC breakout cable**
10	STB*	1
11	AFD*	14
12	DATA0	2
13	ERR*	15
14	DATA1	3
15	INIT*	16
16	DATA2	4
17	SLIN*	17
18	DATA3	5
19	Gnd	18
20	DATA4	6
21	Gnd	19
22	DATA5	7
23	Gnd	20
24	DATA6	8
25	Gnd	21
26	DATA7	9
27	Gnd	22
28	ACK*	10
29	Gnd	23
30	BUSY	11
31	Gnd	24
32	PE	12
33	Gnd	25
34	SLCT*	13

* = active low

Note: The DB connectors are the 3M 3414 series connector or Thomas and Betts, 608–3430. A wiremount male connector can be used to connect a VTC10–IBM cable.

Table B-13 6020 COM1 (J3) and COM2 (J4) pinout

Pin	COM1	COM2
1	DCD	DCD
2	DSR	DSR
3	RxD*	RxD*
4	RTS	RTS
5	TxD*	TxD*
6	CTS	CTS
7	DTR	DTR
8	RI*	RI*
9	Gnd	Gnd
10	+5 VDC Safe	+5 VDC Safe

* = active low

Table B-14 6020 power connector pinout: J5

Pin	Function
1	+5 VDC
2	Gnd

Table B-15 6020 battery pinout: J6

Pin	Function
1	+Battery
2	Keyed
3	Gnd
4	Gnd

Table B-16 Micro PC bus "A" pinout

Pin	Description	Signal	Pin	Description	Signal
A1	I/O CH CK*	I	A17	A14	O
A2	D7	I/O	A18	A13	O
A3	D6	I/O	A19	A12	O
A4	D5	I/O	A20	A11	O
A5	D4	I/O	A21	A10	O
A6	D3	I/O	A22	A9	O
A7	D2	I/O	A23	A8	O
A8	D1	I/O	A24	A7	O
A9	D0	I/O	A25	A6	O
A10	I/O CH RDY	I	A26	A5	O
A11	AEN	O	A27	A4	O
A12	A19	O	A28	A3	O
A13	A18	O	A29	A2	O
A14	A17	O	A30	A1	O
A15	A16	O	A31	A0	O
A16	A15	O			

* = active low

Table B-17 Micro PC bus "B" pinout

Pin	Description	Signal	Pin	Description	Signal
B1	Gnd	I	B17	DACK1*	O
B2	RESET	O	B18	DRQ1	I
B3	+5V	I	B19	DACK0*	O
B4	IRQ9	I	B20	CLOCK	O
B5	NC	Not used	B21	IRQ7	I
B6	DRQ2	I	B22	IRQ6	I
B7	-12V	Not used	B23	IRQ5	I (mapped to IRQ14)
B8	Reserved	Not used	B24	IRQ4	I
B9	+12V	Not used	B25	IRQ3	I (mapped to IRQ10)
B10	Analog Gnd	Not used	B26	DACK2*	I
B11	MEMW*	O	B27	T/C	I
B12	MEMR*	O	B28	ALE	O
B13	IOW*	O	B29	Aux +5V	Not used
B14	IOR*	O	B30	OSC	O
B15	DACK3*	O	B31	Gnd	I
B16	DRQ3	I			

* = active low

Appendix C: 6030 technical data

≡ Technical specifications

CPU
ALi M6117 386SX Embedded Microprocessor

Bus clock
25 MHz, 40 MHz

BIOS
AT compatible with industrial extensions

DRAM
2 MB DRAM soldered on-card

Floppy drive
Floppy drive support via the LPT1 parallel port or external adapter

Hard drive
Hard drive BIOS supported using external hard drive controller which allows extended IDE drives larger than 528 MB

Solid-state disk 0
Supports a 1024 KB flash

Solid-state disk 2
Supports a 128 KB SRAM

ROM-DOS
DOS 6.22 compatible

Serial I/O
COM1 through COM4 are 16C550 compatible

Parallel port

LPT1 is PC compatible with multifunctional capability

Battery backup

On-board battery to backup real time clock and SRAM SSD2

Watchdog timer

Default time-out is 1.6 seconds (typical), software enabled and strobed. Disabled on powerup and reset. Controls are through built-in, enhanced INT17h function calls.

Bus mastering

Bus mastering is not supported

Power requirements

5V ±0.25V @ 1.0 Amp. maximum

Full 40MHz operation:	490mA typical
Suspend:	200mA typical

Environmental specifications

–40° to 85° C when operating at 25 MHz
0° to 60° C when operating at 40 MHz

Note Use of a heat sink may be required to achieve the high end of the temperature range.

–55° to 90° C, nonoperating
RH 5% to 95%, noncondensing

Size

4.5 in. x 4.9 in.

Mating connectors

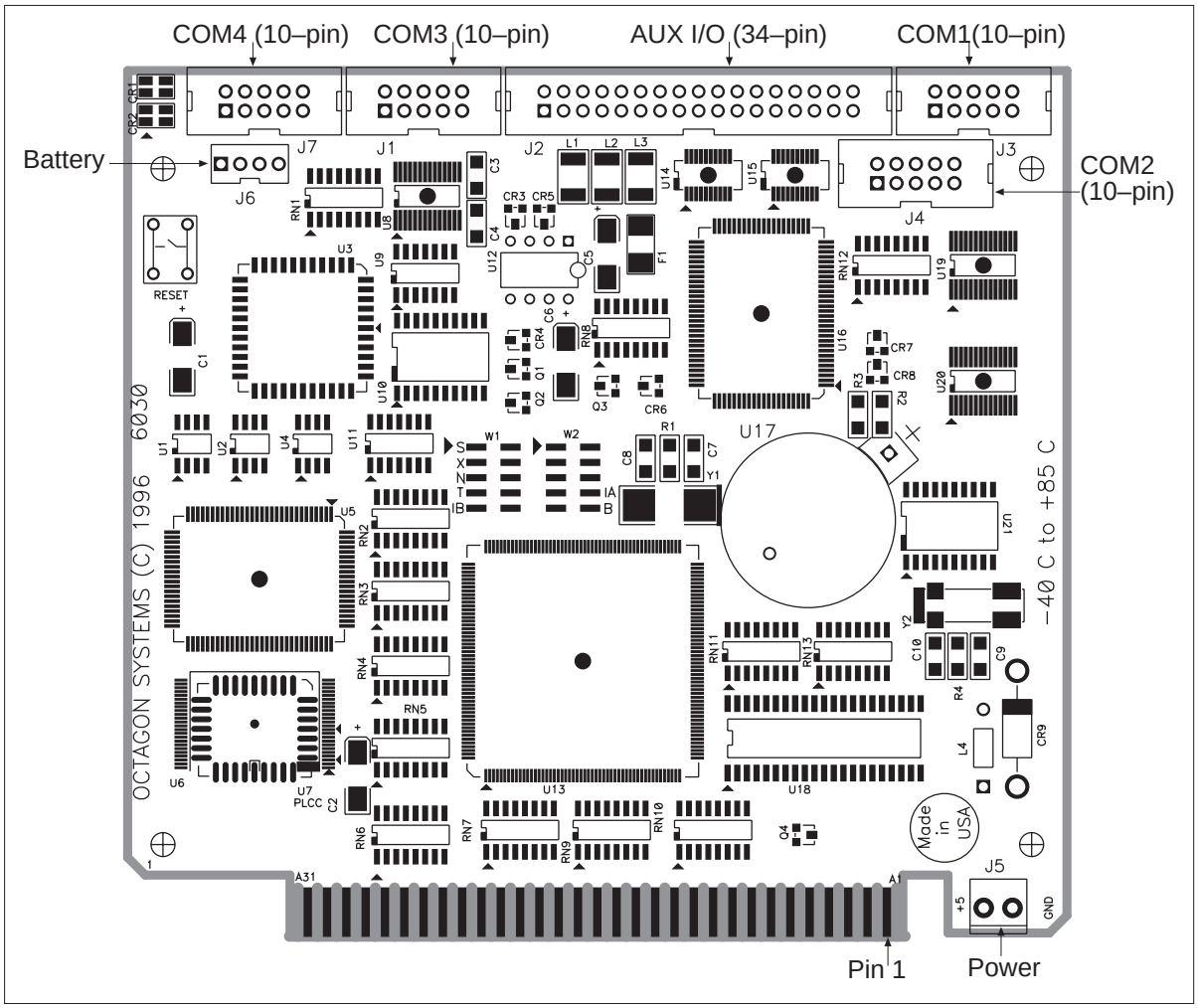
J1, J3, J4, and J7 serial ports, 10-pin shrouded header:
Receptacle: AMP #746288-1
Strain relief: AMP #499252-5

J2 AUX I/O port, 34-pin shrouded header:
Receptacle: AMP #746288-8
Strain relief: AMP #499252-6

J6 battery, 4-pin in-line connector:
Housing: DuPont BERG #746288-1
Crimp to wire pins: DuPont BERG #499252-5

≡ Component diagram

Figure C-1 6030 component diagram



≡ Maps

Table C-1 6030 DMA map

Channel	Description
Channel 0	Reserved for bus memory refresh
Channel 1	Available/reserved for ECP parallel port
Channel 2	Floppy disk drive
Channel 3	Available
Channel 4	Slave
Channel 5	Unavailable (no connection provided)
Channel 6	Unavailable (no connection provided)
Channel 7	Unavailable (no connection provided)

Table C-2 6030 I/O map

Hex range	Function
000H-0A7H	System I/O functions
0A8H-0AFH	General purpose status registers
0B0H-0FFH	System I/O functions
100H-207H	Off-card I/O Space
208H-20BH	System control register 0 read/write access (no SEEP CLK)
20CH-20FH	System control register 1 read/write access (watchdog IOR strobe) (no SEEP CLK)
210H-213H	System control register 0 (RO) (SEEP CLK)
214H-217H	System control register 1 (RO) (watchdog IOR strobe) (serial EEPROM read/write)
2E8H-2EFH	COM4
2F8H-2FFH	COM2
378H-37BH	Bidirectional parallel port (LPT1)
3E8H-3EFH	COM3
3F8H-3FFH	COM1

Table C-3 6030 interrupt map

Interrupt	Description
IRQ0	System timer
IRQ1	Keyboard
IRQ2	Unavailable
IRQ3	COM2 serial port
IRQ4	COM1 serial port
IRQ5	LPT
IRQ6	Floppy disk controller (available and connected to BIRQ6 or FDC)
IRQ7	Available and connected to BIRQ7
IRQ8	RTC alarm
IRQ9	User-configurable (connected to OPTO B)
IRQ10	Available and connected to BIRQ3
IRQ11	COM4 serial port
IRQ12	COM3 serial port
IRQ13	Floating point unit
IRQ14	Available and connected to BIRQ5
IRQ15	Power management interrupt

Table C-4 6030 memory map

Address	Description
00000H-9FFFFH	System memory (640 KB base RAM)
A0000H-BFFFFH	Off-card memory (usually reserved for video memory)
C0000H-C7FFFH	Off-card memory (usually reserved for video BIOS) Shadow enable/disable option in SETUP
C8000H-CFFFFH	Off-card memory Shadow enable/disable option in SETUP
D0000H-DFFFFH	Off-card memory Shadow enable/disable option in SETUP
E0000H-E7FFFH	32 KB BIOS extension area Shadow always enabled
E8000H-EFFFFH	32 KB SSD memory paging window Shadow always disabled in this region
F0000H-FFFFFH	64 KB BIOS area Shadow always enabled
10000H-FFFFFH	16 MB addressable extended memory

≡ Jumper settings

Table C-5 6030 jumper settings: W1 and W2

Jumper position	Pins	Description
"S"	W1[1-2]*	USESETUP
"X"	W1[3-4]*	BIOS extension enable
"N"	W1[5-6]*	Network mode
"T"	W1[7-8]*	Turbo mode
"IA"	W2[7-8]*	IO RGE SEL A
"IB"	W1[9-10]*	IO RGE SEL B
"B"	W2[9-10]	BIOS device

* = default, pins jumpered

≡ Connector/jumper pinouts

Table C-6 6030 BIOS and boot option jumper pinout: W1

Pin	Function
1	Gnd
2	USESETUP (S)
3	Gnd
4	BIOS extension enable (X)
5	Gnd
6	Network mode (N)
7	Turbo mode (T)
8	+5V
9	Gnd
10	IORGESELB (IB)

Table C-7 6030 digital I/O option jumper pinout: W2

Pin	Function
1	NC
2	NC
3	NC
4	NC
5	NC
6	NC
7	Gnd
8	IORGESELA (IA)
9	Gnd
10	BIOSDEV (B)

Table C-8 COM1 (J3), COM2 (J4), COM3 (J1), and COM4 (J7) pinout

Pin	COM1 (J3)	COM2 (J4)	COM3 (J1)	COM4 (J7)
1	DCD	DCD	NC	NC
2	DSR	DSR	NC	NC
3	RxD*	RxD*	RxD*	RxD*
4	RTS	RTS	RTS	RTS
5	TxD*	TxD*	TxD*	TxD*
6	CTS	CTS	CTS	CTS
7	DTR	DTR	1K Pull-up	1K Pull-up
8	RI*	RI*	NC	NC
9	Gnd	Gnd	Gnd	Gnd
10	+5 VDC Safe	+5 VDC Safe	+5 VDC Safe	+5 VDC Safe

* = active low

Table C-9 6030 AUX I/O connector pinout: J2

Pin	Function	DB–9 IDC breakout cable
1	Opto common	1
2	+OPTOB	2
3	Gnd	3
4	+OPTOA	4
5	Keyboard data	5
6	Keyboard clock	6
7	Battery	7
8	Speaker	8
9	+5 Vdc safe	9
Pin	**Function**	**DB–25 IDC breakout cable**
10	STB*	1
11	AFD*	14
12	DATA0	2
13	ERR*	15
14	DATA1	3
15	INIT*	16
16	DATA2	4
17	SLIN*	17
18	DATA3	5
19	Gnd	18
20	DATA4	6
21	Gnd	19
22	DATA5	7
23	Gnd	20
24	DATA6	8
25	Gnd	21
26	DATA7	9
27	Gnd	22
28	ACK*	10
29	Gnd	23
30	BUSY	11
31	Gnd	24
32	PE	12
33	Gnd	25
34	SLCT*	13

* = active low

Note: The DB connectors are the 3M 3414 series connector or Thomas and Betts, 608–3430. A wiremount male connector can be used to connect a VTC10–IBM cable.

Table C-10 6030 power connector pinout: J5

Pin	Function
1	+5 VDC
2	Gnd

Table C-11 6030 battery pinout: J6

Pin	Function
1	+Battery
2	Keyed
3	Gnd
4	Gnd

Table C-12 Micro PC bus "A" pinout

Pin	Description	Signal	Pin	Description	Signal
A1	I/O CH CK*	I	A17	A14	O
A2	D7	I/O	A18	A13	O
A3	D6	I/O	A19	A12	O
A4	D5	I/O	A20	A11	O
A5	D4	I/O	A21	A10	O
A6	D3	I/O	A22	A9	O
A7	D2	I/O	A23	A8	O
A8	D1	I/O	A24	A7	O
A9	D0	I/O	A25	A6	O
A10	I/O CH RDY	I	A26	A5	O
A11	AEN	O	A27	A4	O
A12	A19	O	A28	A3	O
A13	A18	O	A29	A2	O
A14	A17	O	A30	A1	O
A15	A16	O	A31	A0	O
A16	A15	O			

* = active low

Table C-13 Micro PC bus "B" pinout

Pin	Description	Signal	Pin	Description	Signal
B1	Gnd	I	B17	DACK1*	O
B2	RESET	O	B18	DRQ1	I
B3	+5V	I	B19	DACK0*	O
B4	IRQ9	I	B20	CLOCK	O
B5	NC	Not used	B21	IRQ7	I
B6	DRQ2	I	B22	IRQ6	I
B7	-12V	Not used	B23	IRQ5	I (mapped to IRQ14)
B8	Reserved	Not used	B24	IRQ4	I
B9	+12V	Not used	B25	IRQ3	I (mapped to IRQ10)
B10	Analog Gnd	Not used	B26	DACK2*	I
B11	MEMW*	O	B27	T/C	I
B12	MEMR*	O	B28	ALE	O
B13	IOW*	O	B29	Aux +5V	Not used
B14	IOR*	O	B30	OSC	O
B15	DACK3*	O	B31	Gnd	I
B16	DRQ3	I			

* = active low

Appendix D: 6040 technical data

≡ Technical specifications

CPU

ALi M6117 386SX Embedded Microprocessor

Bus clock

25 MHz, 40 MHz

BIOS

AT compatible with industrial extensions

DRAM

2 MB DRAM soldered on-card

Floppy drive

Floppy drive support via the LPT1 parallel port or external adapter

Hard drive

Hard drive BIOS supported using external hard drive controller which allows extended IDE drives larger than 528 MB

Solid-state disk 0

Supports a 1024 KB flash

Solid-state disk 2

Supports a 128 KB SRAM

ROM-DOS

DOS 6.22 compatible

Serial I/O

COM1 and COM2 are 16C550 compatible

Parallel port

LPT1 is PC compatible with multifunctional capability

Battery backup

On-board battery to backup real time clock and SRAM SSD2

Watchdog timer

Default time-out is 1.6 seconds (typical), software enabled and strobed. Disabled on powerup and reset. Controls are through built-in, enhanced INT17h function calls.

Bus mastering

Bus mastering is not supported

Power requirements

5V ±0.25V @ 1.0 Amp maximum

Full 40MHz operation:	780mA operation
Suspend:	380mA typical

Analog inputs

Channels	8 single ended
Resolution	12 bits
Input voltage range	+/– 10V, +/– 5V, 0 to 10V, or 0 to 5V
Input impedance	10M Ohms
Input overvoltage protection	+/– 16.5V
Throughput	100K samples per second

Analog outputs

Channels	2, independent
Resolution	12 bits
Output voltage range	+/– 5V, 0 to 10V, or 0 to 5V
Output current	5mA max.

Environmental specifications

–40° to 85° C when operating at 25 MHz
0° to 60° C when operating at 40 MHz

Note Use of a heat sink may be required to achieve the high end of the temperature range.

–55° to 90° C, nonoperating
RH 5% to 95%, noncondensing

Size

4.5 in. x 4.9 in.

Mating connectors

J1 EZ I/O port, 26-pin shrouded header:
Connector: AMP #746288-6
Strain relief: AMP #499252-3

J2 AUX I/O port, 34-pin shrouded header:
Receptacle: AMP #746288-8
Strain relief: AMP #499252-6

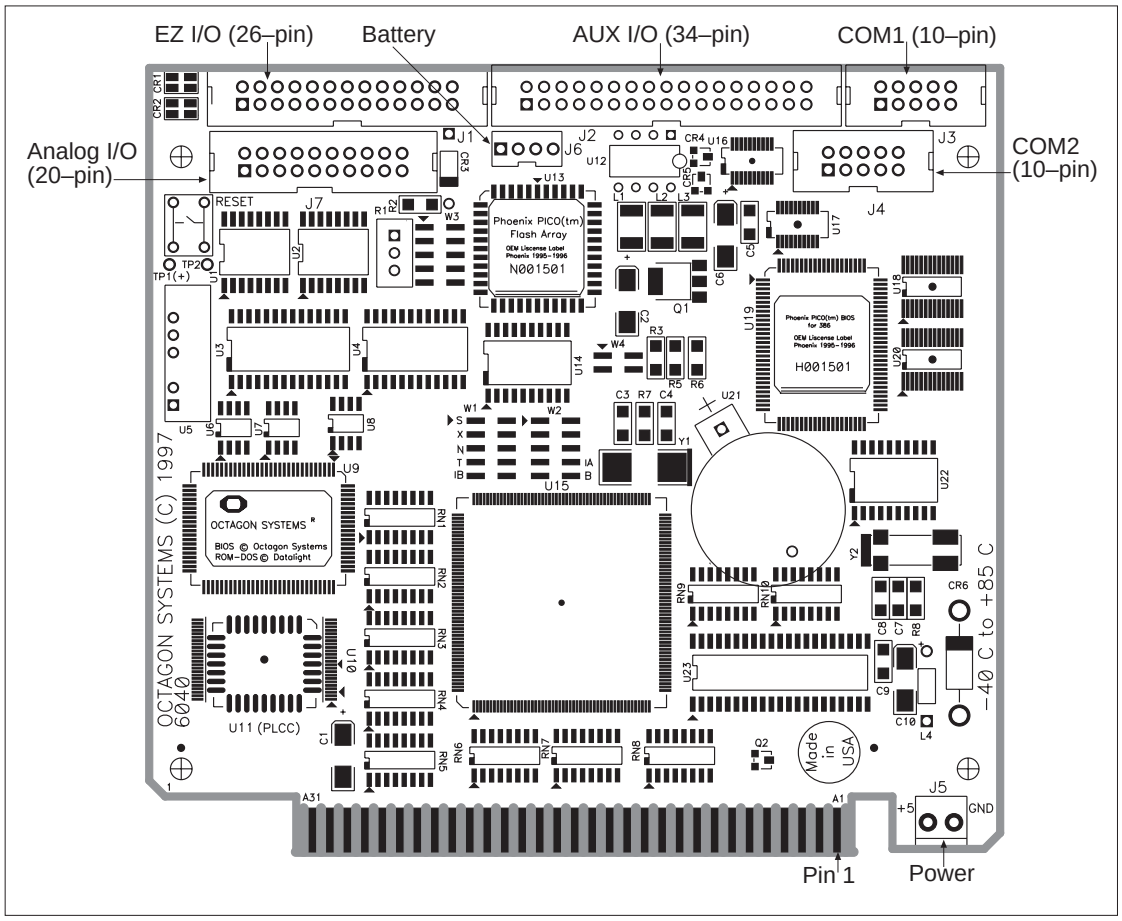
J3 and J4 serial ports, 10-pin shrouded header:
Receptacle: AMP #746288-1
Strain relief: AMP #499252-5

J6 battery, 4-pin in-line connector:
Housing: DuPont BERG #746288-1
Crimp to wire pins: DuPont BERG #499252-5

J7 analog I/O port, 20-pin shrouded connector:
Receptacle: AMP 746288-4
Strain relief: AMP 499252-2

≡ Component diagram

Figure D-1 6040 component diagram



≡ Maps

Table D-1 6040 DMA map

Channel	Description
Channel 0	Reserved for bus memory refresh
Channel 1	Available/reserved for ECP parallel port
Channel 2	Floppy disk drive
Channel 3	Available
Channel 4	Slave
Channel 5	Unavailable (no connection provided)
Channel 6	Unavailable (no connection provided)
Channel 7	Unavailable (no connection provided)

Table D-2 6040 I/O map

Hex range	Function
000H-0A7H	System I/O functions
0A8H-0AFH	General purpose status registers
0B0H-0FFH	System I/O functions
100H-13FH	Off-card I/O space
140H-147H*	Digital I/O 1 (EZ I/O), selectable
148H-14FH*	D/A converter data, selectable
150H-157H*	D/A converter DAC load
158H-15FH*	Analog to digital converter
160H-207H	Off-card I/O space
208H-20BH	System control register 0 read/write access
20CH-20FH	System control register 1 read/write access (watchdog IOR strobe)
210H-213H	System control register 2 (read-only)
214H-217H	System control register 3 (read-only) (watchdog strobe) (serial EEPROM read/write)
2F8H-2FFH	COM2
378H-37BH	Bidirectional parallel port (LPT1)
3F8H-3FFH	COM1

* = These I/O spaces can be relocated to other ranges. See the *6040 EZ I/O base address selection* table in the *EZ I/O* chapter.

Table D-3 6040 interrupt map

Interrupt	Description
IRQ0	System timer
IRQ1	Keyboard
IRQ2	Unavailable
IRQ3	COM2 serial port
IRQ4	COM1 serial port
IRQ5	LPT1
IRQ6	Floppy disk controller (available and connected to BIRQ6 or FDC)
IRQ7	Available and connected to BIRQ7
IRQ8	RTC alarm
IRQ9	User-configurable (connected to OPTO B)
IRQ10	Available and connected to BIRQ3
IRQ11	BIRQ4 on 6010, 6040, 6050; CTC on 6020; COM4 on 6030
IRQ12	PC/104 connector on 6010; CTC on 6020; COM3 on 6030; A/D on 6040; unavailable on 6050
IRQ13	Floating point unit
IRQ14	Available and connected to BIRQ5 (HDC/BIRQ5 on 6010)
IRQ15	Power management interrupt

Table D-4 6040 memory map

Address	Description
00000H-9FFFFH	System memory (640 KB base RAM)
A0000H-BFFFFH	Off-card memory (usually reserved for video memory)
C0000H-C7FFFH	Off-card memory (usually reserved for video BIOS) Shadow enable/disable option in SETUP
C8000H-CFFFFH	Off-card memory Shadow enable/disable option in SETUP
D0000H-DFFFFH	Off-card memory Shadow enable/disable option in SETUP
E0000H-E7FFFH	32 KB BIOS extension area Shadow always enabled
E8000H-EFFFFH	32 KB SSD memory paging window Shadow always disabled in this region
F0000H-FFFFFH	64 KB BIOS area Shadow always enabled
10000H-FFFFFH	16 MB addressable extended memory

≡ Jumper settings

Table D-5 6040 jumper settings: W1, W2, and W4

Jumper position	Pins	Description
"S"	W1[1–2]*	USESETUP
"X"	W1[3–4]*	BIOS extension enable
"N"	W1[5–6]*	Network mode
"T"	W1[7–8]*	Turbo mode
"IA"	W2[7–8]*	IO RGE SEL A
"IB"	W1[9–10]*	IO RGE SEL B
"B"	W2[9–10]	BIOS device
—	W2[1–3]*	EZ I/O port C pull-up
—	W2[3–5]	EZ I/O port C pull-down
—	W2[2–4]*	EZ I/O port A pull-up
—	W2[4–6]	EZ I/O port A pull-down
—	W4[1–2]*	EZ I/O port B pull-up
—	W4[1–3]	EZ I/O port B pull-down

* = default, pins jumpered

Table D-6 6040 EZ I/O base address selection

IA: W1[9-10]	IB: W2[9-10]	I/O address: J1
not jumpered	not jumpered	320H
jumpered	not jumpered	120H
not jumpered	jumpered	340H
jumpered*	jumpered*	140H*

* = default, pins jumpered

Table D-7 6040 pull-down/pull-up EZ I/O: W2 and W4

Configuration	Description
W2[2-4]*	All lines in Port A are pulled to +5V through 10K Ohm
W2[4-6]	All lines in Port A are pulled to Gnd through 10K Ohm
W4[1-2]*	All lines in Port B are pulled to +5V through 10K Ohm
W4[1-3]	All lines in Port B are pulled to Gnd through 10K Ohm
W2[1-3]*	All lines in Port C are pulled to +5V through 10K Ohm
W2[3-5]	All lines in Port C are pulled to Gnd through 10K Ohm

*=default, pins jumpered

Table D-8 6040 digital to analog output range select: W3

Output range	Channel A	Channel B
0V to 10V	W3[6-8]	W3[3-5]
0V to 5V	W3[8-10]	W3[1-3]
-5V to +5V	W3[7-8]*	W3[3-4]*

* = default, pins jumpered

≡ Connector/jumper pinouts

Table D-9 6040 BIOS and boot option jumper pinout: W1

Pin	Function
1	Gnd
2	USESETUP (S)
3	Gnd
4	BIOS extension enable (X)
5	Gnd
6	Network mode (N)
7	Turbo mode (T)
8	+5V
9	Gnd
10	IORGESELB (IB)

Table D-10 6040 BIOS and EZ I/O jumper pinout: W2

Pin	Function
1	+5V AUX
2	+5V AUX
3	Port C
4	Port A
5	Gnd
6	Gnd
7	Gnd
8	IORGESELA (IA)
9	Gnd
10	BIOSDEV (B)

Table D-11 6040 digital to analog range select pinout: W3

Pin #	Function
1 Channel B	0 to +5V range
2	NC
3	Channel B range select
4 Channel B	-5V to +5V range
5 Channel B	0V to +10V range
6 Channel A	0V to +10V range
7 Channel A	-5V to +5V range
8	Channel A range select
9	NC
10 Channel A	0V to +5V range

Table D-12 6040 EZ I/O option jumper pinout: W4

Pin	Function
1	Port B
2	+5V Aux
3	Gnd
4	NC

Table D-13 6040 EZ I/O connector: J1

Pin	Function
	Port A
19	bit 0
21	bit 1
23	bit 2
25	bit 3
24	bit 4
22	bit 5
20	bit 6
18	bit 7
	Port B
10	bit 0
8	bit 1
4	bit 2
6	bit 3
1	bit 4
3	bit 5
5	bit 6
7	bit 7
	Port C
13	bit 0
16	bit 1
15	bit 2
17	bit 3
14	bit 4
11	bit 5
12	bit 6
9	bit 7
2	+5 VDC Safe
26	Gnd

Table D-14 6040 AUX I/O connector pinout: J2

Pin	Function	DB–9 IDC breakout cable
1	Opto common	1
2	+OPTOB	2
3	Gnd	3
4	+OPTOA	4
5	Keyboard data	5
6	Keyboard clock	6
7	Battery	7
8	Speaker	8
9	+5 Vdc safe	9
Pin	**Function**	**DB–25 IDC breakout cable**
10	STB*	1
11	AFD*	14
12	DATA0	2
13	ERR*	15
14	DATA1	3
15	INIT*	16
16	DATA2	4
17	SLIN*	17
18	DATA3	5
19	Gnd	18
20	DATA4	6
21	Gnd	19
22	DATA5	7
23	Gnd	20
24	DATA6	8
25	Gnd	21
26	DATA7	9
27	Gnd	22
28	ACK*	10
29	Gnd	23
30	BUSY	11
31	Gnd	24
32	PE	12
33	Gnd	25
34	SLCT*	13

* = active low

Note: The DB connectors are the 3M 3414 series connector or Thomas and Betts, 608–3430. A wiremount male connector can be used to connect a VTC10–IBM cable.

Table D-15 6040 COM1 (J3) and COM2 (J4) pinout

Pin	COM1	COM2
1	DCD	DCD
2	DSR	DSR
3	RxD*	RxD*
4	RTS	RTS
5	TxD*	TxD*
6	CTS	CTS
7	DTR	DTR
8	RI*	RI*
9	Gnd	Gnd
10	+5 VDC Safe	+5 VDC Safe

* = active low

Table D-16 6040 power connector pinout: J5

Pin	Function
1	+5 VDC
2	Gnd

Table D-17 6040 battery pinout: J6

Pin	Function
1	+Battery
2	Keyed
3	Gnd
4	Gnd

Table D-18 6040 analog I/O pinout: J7

I/O channel	Pin	Description
ADC-0	1	Input
	2	Agnd
ADC-1	3	Input
	4	Agnd
ADC-2	5	Input
	6	Agnd
ADC-3	7	Input
	8	Agnd
ADC-4	9	Input
	10	Agnd
ADC-5	11	Input
	12	Agnd
ADC-6	13	Input
	14	Agnd
ADC-7	15	Input
	16	Agnd
DAC-0	17	Output
	18	Agnd
DAC-1	19	Output
	20	Agnd

Table D-19 Micro PC bus "A" pinout

Pin	Description	Signal	Pin	Description	Signal
A1	I/O CH CK*	I	A17	A14	O
A2	D7	I/O	A18	A13	O
A3	D6	I/O	A19	A12	O
A4	D5	I/O	A20	A11	O
A5	D4	I/O	A21	A10	O
A6	D3	I/O	A22	A9	O
A7	D2	I/O	A23	A8	O
A8	D1	I/O	A24	A7	O
A9	D0	I/O	A25	A6	O
A10	I/O CH RDY	I	A26	A5	O
A11	AEN	O	A27	A4	O
A12	A19	O	A28	A3	O
A13	A18	O	A29	A2	O
A14	A17	O	A30	A1	O
A15	A16	O	A31	A0	O
A16	A15	O			

* = active low

Table D-20 Micro PC bus "B" pinout

Pin	Description	Signal	Pin	Description	Signal
B1	Gnd	I	B17	DACK1*	O
B2	RESET	O	B18	DRQ1	I
B3	+5V	I	B19	DACK0*	O
B4	IRQ9	I	B20	CLOCK	O
B5	NC	Not used	B21	IRQ7	I
B6	DRQ2	I	B22	IRQ6	I
B7	-12V	Not used	B23	IRQ5	I (mapped to IRQ14)
B8	Reserved	Not used	B24	IRQ4	I (mapped to IRQ11)
B9	+12V	Not used	B25	IRQ3	I (mapped to IRQ10)
B10	Analog Gnd	Not used	B26	DACK2*	I
B11	MEMW*	O	B27	T/C	I
B12	MEMR*	O	B28	ALE	O
B13	IOW*	O	B29	Aux +5V	Not used
B14	IOR*	O	B30	OSC	O
B15	DACK3*	O	B31	Gnd	I
B16	DRQ3	I			

* = active low

Appendix E: 6050 technical data

≡ Technical specifications

CPU
ALi M6117 386SX Embedded Microprocessor

Bus clock
25 MHz, 40 MHz

BIOS
AT compatible with industrial extensions

DRAM
2 MB DRAM soldered on-card

Floppy drive
Floppy drive support via the LPT1 parallel port or external adapter

Hard drive
Hard drive BIOS supported using external hard drive controller which allows extended IDE drives larger than 528 MB

Solid-state disk 0
Supports a 1024 KB flash

Solid-state disk 2
Supports a 128 KB SRAM

ROM-DOS
DOS 6.22 compatible

Serial I/O
COM1 and COM2 are 16C550 compatible

Parallel port
LPT1 is PC compatible with multifunctional capability

Battery backup

On-board battery to backup real time clock and SRAM SSD2

Watchdog timer

Default timeout is 1.6 seconds (typical), software enabled and strobed. Disabled on powerup and reset. Controls are through built-in, enhanced INT 17h function calls.

Bus mastering

Bus mastering is not supported

Power requirements

5V ±0.25V @ 1.0 Amp maximum

Full 40 MHz operation:	435mA typical
Suspend:	170mA typical

Environmental specifications

–40° to 85° C when operating at 25 MHz
0° to 60° C when operating at 40 MHz

Note Use of a heat sink may be required to achieve the high end of the temperature range.

–55° to 90° C, nonoperating
RH 5% to 95%, noncondensing

Size

4.5 in. x 4.9 in.

Mating connectors

J1 EZ I/O port, 26-pin shrouded header:
- Connector: AMP #746288-6
- Strain relief: AMP #499252-3

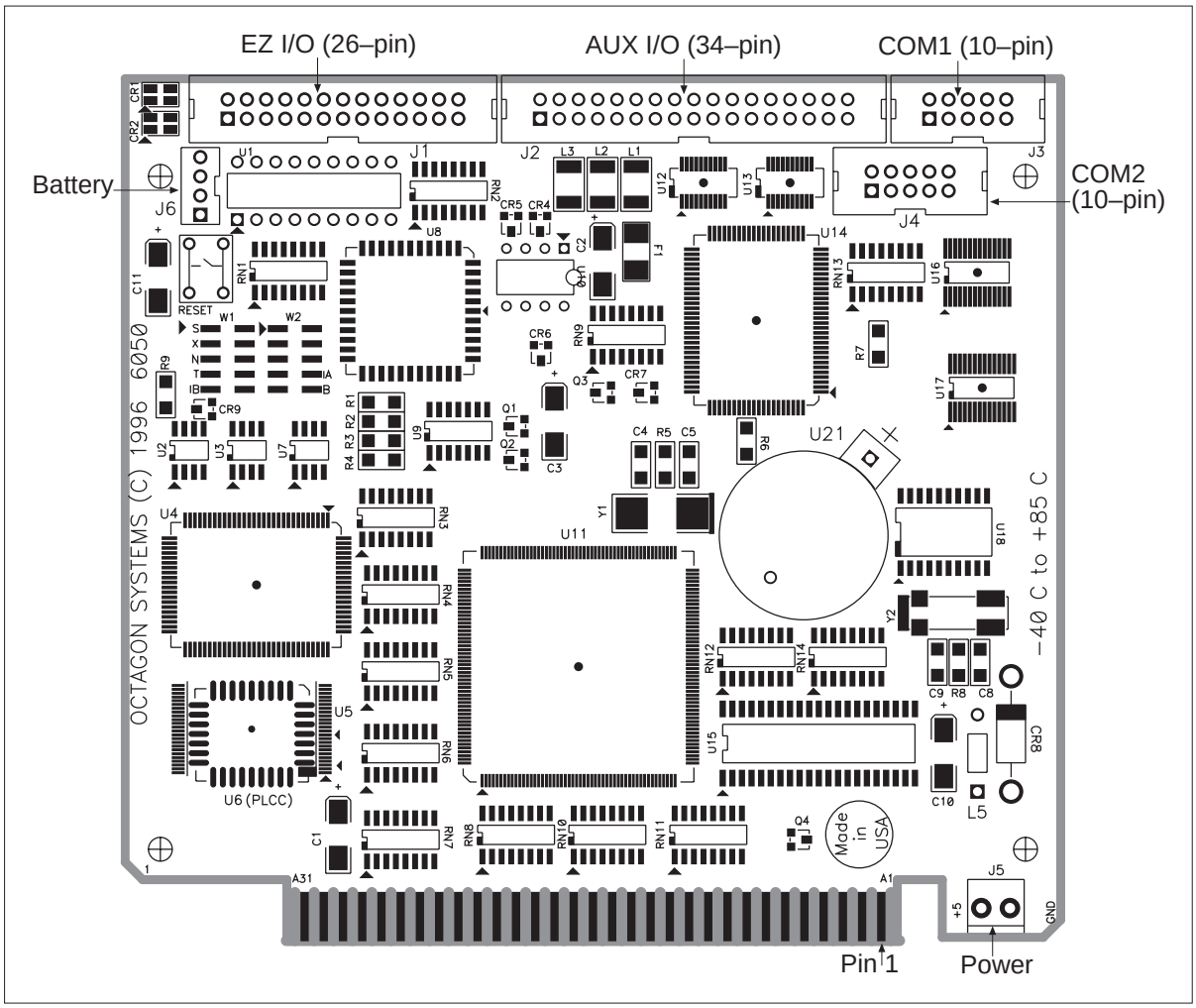
J2 AUX I/O port, 34-pin shrouded header:
- Receptacle: AMP #746288-8
- Strain relief: AMP #499252-6

J3 and J4 serial ports, 10-pin shrouded header:
- Receptacle: AMP #746288-1
- Strain relief: AMP #499252-5

J6 battery, 4-pin in-line connector:
- Housing: DuPont BERG #746288-1
- Crimp to wire pins: DuPont BERG #499252-5

≡ Component diagram

Figure E-1 6050 component diagram



≡ Maps

Table E-1 6050 DMA map

Channel	Description
Channel 0	Reserved for bus memory refresh
Channel 1	Available/reserved for ECP parallel port
Channel 2	Floppy disk drive
Channel 3	Available
Channel 4	Slave
Channel 5	Unavailable (no connection provided)
Channel 6	Unavailable (no connection provided)
Channel 7	Unavailable (no connection provided)

Table E-2 6050 I/O map

Hex range	Function
000H-0A7H	System I/O functions
0A8H-0AFH	General purpose status registers
0B0H-0FFH	System I/O functions
100H-207H	Off-card I/O Space
208H-20BH	System control register 0 read/write access (no SEEP CLK)
20CH-20FH	System control register 1 read/write access (watchdog IOR strobe) (no SEEP CLK)
210H-213H	System control register 0 (RO) (SEEP CLK)
214H-217H	System control register 1 (RO) (watchdog IOR strobe) (serial EEPROM read/write)
2F8H-2FFH	COM2
320H-327H	Digital I/O A (EZ I/O), selectable
378H-37BH	Bidirectional parallel port (LPT1)
3F8H-3FFH	COM1

Table E-3 6050 interrupt map

Interrupt	Description
IRQ0	System timer
IRQ1	Keyboard
IRQ2	Unavailable
IRQ3	COM2 serial port
IRQ4	COM1 serial port
IRQ5	LPT 1 if selected with SETUP
IRQ6	Floppy disk controller (available and connected to BIRQ6 or FDC)
IRQ7	Available and connected to BIRQ7; also selectable with SETUP as LPT1 interrupt
IRQ8	RTC alarm
IRQ9	User-configurable (connected to OPTO B)
IRQ10	Available and connected to BIRQ3
IRQ11	Available and connected to BIRQ4
IRQ12	Unavailable
IRQ13	Floating point unit
IRQ14	Available and connected to BIRQ5
IRQ15	Power management interrupt

Table E-4 6050 memory map

Address	Description
00000H-9FFFFH	System memory (640 KB base RAM)
A0000H-BFFFFH	Off-card memory (usually reserved for video memory)
C0000H-C7FFFH	Off-card memory (usually reserved for video BIOS) Shadow enable/disable option in SETUP
C8000H-CFFFFH	Off-card memory Shadow enable/disable option in SETUP
D0000H-DFFFFH	Off-card memory Shadow enable/disable option in SETUP
E0000H-E7FFFH	32 KB BIOS extension area Shadow always enabled
E8000H-EFFFFH	32 KB SSD memory paging window Shadow always disabled in this region
F0000H-FFFFFH	64 KB BIOS area Shadow always enabled
10000H-FFFFFH	16 MB addressable extended memory

≡ Jumper settings

Table E-5 6050 jumper settings: W1 and W2

Jumper position	Pins	Description
"S"	W1[1–2]*	USESETUP
"X"	W1[3–4]*	BIOS extension enable
"N"	W1[5–6]*	Network mode
"T"	W1[7–8]*	Turbo mode
"IA"	W2[7–8]*	IO RGE SEL A
"IB"	W1[9–10]*	IO RGE SEL B
"B"	W2[9–10]	BIOS device
—	W2[1–3]*	EZ I/O port C pull-down
—	W2[3–5]	EZ I/O port C pull-up
—	W2[2–4]*	EZ I/O port A pull-down
—	W2[4–6]	EZ I/O port A pull-up

* = default, pins jumpered

Table E-6 6050 EZ I/O base address selection

IA: W2[7-8]	IB: W1[9-10]	I/O address: J1
not jumpered	not jumpered	320H
jumpered	not jumpered	120H
not jumpered	jumpered	340H
jumpered*	jumpered*	140H*

* = default, pins jumpered

Table E-7 6050 pull-down/pull-up EZ I/O

Configuration	Description
W2[2–4]*	All lines in Port A are pulled to +5V through 10K Ohm
W2[4–6]	All lines in Port A are pulled to Gnd through 10K Ohm
W2[1–3]*	All lines in Port C are pulled to +5V through 10K Ohm
W2[3–5]	All lines in Port C are pulled to Gnd through 10K Ohm

* = default, pins jumpered

≡ Connector/jumper pinouts

Table E-8 6050 BIOS and boot option jumper pinout: W1

Pin	Function
1	Gnd
2	USESETUP (S)
3	Gnd
4	BIOS extension enable (X)
5	Gnd
6	Network mode (N)
7	Turbo mode (T)
8	+5V
9	Gnd
10	IORGESELB (IB)

Table E-9 6050 BIOS and boot option jumper pinout: W2

Pin #	Function
1	+5V AUX
2	+5V AUX
3	Port C
4	Port A
5	Gnd
6	Gnd
7	Gnd
8	IORGESELA (IA)
9	Gnd
10	BIOSDEV (B)

Table E-10 6050 EZ I/O connector: J1

Pin	Function	Pin	Function	Pin	Function
	Port A		**Port B***		**Port C**
19	bit 0	10	bit 0	13	bit 0
21	bit 1	8	bit 1	16	bit 1
23	bit 2	4	bit 2	15	bit 2
25	bit 3	6	bit 3	17	bit 3
24	bit 4	1	bit 4	14	bit 4
22	bit 5	3	bit 5	11	bit 5
20	bit 6	5	bit 6	12	bit 6
18	bit 7	7	bit 7	9	bit 7
2	+5 VDC Safe				
26	Gnd				

*Port B can only be configured as output on the 6050. The output level is inverted from input. This is due to the inverted-output, high-current driver used on the 6050. Consider these factors when using and programming this port.

Table E-11 6050 AUX I/O connector pinout: J2

Pin	Function	DB–9 IDC breakout cable
1	Opto common	1
2	+OPTOB	2
3	Gnd	3
4	+OPTOA	4
5	Keyboard data	5
6	Keyboard clock	6
7	Battery	7
8	Speaker	8
9	+5 Vdc safe	9
Pin	**Function**	**DB–25 IDC breakout cable**
10	STB*	1
11	AFD*	14
12	DATA0	2
13	ERR*	15
14	DATA1	3
15	INIT*	16
16	DATA2	4
17	SLIN*	17
18	DATA3	5
19	Gnd	18
20	DATA4	6
21	Gnd	19
22	DATA5	7
23	Gnd	20
24	DATA6	8
25	Gnd	21
26	DATA7	9
27	Gnd	22
28	ACK*	10
29	Gnd	23
30	BUSY	11
31	Gnd	24
32	PE	12
33	Gnd	25
34	SLCT*	13

* = active low

Note: The DB connectors are the 3M 3414 series connector or Thomas and Betts, 608–3430. A wiremount male connector can be used to connect a VTC10–IBM cable.

Table E-12 6050 COM1 (J3) and COM2 (J4) pinout

Pin	COM1	COM2
1	DCD	DCD
2	DSR	DSR
3	RxD*	RxD*
4	RTS	RTS
5	TxD*	TxD*
6	CTS	CTS
7	DTR	DTR
8	RI*	RI*
9	Gnd	Gnd
10	+5 VDC Safe	+5 VDC Safe

* = active low

Table E-13 6050 power connector pinout: J5

Pin	Function
1	+5 VDC
2	Gnd

Table E-14 6050 battery pinout: J6

Pin	Function
1	+Battery
2	Keyed
3	Gnd
4	Gnd

Table E-15 Micro PC bus "A" pinout

Pin	Description	Signal	Pin	Description	Signal
A1	I/O CH CK*	I	A17	A14	O
A2	D7	I/O	A18	A13	O
A3	D6	I/O	A19	A12	O
A4	D5	I/O	A20	A11	O
A5	D4	I/O	A21	A10	O
A6	D3	I/O	A22	A9	O
A7	D2	I/O	A23	A8	O
A8	D1	I/O	A24	A7	O
A9	D0	I/O	A25	A6	O
A10	I/O CH RDY	I	A26	A5	O
A11	AEN	O	A27	A4	O
A12	A19	O	A28	A3	O
A13	A18	O	A29	A2	O
A14	A17	O	A30	A1	O
A15	A16	O	A31	A0	O
A16	A15	O			

* = active low

Table E-16 Micro PC bus "B" pinout

Pin	Description	Signal	Pin	Description	Signal
B1	Gnd	I	B17	DACK1*	O
B2	RESET	O	B18	DRQ1	I
B3	+5V	I	B19	DACK0*	O
B4	IRQ9	I	B20	CLOCK	O
B5	NC	Not used	B21	IRQ7	I
B6	DRQ2	I	B22	IRQ6	I
B7	-12V	Not used	B23	IRQ5	I (mapped to IRQ14)
B8	Reserved	Not used	B24	IRQ4	I (mapped to IRQ11)
B9	+12V	Not used	B25	IRQ3	I (mapped to IRQ10)
B10	Analog Gnd	Not used	B26	DACK2*	I
B11	MEMW*	O	B27	T/C	I
B12	MEMR*	O	B28	ALE	O
B13	IOW*	O	B29	Aux +5V	Not used
B14	IOR*	O	B30	OSC	O
B15	DACK3*	O	B31	Gnd	I
B16	DRQ3	I			

* = active low

Appendix F: Miscellaneous

The *Miscellaneous* chapter discusses Octagon's power supplies. The *Miscellaneous* chapter also discusses how to build a custom communication cable and how to upload files from the PC Microcontroller. For more information on these three areas, refer to the *Miscellaneous* chapter in the *6000 Series user's manual*.

Appendix G: Accessories

The *Accessories* chapter lists product name, description, and part numbers to all cables, terminal and interface boards, LCD displays, keypads, opto racks and modules, and miscellaneous parts that are relevant to the 6000 Series PC Microcontrollers. To view this listing, refer to the *Accessories* chapter in the *6000 Series user's manual*.

Warranty

Refer to the *6000 Series user's manual* for a complete description on Octagon's service policy, product repair, returns, governing law, and limitations on warranty.