NOTICE

The drivers and utilities for Octagon products, previously provided on a CD, are now in a self-extracting zip file located at the Octagon Systems web site on the product-specific page. Download this file to a separate directory on your hard drive, then double click on it to extract the files. All references in this manual to files and directories on the CD now refer to files in the Utilities zip file.

4020 User's Manual

Doc. #04212 Rev. 1197

OCTAGON SYSTEMS CORPORATION®

6510 W. 91st Ave. Westminster, CO 80030
Tech. Support: 303–426–4521

COPYRIGHT

Copyright 1996, 1997—Octagon Systems Corporation. All rights reserved. However, any part of this document may be reproduced, provided that Octagon Systems Corporation is cited as the source. The contents of this manual and the specifications herein may change without notice.

TRADEMARKS

Micro PC™, PC SmartLink™, Octagon Systems Corporation®, the Octagon logo and the Micro PC logo are trademarks of Octagon Systems Corporation. QuickBASIC® is a registered trademark of Microsoft Corporation. ROM-DOS™ is a trademark of Datalight.

NOTICE TO USER

The information contained in this manual is believed to be correct. However, Octagon assumes no responsibility for any of the circuits described herein, conveys no license under any patent or other right, and makes no representations that the circuits are free from patent infringement. Octagon makes no representation or warranty that such applications will be suitable for the use specified without further testing or modification.

Octagon Systems Corporation general policy does not recommend the use of its products in life support applications where the failure or malfunction of a component may directly threaten life or injury. It is a Condition of Sale that the user of Octagon products in life support applications assumes all the risk of such use and indemnifies Octagon against all damage.

IMPORTANT!

Please read 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. This section describes some of the common 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 power-up** - 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 power-up. This type of failure is typical on serial interface chips.

- **Serial and parallel** - Customers sometimes connect the serial and printer devices to the Micro PC while the power is off. This can cause the failure mentioned in the above section, *Failure upon power-up*. Even if they are connected with the Micro PC on, there can be another failure mechanism. Some serial and printer devices do not share the same power (AC) grounding. The leakage can cause the serial or parallel signals to be 20-40V above the Micro PC ground, thus, damaging the ports as they are plugged in. This would not be a problem if the ground pin is connected first, but there is no guarantee of this. Damage to the printer port chip will cause the serial ports to fail as they share the same chip.

- **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.

- **Using desktop PC power supplies** - Occasionally, a customer will use a regular desktop PC power supply when bringing up a system. Most of these are rated at 5V at 20A or more. Switching supplies usually require a 20% load to operate properly. This means 4A or more. Since a typical Micro PC system takes less than 2A, the supply does not regulate properly. Customers have reported that the output can drift up to 7V and/or with 7-8V voltage spikes. Unless a scope is connected, you may not see these transients.

- **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.

TABLE OF CONTENTS

This page intentionally left blank.

PREFACE

This manual provides all the information required to install, configure, and operate the 4020 Micro PC Control Card. It is part of Octagon's Micro PC user manual series. To receive the Micro PC User Manual Binder, please return the reply card included with your Control Card.

By using this manual, you will be able to:

- Interface the 4020 Control Card to your PC and the Micro PC expansion cards.
- Set up communications between the 4020 card and a PC.
- Gain an understanding of the operation and various options allowed in the 4020 Control Card.

CONVENTIONS USED IN THIS MANUAL

1. Information which appears on your screen is shown in a different type face, for example:

```
Octagon 4020-386-25MHz-1MB BIOS Vers x.xx
Copyright (c) 1995 Octagon Systems, Corp. (TM)
All Rights Reserved.
```

2. Commands that you must key in are shown in **Courier Bold**, for example:

   C:> **RESET**

3. Italicized refers to information that is specific to your particular system or program, e.g.,

   Enter *filename*

   means enter the name of your file.

4. Warnings always appear in this format:

   WARNING: The warning message appears here.

5. Paired angle brackets are used to indicate a specific key on your keyboard, e.g., <ESC> means the escape key; <CTRL> means the control key; <F1> means the F1 function key.

6. All addresses are given in hexadecimal.

SYMBOLS AND TERMINOLOGY

Throughout this manual, the following symbols and terminology are used:

W[–]	Denotes a jumper block and the pins to connect.
Autoexecution	Automatic execution of a program on power–up or reset.
BIOS drive	The solid–state disk which contains the system BIOS and ROM–DOS.
Console Port	Video card or COM1 where BIOS and DOS messages appear and keyboard input is available.
Control Card	Contains the CPU, memory, and operating system and controls the operation of all the extension cards.
DRAM	Dynamic Random Access Memory devices. DRAMs provide volatile memory with unlimited read and write cycles.
Expansion Card	The expansion cards add I/O functions to the Micro PC system, such as analog input/output, digital input/output, motion control, display, and so on.
Flash PROM	Electrically erasable PROM which allows at least 10,000 write cycles.
Memory device	The type of static RAM, DRAM, flash PROM or EPROM specified for either volatile or nonvolatile memory.
PC SmartLINK	A serial communications software package designed by Octagon for use with the 4020 Control Card. Refers to all versions of PC SmartLINK.

ROM	Read Only Memory devices. ROMs provide nonvolatile memory, have a limited number of write cycles, and include EPROMs, EEPROMs, and flash PROMs.
ROM–DOS	Operating system included in Micro PC ROM.
Solid–State Disk (SSD)	A simulated disk using a high speed solid–state memory device, for example flash PROM, EEPROM, or static RAM.
Static RAM	Static Random Access Memory device. Static RAMs provide volatile memory with unlimited read and write cycles. They may be used with a battery back–up module.
TTL Compatible	Transistor transistor logic compatible; 0–5V logic levels.
Virtual Drive	A disk created in DOS or extended memory which emulates an actual disk. Provides temporary storage for files. When power to the computer is turned off, the virtual drive disappears.
XMODEM	A communications protocol which allows transfer of files between two computers.
XON/XOFF	A communications protocol for asynchronous connections. The receiver can pace the sender by sending the XOFF and XON characters to stop and continue the data flow.
H	The suffix “H” denotes a hexadecimal number. A decimal number has no prefix or suffix. For example, 1000H and 4096 are equivalent.

TECHNICAL SUPPORT

If you have a question about the 4020 Control Card and cannot find the answer in this manual, call Technical Support. They will be ready to give you the assistance you need.

When you call, please have the following at hand:

Your *4020 Control Card User's Manual*

A description of your problem.

The direct line to Technical Support is 303–426–4521.

DESCRIPTION

The 4020 is a low cost, single board PC for use in a wide variety of embedded applications. The 25 MHz 386SX processor has enough processing power for most control and data acquisition applications.

Despite its small size, the features include: DOS 6.22 in ROM; three serial ports, including one RS-485 port; a multifunctional LPT1 parallel port; a watchdog timer; 1 MB of DRAM; a socket for optional 512K of flash memory with integral programmer or 1 MB of standard EPROM; 128K of SRAM; keyboard and speaker ports; three solid–state disks; 8-bit ISA interface; forty-eight lines of digital I/O; eight lines of high current drive I/O; three counter/timer channels; opto-isolated reset; and two opto-isolated interrupts.

The card can be used in a stand–alone mode or installed in a passive ISA bus backplane. The 4020 can also be installed in a three or four slot card cage. Bus mastering is not supported on the 4020.

MAJOR FEATURES

Instant DOS

The 4020 is an “instant DOS” system. The card includes 6.22 compatible DOS in a solid–state disk. The system boots and operates the same way as your desktop PC.

Watchdog Timer

The watchdog timer resets the system if the program stops unexpectedly. The watchdog is enabled, disabled and strobed under software control. The timeout is 1.6 seconds (1.6 sec. typical, 1.00 sec. min., 2.25 sec. max.).

Calendar/Clock

The 4020 has a built–in, AT style calendar/clock. An external AT clock battery plugs into the card and powers the clock during power–down.

Solid–State Disk Options

SSD0 contains the BIOS drive and DOS 6.22 in a 256K EPROM.

SSD1 is used for storage of the applications program. 128K/512K flash or 512K/1 MB EPROM may be used. The flash programmer is built–in allowing reprogramming locally or through a serial port.

SSD2 uses 128K SRAM soldered on card. The solid–state disks look like disks to the user. All necessary software is provided to program the flash and access all solid-state disks.

Speaker and Keyboard Port

The 4020 accepts AT keyboard input and has the PS–2 style keyboard connector. The speaker port is a 3–pin connector for use with any external speaker from 8–50 ohms.

Mounting

There are several ways to mount the 4020:

1. Plug it directly into a Micro PC card cage.
2. Use the optional PC mounting bracket and plug it into any passive backplane.
3. Panel mount it using the four mounting holes. A screw terminal connector is used to supply the 5V power.
4. Stack it with other Micro PC cards.

COM1, COM2 and COM3 Serial Ports

COM1 and COM2 serial ports are 16C550 compatible. The baud rates are programmable from 150 to 115.2K baud. Both ports have a RS–232 interface. RS–232 voltages are generated on–card.

The COM3 serial port is also 16C550 compatible. The baud rates are programmable from 150 to 115.2K baud. This port supports both RS-232 and RS-485 interfaces. A jumper located at W5 selects the receive data either from an RS-232 or RS-485 interface.

LPT1 Bidirectional Parallel Port

The LPT1 bidirectional parallel port can be used for a printer port or for general purpose I/O. For embedded applications, an interface board and software are available to interface with a 4–line LCD display and a 16–position keypad. The port can also be connected to the MPB–16PC, a 16–position opto module rack for driving high current AC and DC loads.

Digital I/O

The 4020 has forty-eight digital I/O lines for general purpose control and input. The lines can be programmed as inputs or outputs in groups of three. The digital I/O connectors are at J3 and J6 on the 4020. Eight of the digital I/O lines have high current outputs for driving loads up to 500 mA at 50V.

Counter/Timer Channels

The 4020 supports three counter/timer channels: Channel 0, Channel 1, and Channel 2. Channel 0 clock input is connected to a 1.8432 MHz oscillator and acts as a pre-scalar. Its gate is always enabled and its output is brought out to W6.

Channel 1 and 2 clock inputs can be configured to be either Channel 0 output or digital I/O bits Port C, bit 2, and Port C, bit 1, respectively. Likewise, Channel 1 and 2 gates can be configured via W6 to be either always enabled or enabled via Port C, bit 4, and Port C, bit 5, respectively.

The output of Channel 1 is brought to W1 and can be connected to IRQ5 or IRQ9. The output of Channel 2 is hard-wired to IRQ12.

Setup stored in serial EEPROM

The 4020 stores the setup information in nonvolatile EEPROM; as a result it is immune to battery or power failure (with the exception of time and date). The user can also store additional information in the EEPROM. Up to 1,536 bytes are available.

Hardware Reset

A hardware reset can be done by any of the following means: issuing the RESET command; cycling power; depressing the reset switch; or by applying 5V across the opto isolated reset input (J5 [1-2]). A hardware reset ensures complete reset of the system and all attached peripherals.

Boot sequence

A system can be configured to boot from the on–card, solid–state disk, floppy or hard disk.

Where to go from here:
Before you begin developing your application program for the 4020, we recommend you read Chapters 2–4. These chapters give instructions for hardware installation, downloading and saving your program, and autoexecuting your application.

Chapter 2 Quick Start	Covers the basics of setting up a 4020 system. This chapter describes how to install the 4020 into the card cage, how to establish a serial communications link with your PC and how to download files to the 4020.
Chapter 3 EPROMs & Battery Backup	Configuring and installing EPROMs. Also, installing the battery backup for SSD2 and calendar clock.
Chapter 4 SETUP	Running the SETUP configuration program.
Chapter 5 Save & Run Programs	How to save your program files and autoexecute them from the 4020.
Chapter 6 Serial Ports	Using COM1, COM2 and COM3. Setting COM1 as the main console I/O for serial communications with your PC.
Chapter 7 Watchdog Timer, Reset & Interrupts	Enabling the watchdog timer, system reset, and interrupts.
Chapter 8 LPT1 Parallel Port	Using the LPT1 parallel port for a printer, display, keypad or opto rack.
Chapter 9 Digital I/O Lines, High Current Ports & CTC	How to use the digital I/O lines, high current ports, and counter timers.
Chapter 10 Serial EEPROM	How to read and write to the serial EEPROM.

Chapter 11 Video/Keyboard/Speaker	Configuring the 4020 with a video, keyboard and speaker.
Chapter 12 External Drives	Configuring the 4020 with a floppy drive or hard drive.
Chapter 13 Using Your Own DOS	Configuring the 4020 with a version of DOS other than ROM–DOS.
Chapter 14 User-defined Jumper	Reading the user-defined jumper by code in your program.
Chapter 15 CPU Power Management	Using the SLEEP.COM and SLOW.COM as power management utilities.
Chapter 16 Troubleshooting	Problems encountered when using the 4020.
Chapter 17 Technical Data	Technical specifications, jumper configurations and connector pinouts.
Appendix A Software Utilities	Description and operation of software utility programs and device drivers.
Appendix B Tips	Using non–Octagon cables and power supplies, programming EPROMs, uploading files from the 4020, and assigning drive designa tors.

This page intentionally left blank.

This chapter covers the basics of setting up a 4020 system and tells you:

1. How to panel mount, stack or install the 4020 into the card cage;
2. How to set up a serial communications link between the 4020 and your PC; and
3. How to download files to the 4020 and run a program from the virtual drive.

WARNING: The 4020 may not be installed in a PC. These cards are designed to be independent CPU cards only, not accelerators or coprocessors.

HARDWARE INSTALLATION

Your 4020 Control Card can be installed in one of several ways:

1. Plug it directly into a Micro PC card cage;
2. Panel mount it using the four mounting holes;
3. Stack it with other Micro PC cards;
4. Use the optional PC mounting bracket and plug it into any passive backplane.

Figure 2-1 provides a component diagram of the 4020. Refer to it as needed.

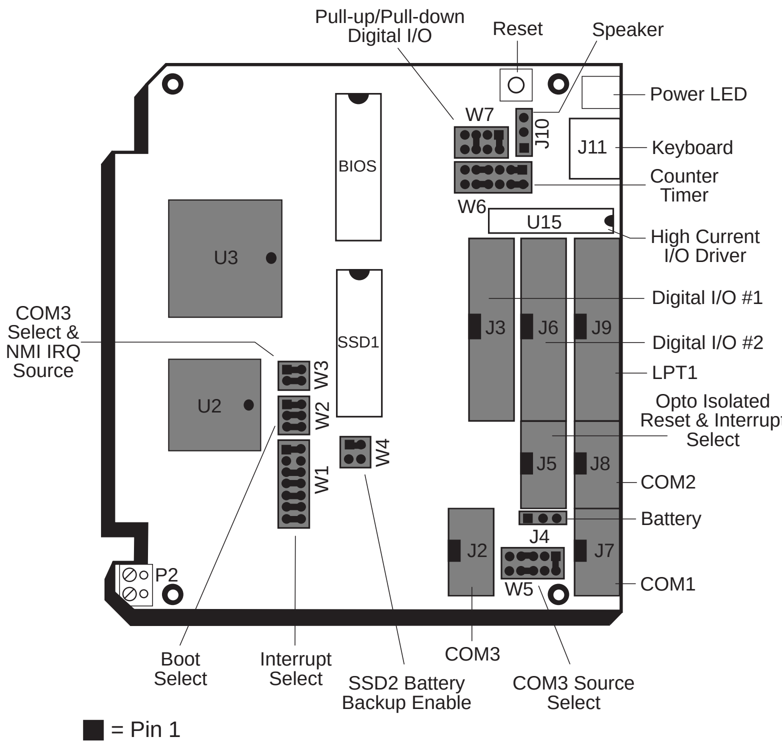

Figure 2-1 – 4020 Component Diagram

Using a Micro PC Card Cage

To install the 4020 in a Micro PC card cage, you will need the following equipment (or equivalent):

4020 Control Card
Micro PC Card Cage (52xx Card Cage)
Power Module (51xx Power Supply)
VTC–9F Cable
Null modem adapter
4020 ROM–DOS & Utility Software Disk
PC SmartLINK with manual
Your PC

Please refer to Appendix B if you are making your own serial cable or using other non–Octagon components.

To install the 4020:

1. Refer to Figure 2-1 for the location of various connectors before installing the 4020 Control Card.

WARNING: The 4020 Control Card contains static–sensitive CMOS components. The card is most susceptible to damage when it is plugged into a card cage. The 4020 card 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 4020 card.
- Disconnect power before removing or inserting the card.
- When programming a memory device, place the device in the socket before applying power.

Take care to correctly position the 4020 card in the card cage. The VCC and ground signals must match those on the backplane. Figure 2-2 shows the relative positions of the 4020 card as it is installed in the card cage.

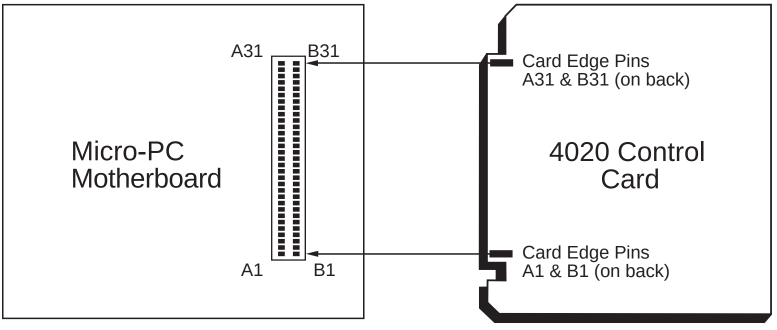

Figure 2-2 – Edge Connector Orientation

2. Attach the 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 4020 into the card cage. The ROM–BIOS label on the card should face to the left. See Figure 2-3 for an illustration of the 4020 in a Micro PC card cage.

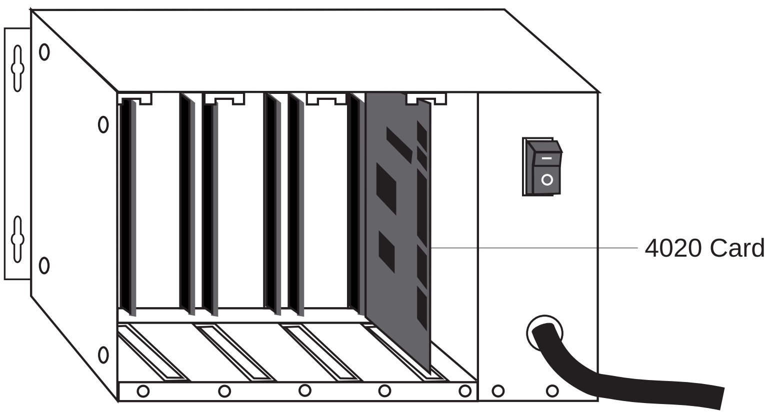

Figure 2-3 — Populated Micro PC Card Cage

WARNING: Plugging the card in incorrectly will destroy the card and void the warranty!

5. Connect one end of a VTC–9F cable to the null modem adapter. Connect the other end to COM1 (J7) on the 4020.

   NOTE: You must use COM1 on the 4020 in order to establish a serial communications link with your PC.

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

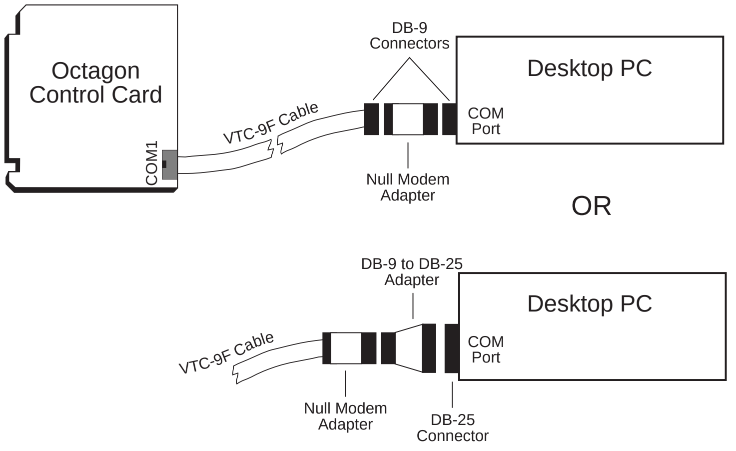

Figure 2-4 – Serial Communications Setup

NOTE: Please refer to the PC SmartLINK manual for more information on using a COM port other than COM1.

You are now ready to transfer files between your PC and the 4020, please continue with the section, “Establishing Communications with the 4020” in this chapter.

Panel Mounting or Stacking the 4020

To panel mount or stack the 4020, you will need the following equipment (or equivalent):

4020 Control Card
5V Power Supply
VTC–9F Cable
Null modem adapter
4020 ROM–DOS & Utility Software Disk
PC SmartLINK with manual
Your PC

5252MB Stacking Kit (required for stacking only) (P/N 3590)

Please refer to Appendix B if you are making your own serial cable or using other non–Octagon components.

If you are panel mounting or stacking the 4020, a screw terminal connector (P2) is provided to supply the 5V power. Refer to Figure 2-5 for an illustration of panel mounting the 4020. Refer to Figure 2-6 for an illustration of stacking the 4020 with the 5252MB Stacking Kit.

WARNING: Miswiring the voltage at P2 of the 4020 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!

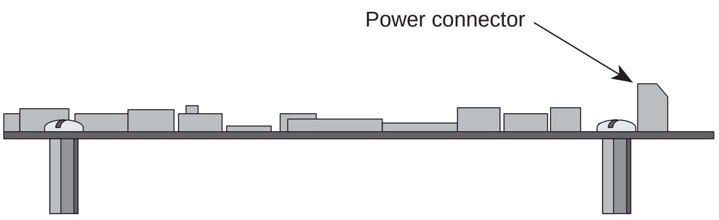

Figure 2-5 — Panel Mounting the 4020

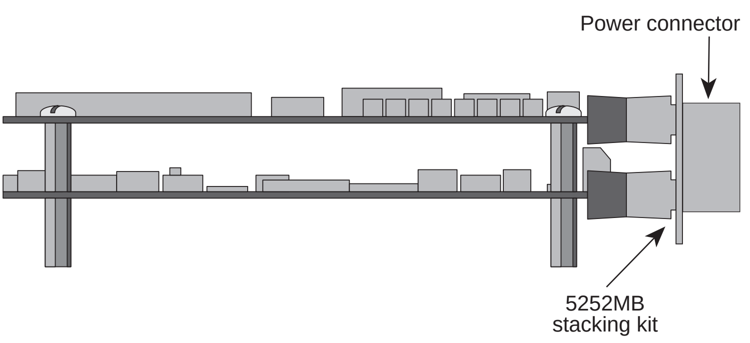

Figure 2-6 — Stacking the 4020

1. To panel mount the 4020, use #4–40 standoffs and screws to bolt down the card. The following diagram shows the center to center mounting hole dimensions.

   To stack the 4020, refer to the *5252MB Stacking Kit Product Sheet* enclosed with the kit. Then proceed with Step 2 in this section.

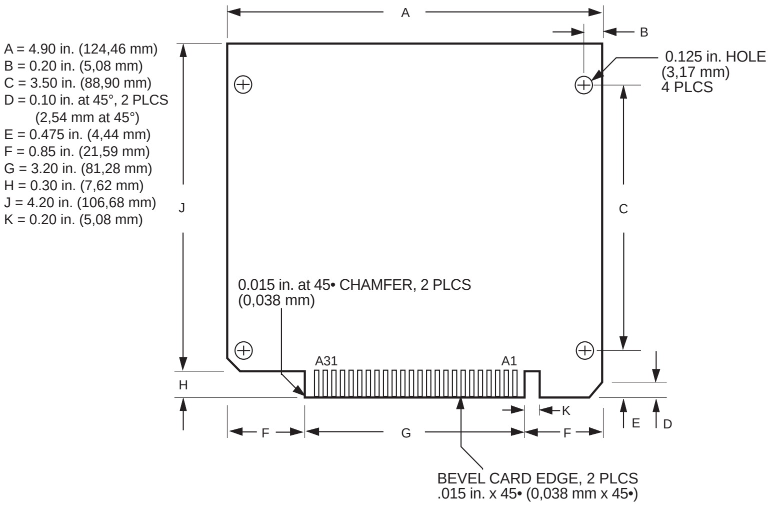

Figure 2-7 — 4020 Center to Center Hole Dimensions

2. Connect the proper ground and 5V wires to the terminal block at P2.

3. Connect one end of the VTC–9F cable to the null modem adapter. Connect the other end to COM1 (J7) on the 4020.

NOTE: You must use COM1 on the 4020 in order to establish a serial communications link with your PC.

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

NOTE: Please refer to the PC SmartLINK manual for more information on using a COM port other than COM1.

You are now ready to transfer files between your PC and the 4020, please continue with the section, "Establishing Communications with the 4020" in this chapter.

Using the 4020 in a Passive Backplane

To plug the 4020 into a passive backplane, you will need the following equipment (or equivalent):

4020 Control Card
Micro PC Backplane (52xx-BP)
Mounting Bracket (optional)
Power Module (51xx Power Supply)
VTC–9F Cable
Null modem adapter
4020 ROM–DOS & Utility Software Disk
PC SmartLINK with manual
Your PC

Please refer to Appendix B if you are making your own serial cable or using other non–Octagon components.

To install the 4020:

1. Make sure power to the backplane is OFF.

2. Insert the 4020 into a connector on the backplane. Take care to correctly position the card's edge with the connector of the backplane. Figure 2-2 shows the relative positions of the 4020 card as it is installed into a backplane.

   WARNING: Plugging the card in incorrectly will destroy the card and void the warranty!

3. Place the backplane on a flat surface so that the card is in an upright position. With the top of the card and its components facing left, attach the mounting bracket (optional) onto the edge nearest you. Secure the mounting bracket with the two screws provided in the kit. See Figure 2-8.

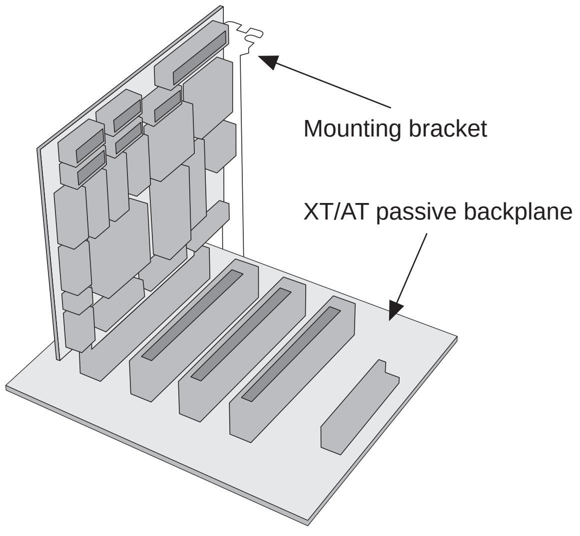

Figure 2-8 – Using a Passive Backplane

NOTE: The 4020 can drive up to three I/O cards.

4. Connect one end of a VTC–9F cable to the null modem adapter. Connect the other end to COM1 (J7) on the 4020.

   NOTE: You must use COM1 on the 4020 in order to establish a serial communications link with your PC.

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

NOTE: Please refer to the PC SmartLINK manual for more information on using a COM port other than COM1.

You are now ready to transfer files between your PC and the 4020, please continue with the section, “Establishing Communications with the 4020” in this chapter.

ESTABLISHING COMMUNICATIONS WITH THE 4020

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 4020 files from the 4020 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 4020 Control Card.

4. Power on the 4020.

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

```
Octagon 4020-386-25MHz-1MB BIOS Vers. x.xx
Copyright (c)1996 Octagon Systems Corp. (TM)
All Rights Reserved
 640K BASE RAM
 384K EXTENDED RAM
 INT 17h BIOS extension (Revision 1.00)
Copyright (c) 1995-96 Octagon Systems Corporation

 EPP BIOS extension (Revision 1.00)
Copyright (c) 1995-96 Octagon Systems Corporation

 Power Management BIOS extension (Revision 1.00)
Copyright (c) 1995-96 Octagon Systems Corporation

Starting ROM-DOS...

HIMEM v6.22 (Revision 2.10.08)
Copyright (c) 1989-1995 Datalight, Inc.

VDISK v6.22 (Revision 2.10)
Copyright (c) 1989-1995 Datalight, Inc.
    Extended memory present.

VDISK v6.22 (Revision 2.10)
Copyright (c) 1989-1995 Datalight, Inc.
    Formatting 320K XMS memory as drive D:
SSDDRIVE.SYS V1.00, SSD1 not found.
SSDDRIVE.SYS V1.00, assigning SSD2 (128KB) as drive E.
```

```
C:\> path C:\;D:\;
C:\> prompt 4020 $p$g
4020 C:\> showtime
Current date/time is: SAT 5/13/1995 9:44:05
4020 C:\>
```

If you do not get the proper logon message:

- Check the 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 Chapter 16, *Troubleshooting*.

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

   4020 C:\> **DIR**

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

```
Volume in drive C is BIOS DRIVE
Directory of C:\

COMMAND      COM  26,321   04–17–95     6:22a
FAST         COM     277   01–19–96    10:28a
RESET        COM     284   01–19–96    10:28a
SETUP        COM   4,466   01–19–96    10:28a
SHOWTIME     COM     350   01–19–96    10:28a
SLOW         COM     277   01–19–96    10:28a
DISKSAVE     EXE  23,939   01-19-96    10:52a
FMTSSD       EXE   3,128   01-19-96    11:28a
REMDISK      EXE   9,355   04-17-95     6:22a
TRANSFER     EXE   9,969   01–05–93     2:36p
CONFIG       SYS     133   01–12-95     2:58p
HIMEM        SYS   2,664   09-20-95     9:53a
SSDDRIVE     SYS   4,301   01–19–96    11:28a
VDISK        SYS   4,699   04-21-95     2:11p
AUTOEXEC     BAT      46   06-02-95    11:21a
    15 File(s)           90,209 bytes
                                0 bytes free
```

7. You are now ready to transfer files between your PC and the 4020.

TRANSFERRING FILES BETWEEN 4020 & YOUR PC

Once you have established communications between your PC and the 4020, you can serially download files to any read/write drive used by the 4020. You can then test and debug your application files before permanently saving them to flash or EPROM. You can also upload files from the 4020 to your desktop PC for editing and debugging.

When booting from the 4020 BIOS drive, the default CONFIG.SYS device drivers designate drive C: as the BIOS drive, drive D: as a virtual drive, drive E: as the SSD flash drive, and drive F: as the SSD SRAM drive. All drives assigned, except for drive C: (BIOS drive), can be accessed as read/write drives and files can be serially transferred to and stored on any of these drives.

NOTE: The SSD device drivers are optional when booting from SSD1, floppy or hard drive. For example, if you do not need a virtual drive with a 512K 4020 system, do not use VDISK.SYS.

There are two methods to download files through the serial port to the 4020:

1. The TRANSFER utility is used to download files, one at a time, to the 4020 using the XMODEM protocol. TRANSFER.EXE resides on the 4020 BIOS drive and on the 4020 utility diskette 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).

2. REMDISK/REMSERV utilities allow access to all of the files on a remote disk drive. REMDISK.EXE and REMSERV.EXE are located on the 4020 BIOS drive and the 4020 utility diskette. Once these programs are executed, single or multiple files can then be transferred to and from the 4020 using DOS COPY or XCOPY commands.

TRANSFER.EXE, REMDISK.EXE and REMSERV.EXE are located on the 4020 BIOS drive and on the 4020 utility diskette in the \DOS directory. Refer to Appendix A 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 4020 and your PC uses the example program DEMO.EXE. This file is on the 4020 utility diskette in the \DEMO directory.

Downloading Files to the 4020 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 those programs instructions on sending a file from your PC to a target system. Refer to Appendix A 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 4020.

- A 4020 running TRANSFER.EXE out of COM1.

1. Connect the equipment as per the following diagram:

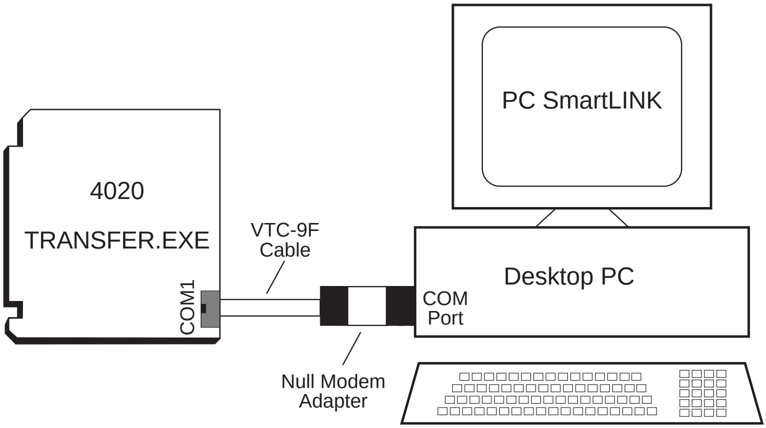

Figure 2-9 – Downloading Files using TRANSFER.EXE

2. On the PC, log into the directory which contains the file(s) you will download to the 4020, for example:

   `C:\MPC\4020\DEMO`

3. Start PC SmartLINK and power on the 4020.

4. Execute the TRANSFER.EXE program from the 4020 by entering:

   `4020 C:\>` **`TRANSFER D:DEMO.EXE`**

NOTE: In this case, D: is the virtual drive assigned in CONFIG.SYS. Any 4020 read/write drive could be substituted.

   The following message is displayed from the 4020:

   `Receiving D: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 1, then the entire path may have to be entered **C:\MPC\DEMO\DEMO.EXE**)

c. To begin the transfer:
   - either press **ENTER** (default download START);
   - tab to **START**;
   - 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 4020 is displayed:

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

6. When the file transfer is complete, type the following DOS command to view the D: drive directory and confirm that your file has been transferred to the 4020:

```
4020 C:\> DIR D:
```

The system will display the contents of drive D:

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

DEMO      EXE    27264  01-01-80     2:57p
     1 file(s)  27264 bytes
```

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

```
4020 C:\> D:DEMO
```

The DEMO program displays a message on your PC.

Downloading Files to the 4020 using REMDISK/REMSERV

There are three methods of using REMDISK/REMSERV with a 4020:

1. 4020 with no video card, one serial cable
2. 4020 with no video card, two PCs, two serial cables
3. 4020 with a 5420 video card, one serial cable

Refer to Appendix A for specific information on using REMDISK.EXE and REMSERV.EXE.

<u>4020 with no video card, one serial cable</u>

Hardware and software requirements:

- Desktop PC, running REMDISK, connected by a VTC-9F cable and a null modem adapter to COM1 or COM2 of the 4020.
- A 4020 running REMSERV out of COM1 or COM2.

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

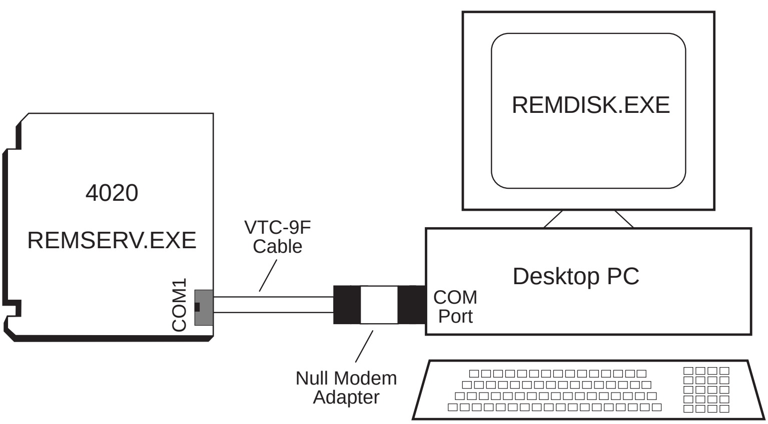

Figure 2-10 – Downloading Files to 4020 with No Video Card Using REMDISK/REMSERV

2. On the PC, start PC SmartLINK from the C:\MPC\4020\DOS directory and power on the 4020.

3. Execute REMSERV.EXE on the 4020. Read/write SSD flash drive E: is the shared drive and COM1 is the default port. COM2 can be selected and the serial cable swapped to the COM2 header after REMSERV has been started. Enter:

   4020 C:\> **REMSERV E:**

   The following message is displayed from the 4020:

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

Using COM1 at 115K+ baud. Accessing Drive E:
Time-out is 2 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 D:    /COM1   /B115+   /T3
```

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

6. Files are transferred to the 4020 read/write drives by using the DOS COPY and XCOPY commands. Enter:

   C:\> **COPY C:\MPC\4020\DEMO.EXE D:**
   C:\> **DIR D:**
   C:\> **D:DEMO.EXE**

   The DEMO program displays a message on your PC.

In this case, drive D: is the remote read/write SSD flash disk drive of the 4020. 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 4020.

<u>4020 with no video card, two PCs, two serial cables</u>

The first desktop PC is used as the terminal for the 4020, and the second desktop PC's hard drive is accessed as a remote drive, containing the files to be downloaded to the 4020.

Hardware and software requirements:

- Desktop PC, running PC SmartLINK, connected by a VTC-9F cable and a null modem adapter to COM1 of the 4020.

- Desktop PC, running REMSERV.EXE, connected by a VTC-9F cable and a null modem adapter to COM2 of the 4020.

- A 4020 running REMDISK.EXE from COM2.

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

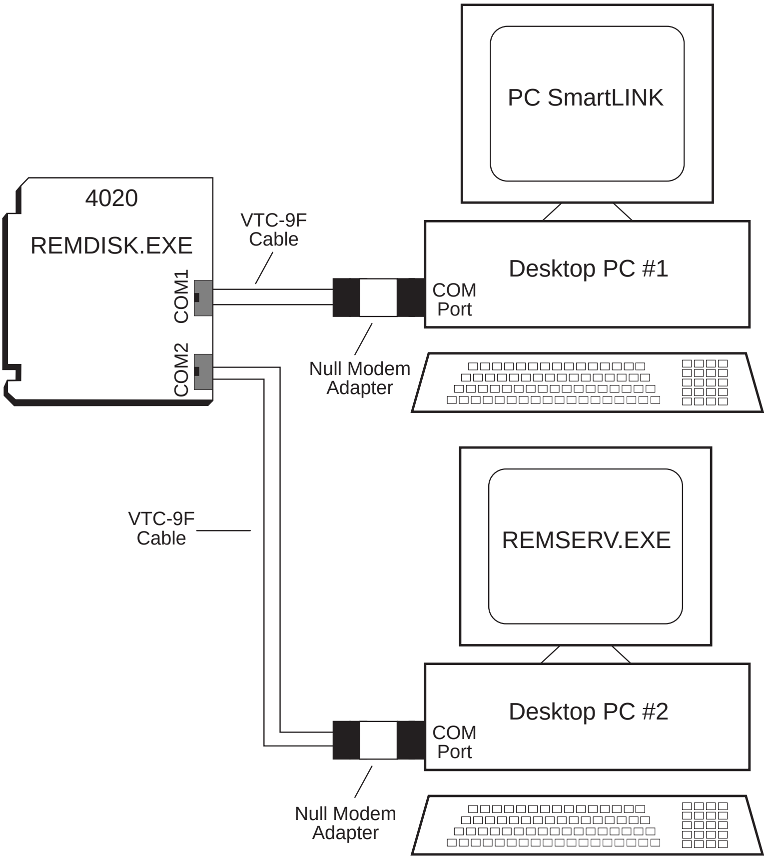

Figure 2-11 – Downloading Files to 4020 with No Video Card & Two PCs

2. On PC #1 (i.e., the terminal PC), start PC SmartLINK and power on the 4020.

3. Execute REMDISK.EXE from COM2 on the 4020 by entering:

   `4020 C:\>` **`REMDISK /COM2`**

   The following message is displayed from the 4020:

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

Installed as Drive G:   /COM2   /B115+   /T3

4020 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 2 seconds
Press <Esc> to Exit.  (There may be a delay
before exit occurs)
```

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

   4020 C:\> **G:**
   4020 G:\> **CD G: \MPC\4020\DEMO**

6. Files are transferred to the 4020 read/write drives by using the DOS COPY and XCOPY commands. Enter:

   4020 G:\MPC\4020\DEMO> **COPY DEMO.EXE E:**
   4020 G:\MPC\4020\DEMO> **DIR E:**
   4020 G:\MPC\4020\DEMO> **E:DEMO.EXE**

   The DEMO program displays a message on your PC.

   In this case, drive G: is the remote disk drive of PC #2, and drive E: is the read/write SSD flash disk drive of the 4020. Files are easily copied between the drives.

4020 with a video card, 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 4020.

- A 4020 system, including a keyboard, a 5420 SVGA video card and VGA monitor, running REMDISK from COM1 or COM2.

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

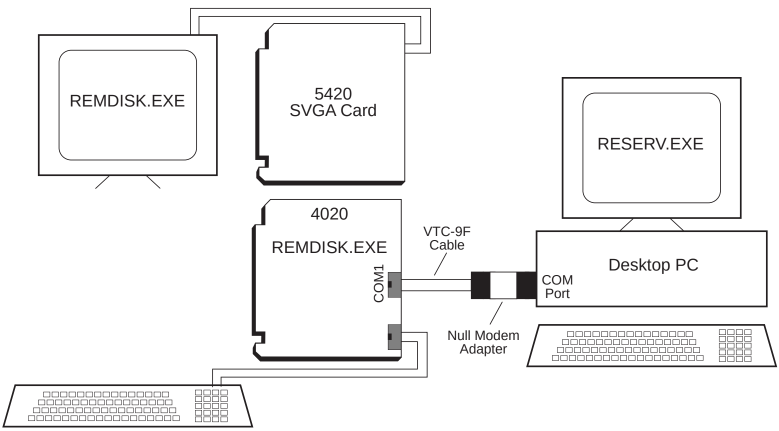

Figure 2-11 – Downloading Files to 4020 with Video Card

2. On the 4020 system, execute REMDISK.EXE by entering:

   C:\> **REMDISK**

   The following message is displayed on the 4020 monitor:

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

Installed as Drive G:   /COM1   /B115+   /T3
```

NOTE: REMDISK assigns the remote drive as the last drive in the system. In this case, drive G: 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 2 seconds
   Press <Esc> to Exit.  (There may be a delay
   before exit occurs)
   ```

4. Files are transferred to the 4020 read/write drives by using the DOS COPY and XCOPY commands. From the 4020 system, enter:

   ```
   4020 C:\> COPY G:\MPC\4020\DEMO.EXE E:
   4020 C:\> DIR E:
   4020 C:\> E:DEMO.EXE
   ```

   The DEMO program displays a message on the 4020 monitor.

   In this case, drive G: is the remote PC disk drive, and E: is the read/write SSD flash drive on the 4020. Files are easily copied between the drives.

5. When finished, on the 4020 system, execute:

   ```
   4020 C:\> REMDISK /U
   ```

   This unloads REMDISK from the desktop PC.

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

CHAPTER 3 EPROMs & BATTERY BACKUP

DESCRIPTION

Before you can save and boot your application from the 4020, you must first configure the system for your particular application requirements.

SSD1

SSD1 generally is meant for storing the application programs to be executed on power–up. The programs are automatically loaded into DOS memory and executed. SSD1 accepts a 512K, 5V only, flash. Your application programs can be saved to the flash using the on–card programmer. These devices are erased automatically during the programming process. You can write to the flash a limited number of times (about 100,000), if your application programs require changes.

When installed with the proper 5V flash, SSD1 can also be accessed directly as a read/write DOS drive when the SSDDRIVE.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 SSD1 be used as a data logging device. Use SSD2 instead, which is SRAM, for files that frequently change. Not all 5V flash available will work with SSDDRIVE.SYS in the read-write mode. Refer to Appendix A for information on supported flash devices and a description of SSDDRIVE.SYS.

Order Octagon P/N 4321: 512K 5V read/write flash.

You can also use a 256K, 512K or 1 MB standard EPROM for SSD1. These EPROMs must be programmed with an off–card programmer. Please refer to Appendix B for more information.

To Install an EPROM/flash

1. Install the EPROM/flash into socket SSD1.

WARNING: When installing the chip, be sure to match the notch in the chip with the notch in the silkscreen. Incorrect installation will destroy the chip!

NOTE: Two types of flash are supported. One type can be used as a read/write drive and the other type can be used as a read-only drive. See the *SSDDRIVE.SYS* section in Appendix A for a list of supported flash and the listed type.

If installing a new flash that operates in a read/write mode, the new flash will be automatically formatted to its maximum capacity on power-up and a message similar to "SSDDRIVE.SYS v1.00, assigning SSD1 (512KB) as drive E:" will be displayed. The SSD1 device is recognized as a disk drive and the size and drive designator are reported. Once the SSD1 device has been formatted, it will be recognized as a read/write drive. On subsequent power-up, it will not be formatted again. If you want to format your SSD1 device after the auto format, then use FMTSSD.EXE. To make a bootable SSD1 with user-supplied DOS, use DISKSAVE.EXE.

If installing a new flash that operates in a read-only mode, DISKSAVE.EXE must be used to program the new flash. DISKSAVE.EXE is used to make a read-only flash look like a disk or bootable disk. SSDDRIVE.SYS will not recognize an unprogrammed flash/EPROM and will display the message "SSDDRIVE.SYS v1.00, SSD1 not found."

For programming flash, see Chapter 5, *Save and Run Programs*, and *DISKSAVE.EXE*, *DISKSEND.EXE* and *SSDDRIVE.SYS* in Appendix A.

SSD2

SSD2 is a 128K static RAM. A 3.6V AT clock battery can be used to battery back SSD2 via jumper block W4. SSD2 is recommended to be used as a read/write drive for files that change frequently, such as data logging files.

The 3.6V clock battery installed in J4 is used to battery back the calendar clock, and can be used to battery back SSD2.

To Install Battery Backup for SSD2, and Calendar Clock

W4: SSD2 Battery Backup	
Pins Jumpered	**Description**
[1-2]*	Battery backup for calendar/clock. No battery backup for SSD2.
[2-4]	Battery backup for calendar/clock & SSD2.

* = default

CAUTION: You must jumper pins [1-2] or [2-4] on block W4. If neither of the two configurations is selected, the SRAM on the 4020 may be damaged and/or the system may not operate.

1. Install the 3.6V AT clock battery on the J4 connector. Refer to Figure 2-1 for the location of J4.

2. Jumper block W4[2-4] enables battery backup for SSD2.

This page intentionally left blank.

DESCRIPTION

The SETUP program defines the 4020 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 BIOS drive and on the 4020 utility disk.

4020 SETUP Parameters	Description	Default
COM1 Console Baud Rate	Specifies communications rate between your PC and the 4020 when no video card is in use.	9600
Power-on Memory Test	Extensive memory testing performed on bootup.	Enabled
SSD1 Device	Specifies the type of memory device installed in SSD1.	512K flash
Boot from	Specifies the default boot drive.	BIOS drive using ROM-DOS
On-board LPT Mode	Specifies the on-board LPT operation mode.	Bi-directional
LPT IRQ	Specifies the IRQ to be used with the LPT.	IRQ7
LPT address	Specifies the port address for on-board LPT.	378h
UART 1 address	Specifies the port address for UART 1.	3F8h
UART 2 address	Specifies the port address for UART 2.	2F8h
Number of Floppy Drives	Specifies the number of floppy drives attached.	0
Floppy Drive Size	Specifies size of the first floppy drive.	1.44 MB
Number of line printers	System will automatically check to verify if line printer port(s) exist.	Auto check
Number of hard drives	Specifies the number of hard drives attached.	0
Drive 0 parameters	Specifies the cylinders, heads and sectors of drive 1.	Varies with each drive

If you are running SETUP for the first time and have not previously saved and autoexecuted your program, we recommend you keep the default setting, “Boot from: BIOS drive using ROM–DOS”. The 4020 continues to boot from the BIOS drive allowing you to verify your program files are successfully saved to SSD1. You can also test your program before setting the system to boot from your AUTOEXEC.BAT file. Once your program is tested and verified, you can run SETUP to configure the system to autoexecute your program.

RUNNING SETUP

1. Make sure you have established a serial communications link between the 4020 and your PC.

2. Enter:

   `4020 C:\>` **`SETUP`**

   NOTE: If you are not booting from the BIOS drive, the drive designator may differ.

3. The system will display the 4020 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.

   ```
   • COM1 Console Baud Rate:
        1200
        2400
        4800
        9600
        19200
        38400
        57600
        115200
   ```

   The following messages may appear:

   ```
   NOTE:  To use COM1 as the console at a speed
   other than 9600 baud, you must install the
   BIOS boot jumper. (W2[3–4])
   ```

- Power on memory test:
    Enabled
    Disabled

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

- SSD1 device:
    128K 5V FLASH (29F010/29C010/29EE010)
    512K 5V FLASH (29F040/29C040/28SF040)
    EPROM (27C0x0)
    None

NOTE: After setting the SSD1 device, use DISKSAVE/ DISKSEND to program the flash PROM.

NOTE: If SSD1 is not programmed, SSDDRIVE.SYS may display the message "SSD1 not found" when the system comes up.

- Boot from:
    BIOS drive using ROM–DOS
    SSD1 using ROM–DOS
    Floppy or Hard drive
    SSD1 using User supplied DOS/OS

NOTE: If NONE was selected for the SSD1 device type, the SSD1 boot options are not available.

We recommend that you do not change this option until you have saved and verified your program files in SSD1. If booting from the BIOS drive, the No Video jumper, W2[1–2], is ignored. If the BIOS boot jumper, W2[3–4], is not installed and you selected an option other than “Boot From BIOS Drive Using ROM–DOS”, the following message appears:

```
NOTE:  To boot from the specified device you
must install the BIOS boot jumper. (W2[3-4])
```

- On-card LPT port mode:
    Bi-directional mode
    EPP mode
    Disabled
    Standard (Uni-directional) mode

NOTE: Standard mode is provided for compatibility only. We recommend the use of bidirectional mode. The EPP mode is provided for equipment that has the capability to operate at these modes for enhanced performance.

- `IRQ for LPT port:`
  `IRQ7`
  `IRQ5`

NOTE: IRQ7 is recommended for use.

- `On-board LPT address:` `378H`
  `278H`
  `3BCH`

- `UART 1 address:`
  `3F8H`
  `2F8H`
  `338H`
  `3E8H`
  `2E8H`
  `220H`
  `238H`
  `2E0H`
  `228H`
  `Disabled`

- `UART 2 address:`
  `3F8H`
  `2F8H`
  `338H`
  `3E8H`
  `2E8H`
  `220H`
  `238H`
  `2E0H`
  `228H`
  `Disabled`

NOTE: We strongly recommend the use of 3F8H for UART 1 and 2F8H for UART 2.

NOTE: The choices for UART addresses are mutually exclusive; therefore, you may not see all the choices listed above.

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

A maximum of 1 floppy drive is possible if booting from SSD1 and using your own DOS. See Chapter 13, *Using Your Own DOS* for details. The following message will appear if you select one floppy disk and you boot from SSD1 with your own DOS:

```
NOTE:  Connect the floppy to the second floppy
cable connector.  The drive will be known as B:
```

- `Floppy drive 1 size:`
  ```
  360K
  1.2 MB
  720K
  1.44 MB
  ```

- `Floppy drive 2 size:`
  ```
  360K
  1.2 MB
  720K
  1.44 MB
  ```

These two options only display if you have specified that a floppy drive(s) is attached to the 4020.

- `Number of line printers:`
  ```
  Auto Check
  0
  1
  2
  3
  ```

If you select Auto Check, the system automatically checks the available parallel printer interfaces to verify their existence by writing a pattern to the printer data lines during boot–up or reset. If you have a non–printing device attached to the LPT1 port, e.g., MPB–16PC and do not want data written to that port during boot–up, deselect the Auto Check option.

- `Number of hard drives`
  ```
  0
  1
  2
  ```

NOTE: If you are using a 5800A hard drive controller card, you should select 0 hard drives. Enter the hard drive parameters with HDSETUP.COM.

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

```
Press ENTER to SAVE the changes or
Press ESC to EXIT without saving the changes.
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.
```

SETUP EXAMPLE

The following example configures a system with 512K flash PROM in SSD1, no memory test, 9600 baud, and booting from SSD1 with ROM–DOS:

```
OCTAGON SYSTEMS CORPORATION
4020 SETUP UTILITY Vx.x
(Press SPACE to CHANGE, ENTER to ACCEPT, ESC to
EXIT)
```

```
COM1 Console Baud Rate:  9600
Power on memory test:  Disabled
SSD1 device: 512K 5V FLASH (29F040/29C040/28SF040)
Boot from:  SSD1 using ROM–DOS
On-card LPT port mode:  Bi-directional mode
IRQ for LPT port:  IRQ7
UART 1 address:  3F8H
UART 2 address:  2F8H
Number of floppy drives: 0
Number of line printers:  Auto check
Number of hard drives: 0
```

```
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.
4020 C:\>
```

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

SAVE AND RUN YOUR PROGRAMS ON THE 4020

Once you have written, tested and debugged your application, you can then save it to either battery–backed static RAM or flash memory in SSD1. When you reboot the 4020, your program can automatically load into DOS memory and execute.

This chapter tells you:

1. How to save an application program to SSD1;
2. How to autoexecute the program from the 4020; and
3. How to override 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 SSD1, using your own DOS, when using programs with undocumented DOS calls. Refer to Chapter 13, *Using Your Own DOS* for more information on saving and autoexecuting programs.

This chapter also assumes you will be using the 4020 without a video card/monitor. If you are using these devices, refer to Chapter 11, *Video/Keyboard/Speaker* for more information on transferring and saving programs.

SAVING PROGRAM AND SUPPORT FILES

In addition to your application program, you must also transfer support files to the 4020 to ensure proper operation. These files include the ROM–DOS COMMAND.COM, AUTOEXEC.BAT, CONFIG.SYS, and other files specific to your application. ROM–DOS COMMAND.COM is required to boot the 4020 with ROM–DOS from SSD1. AUTOEXEC.BAT defines the routine for autoexecution of your program.

CONFIG.SYS defines the various device drivers of your 4020 system. The following is an example listing of CONFIG.SYS entries for the device drivers included with the 4020. Each of these device drivers is discussed in greater detail in Appendix A, *Software Utilities*. Refer to Appendix B for more information on how the 4020 assigns drive designators.

`DEVICE=SSDDRIVE.SYS SSD1`	Accesses the SSD1 drive
`DEVICE=SSDDRIVE.SYS SSD2`	Accesses the SSD2 drive
`DEVICE=SSDDRIVE.SYS BIOS`	Accesses the BIOS drive
`DEVICE=VDISK.SYS /E`	Accesses the virtual drive in extended memory
`DEVICE=VDISK.SYS 136`	Accesses a virtual drive in DOS base memory

NOTE: We recommend you include in your CONFIG.SYS file the entry DEVICE=SSDDRIVE.SYS BIOS. This allows you to easily access utility programs (SETUP, TRANSFER, etc.) that are located on the BIOS drive.

Saving Files to 4020 SSD1 using DISKSAVE/DISKSEND

The following information leads you through transferring, saving and autoexecuting a program using DEMO.EXE and the SSD1 flash drive. All the files for this application are located on the 4020 utility disk in the \DEMO directory. The two programs, DISKSAVE and DISKSEND, transfer and save files from a disk or hard drive directory to SSD1. The DISKSAVE program resides on the 4020 BIOS drive and the DISKSEND program is located in the \4020 directory on the utility disk. The following procedures assume you are using PC SmartLINK and PC SmartLINK is included in your directory path. Refer to Appendix B for specific information on using DISKSAVE.EXE and DISKSEND.EXE.

Hardware and software requirements:

- Desktop PC, running PC SmartLINK and DISKSEND.EXE, connected by a VTC-9F cable and a null modem adapter to COM1 of the 4020.

- A 4020 running DISKSAVE.EXE out of COM1.

1. Hookup equipment as per the following diagram:

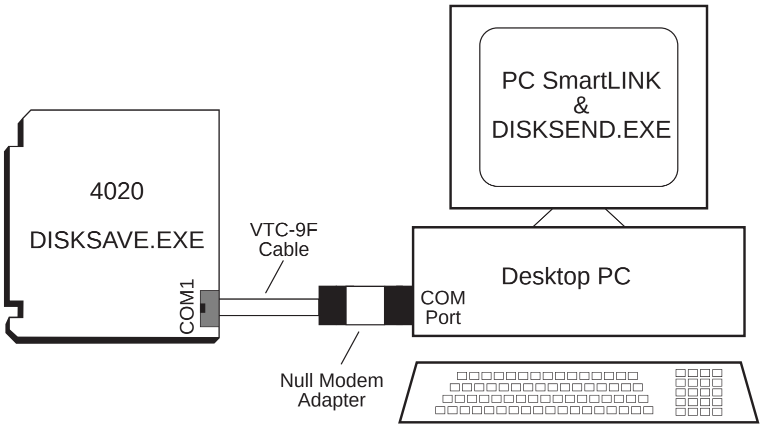

Figure 5-1 – Saving Files to 4020 using DISKSAVE/DISKSEND

2. Do an XCOPY of the 4020 utility disk to your hard drive. This will copy all subdirectories on the utility disk to your drive.

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

3. Change to the 4020 directory to allow access to DISKSEND.EXE:

   CD \MPC\4020

4. Start PC SmartLINK and power on the 4020.

NOTE: If you are using PC SmartLINK from COM2 on your PC, you must use the /C2 switch with DISKSEND.EXE. Refer to the DISKSEND section in Appendix A for more information. Also, if you cannot communicate at 38400 baud (default), use the /Bxxx switch on both DISKSAVE and DISKSEND and select a slower baud rate.

5. On the 4020, execute the DISKSAVE program by entering:

   4020 C:\> **DISKSAVE /X /DSSD1**

NOTE: /X specifies programming SSD1 over the serial port, /DSSD1 specifies disk drive SSD1.

The following message is displayed from the 4020:

```
Attempting connection with DISKSEND on the
desktop PC.

If software handshaking is not established with
DISKSEND within 40 seconds, DISKSAVE will time-
out.
```

6. Exit PC SmartLINK by pressing <ALT><X> and enter:

   C:> **DISKSEND \MPC\DEMO**

   The 4020 system will erase the SSD1 flash drive and then program SSD1 with the contents of the \DEMO directory. This may take several minutes to complete. Progress will be displayed on the screen.

```
Contents of \DEMO directory:
COMMAND.COM
CONFIG.SYS
   HIMEM.SYS
   VDISK.SYS
   SSDDRIVE.SYS
   AUTOEXEC.BAT
   DEMO.EXE
   DEMO.BAS
```

7. Restart PC SmartLINK.

8. Confirm that the “Boot from” option in SETUP shows “BIOS drive with ROM-DOS”. Then enter:

   4020 C:> **RESET**

   By resetting the 4020, the FAT table of the newly programmed SSD1 flash drive is now recognized.

9. Display and verify the contents of SSD1:

   ```
   4020 C:> DIR E:
   ```

10. Execute the DEMO.EXE program which now is located on the E: SSD1 flash drive:

    ```
    4020 C:> E: DEMO
    ```

Refer to the next section, “Autoexecuting Your Program” if you want to boot and run your program from SSD1.

AUTOEXECUTING YOUR PROGRAM

Once you have saved your program and other files to SSD1 you may boot from SSD1 and autoexecute your program.

1. Make sure jumper W2[3-4] is installed. (This is the default setting and allows you to boot from the SSD1 drive when this option is selected in SETUP as in Step 4 below).

2. Start PC SmartLINK and power on the 4020.

3. Make sure the following files are in the E: SSD1 flash drive and that AUTOEXEC.BAT contains the name(s) of the file(s) to be autoexecuted (in this case, DEMO.EXE):

   ```
   COMMAND.COM
   CONFIG.SYS
   SSDDRIVE.SYS
   AUTOEXEC.BAT
   DEMO.EXE
   ```

4. Run SETUP from the 4020 BIOS drive and specify “Boot from: SSD1 using ROM-DOS”.

   ```
   4020 C:> SETUP
   ```

5. Reset the 4020 by pressing the reset switch or entering:

   ```
   4020 C:> RESET
   ```

   The 4020 will reset and boot from the SSD1 flash drive. SSD1 now becomes drive C: and the programs listed in AUTOEXEC.BAT will be autoexecuted.

NOTE: This example uses ROM-DOS COMMAND.COM. Refer to Chapter 13, *Using Your Own DOS* if you wish to use another operating system such as MS-DOS.

OVERRIDING PROGRAM AUTOEXECUTION FROM SSD1

If you want to make changes to your program and need to override autoexecution of your program, you must reboot the 4020 from the BIOS drive. There are two options available:

1. You can rerun SETUP to change the “Boot from” option to “BIOS drive with ROM–DOS”. If you include the line DEVICE=SSDDRIVE.SYS BIOS in your CONFIG.SYS file, you can access the SETUP program on the 4020 BIOS drive.

2. You can remove jumper W2[3–4]. However, this may be inconvenient and/or impossible if you are making program changes from an off–site location.

Running SETUP Again

1. Make sure you have established a serial link between your PC and the 4020.

2. To execute SETUP which is on the BIOS drive, type:

   ```
   4020 C:\> D:SETUP
   ```

   NOTE: The drive designator may vary depending on the hardware configuration of the 4020.

3. Select the "Boot from BIOS drive using ROM–DOS" option.

4. Enter:

   ```
   4020 C:\> D:RESET
   ```

5. Make the necessary changes to your application and copy the new files to a floppy disk, RAM disk, or directory.

6. Rerun DISKSEND and DISKSAVE to save your new files to SSD1. Verify and test your program.

7. Rerun SETUP to change the default boot drive to "SSD1 using ROM-DOS".

8. Reset the 4020.

Removing Jumper W2[3–4]

If the SETUP program is not accessible from SSD1, you must remove jumper W2[3–4]. This configuration uses video over COM1 and boots from the BIOS drive using ROM–DOS. COM1 is configured for 9600, N, 8, 1. The following message appears when you reboot the 4020:

```
BIOS boot jumper (W2[3–4]) not installed, boot-
ing from the BIOS drive and ignoring the video
jumper setting.
.
.
4020 C:\>
```

After booting from the BIOS drive, use the DISKSAVE and DISKSEND programs to download new files to SSD1. Before rebooting the 4020, be sure to reinstall jumper W2[3–4] if you want the 4020 to boot a device other than the BIOS drive.

This page intentionally left blank.

DESCRIPTION

The 4020 has three serial ports that 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 115.2K.

J7: COM1, J8: COM2, & J2: COM3 Serial Ports

Pin #	COM1	COM2	COM3
1	DCD	N.C.	N.C.
2	DSR	N.C.	N.C.
3	RxD	RxD	RxD†
4	RTS	RTS	RTS
5	TxD	TxD	TxD
6	CTS	CTS	CTS
7	DTR	N.C.	N.C.
8	RI	N.C.	N.C.
9	Gnd	Gnd	Gnd
10	+5V	+5V	+5V

† = All J2 inputs and outputs remain active in RS-485 mode, except for Receive Data. To receive RS-232 data, W5 must be configured to [1-2].

J2, J7 & J8 Serial Ports, 10-pin Mating Connectors:
Connector: Thomas & Betts 609-1030
Strain Relief: Thomas & Betts 609-1031

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. When interfacing the 4020 to your PC, you will need to use a null modem adapter.

COM1 AS CONSOLE I/O

The default settings for the 4020 are as follows:

- W2[1–2] — Video enabled
- W2[3–4] — Boot using parameters defined by SETUP
- W2[5–6] — User defined

<table>
<tr><th colspan="3">W2: COM1, Video and BIOS Boot Options</th></tr>
<tr><th>Pins Jumpered</th><th>Video System</th><th>Description</th></tr>
<tr><td>[1-2][3-4]*</td><td rowspan="3">No video card installed in system.</td><td>Video over COM1. System will boot SETUP boot device</td></tr>
<tr><td>[1-2]</td><td>Video over COM1. System will boot BIOS drive.</td></tr>
<tr><td>[3-4]</td><td>No COM1 video available. COM1 available for use in application. System will boot SETUP boot device.‡</td></tr>
<tr><td>[3-4]†</td><td rowspan="2">Video card installed in system.</td><td>Video on CRT. System will boot SETUP boot device.</td></tr>
<tr><td>[3-4] not jumpered†</td><td>Video on CRT. System will boot BIOS drive.</td></tr>
</table>

* = default

† = W2[1-2] is ignored

‡ = If SETUP boot device is BIOS drive, system will use video over COM1.

NOTE: When W2[3–4] is removed, the baud rate defaults to 9600. If a video card is present, jumper W2[1–2] is ignored.

Some programs which access the video memory directly will not work properly on the 4020 without a video card resident. Refer to the DEMO.BAS program on the utility disk for an example of required QuickBASIC modifications. Refer to Chapter 11, *Video/Keyboard/Speaker* for more information on using a video as the console.

COM1 AS RS–232 I/O

When you have completed developing your application and programmed the 4020, you can use COM1 as an RS–232 serial port for connection to a printer, modem or other serial device. To access COM1 you have two options:

1. Configure the 4020 for no console port by removing jumper W2[1–2] and boot the system from SSD1 or floppy/hard drive (not the BIOS drive). If you do not remove W2[1–2], the BIOS sign on messages will be sent to your printer, modem or other device connected to COM1.
2. Add a video card and monitor to your 4020 system.

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.

DISABLING INTERRUPTS

The PC Bus does not allow shared interrupts on the bus. You can, however, disable the COM1 and COM2 interrupts (IRQ4 and IRQ3) to allow for other devices which use these interrupts. If COM1 is the console, its interrupt (IRQ4) is in use. COM2 (IRQ3) is not used by the BIOS.

USING QUICKBASIC TO COMMUNICATE VIA COM1

Several programming languages including QuickBASIC V4.5 assume a video card is present, and for system speed reasons write directly to the video hardware. This 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 V4.5.

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 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. Remove the video jumper W2[1–2].

2. Boot from a drive other than the BIOS drive, e.g. SSD1 with ROM–DOS.

3. 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 COM1 device number.

Method 2

1. Leave the video jumper W2[1–2] on.

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, 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 4020 Utilities diskette.

Method 3

1. Leave the video jumper W2[1–2] on.

2. Use the PRINTS, PRINTSL, KEYHIT$, INKEY2$ commands as found in the DEMO.BAS and DSQBTEST.BAS programs (included on the utility diskette). 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, 1 stop bit.

COM3

COM3 is a multifunctional serial port that can be used either as a four-wire RS-232 channel or a two-wire RS-485 channel. COM3 can also reside at two separate I/O locations. The interrupt from COM3 may also be user-defined as one of three interrupts available.

Jumper W5 defines the operation mode for COM3. If W5[1-2] is connected, then the RS-232 mode is selected. If W5[1-3] is connected, then the RS-485 mode is selected. Even though one mode is selected, the data being transmitted appears at both connector headers. Jumper W5 controls only the source of the receive data.

RS-232 at COM3 is connected to J2. Connector J2 is a four-wire interface having Transmit Data and Request to Send as outputs. Receive Data and Clear to Send are the inputs.

RS-485 at COM3 is connected to J5. Connector J5 is a two-wire balanced interface. The Request to Send (RTS) bit of COM3 UART controls the transmit/receive functions. The RTS bit is located at 3ECh bit position 1 if W3[1-2] is jumpered, and at 30Ch bit position 1 if W3[1-2] is not jumpered. If this bit is a 0 (power on reset, default), the channel is set to receive. If this bit is a 1, the channel is set to transmit.

RS-485 Transmitter Control

To turn the transmitter ON and OFF through software control, refer to the following table:

4020 RS-485 Transmitter Control	
Program Statement	**Description**
COM3 at 3E8H (W3[1-2] installed)	
Set bit 1 at location 3ECH high	Enables COM3 RTS which enables RS-485 transmitter output.
Set bit 1 at location 3ECH low	Disables COM3 RTS which disables RS-485 transmitter output.
COM3 at 308H (W3[1-2] not installed)	
Set bit 1 at location 30CH high	Enables COM3 RTS which enables RS-485 transmitter output.
Set bit 1 at location 30CH low	Disables COM3 RTS which disables RS-485 transmitter output.

The RS-485 needs to be configured to be terminated for either marking of spacing idle condition or not terminated. The nodes at each end of the balanced RS-485 need to be terminated; all nodes in between should not be terminated. Jumper W5, pins 5 through 10, determine the termination.

If a node needs to be terminated, both ends of the network must be terminated. W5[5-7][6-8] must be jumpered to provide for a spacing idle condition. W5[7-9][8-10] must be jumpered to provide for no terminations.

W5: COM3, RS-232 or RS-485	
Pins Jumpered	**Description**
[1-2]*	RS-232 Receive
[1-3]	RS-485 Receive
[5-6]	RS-485 (+) Terminated, idle line at a space
[7-8]	RS-485 (-) Terminated, idle line at a space
[5-7]*	RS-485 (+) Terminated, idle line at a mark
[6-8]*	RS-485 (-) Terminated, idle line at a mark
[7-9]	RS-485 Unterminated
[8-10]	RS-485 Unterminated

* = default

COM3 can be located at either 3E8h, the standard PC location, or at 308h. When W3[1-2] is jumpered, COM3 is located at 3E8h. When W3[1-2] is not jumpered, then COM3 is located at 308h.

The interrupt from COM3 can be configured to be IRQ4, IRQ7, or IRQ11. When W1[5-6] is jumpered, IRQ4 is selected. IRQ4 is the standard COM3 interrupt. IRQ4 is also shared with COM1. When W1[3-5] is jumpered, COM3 interrupt is routed to IRQ7. When W1[5-7] is jumpered, COM3 interrupt is routed to IRQ11.

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 reset by the software. The watchdog timer can be controlled through the enhanced INT 17H interface which is built-in function on the 4020.

When you want to start using the watchdog timer, enable the watchdog with the Enable Watchdog function call. You must strobe the watchdog timer within the time-out period to prevent the board from resetting. This can be accomplished by using the Strobe Watchdog function call or by reading address 20CH. When the watchdog timer is strobed, the timer is reset and begins counting down again. To disable the watchdog timer, the Disable Watchdog function is called.

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 watch dog 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 interrupt function call.

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
    }
```

ISA BUS IOCHK NMI

The ISA Bus IOCHK NMI may be routed into the system via W3[3-4]. You must install your own interrupt handler, such as a routine to respond to the NMI interrupt. The default NMI interrupt handler will generate the message "PARITY ERROR 2" when the -IOCHK signal goes low or the power drops below 4.75V.

W3: NMI Interrupt Source & COM3

Pins Jumpered	Description
[1-2]*	COM3 Select Pins jumpered: COM3 at 3E8h Pins not jumpered: COM3 at 308h
[3-4]*	ISA Bus IOCHK NMI

* = default

HARDWARE RESET

The 4020 has a button which allows you to reset the system without turning off the power. This provides a more complete reset than the <CTL><ALT><DEL> method. The RESET command also accomplishes the same thing as the reset button. Refer to Figure 2-1 for the location of the reset switch.

Remote Reset

In addition to the push button reset, there is a separate opto–isolated input so that the 4020 can be remotely reset. The opto–isolation allows the reset line to extend up to 50 feet from the card. A 5V signal applied to the optical reset inputs will reset the system. Noise filtering is built–in. The isolation from the system ground is 500V. The remote reset is accessed at J5[1-2]. A voltage greater than 3.1V at 2.0 mA will guarantee a reset, while a voltage less than 1.8V will guarantee that a reset will not occur. Refer to Figure 2-1 for the location of J5.

J5: Opto-Isolated Reset, Interrupt & RS-485	
Pin #	**Signal**
1	Reset Source
2	Reset Return
3	Opto IRQ5 Source
4	Opto IRQ5 Return
5	Opto IRQ15 Source
6	Opto IRQ15 Return
7	N.C.
8	RS-485 GND
9	RS-485 (+)
10	RS-485 (-)

J5 Opto-Isolated Reset, Interrupt & RS-485,
10-pin Mating Connector:

Connector: Thomas & Betts #609-1030
Strain Relief: Thomas & Betts #609-1031

INTERRUPTS

Even though the 4020 employs an 8-bit PC/XT style bus, it supports four additional interrupts: IRQ10, IRQ11, IRQ14 and IRQ15 which are normally found in a full 16-bit AT style bus. This allows applications using expansion cards such as the Micro PC 5300 Counter Timer Card to use interrupts which have previously conflicted with the CPU.

IRQ10, IRQ11 and IRQ14 are jumper selectable at W1 on the 4020. IRQ10 on the 4020 is jumper selectable to bus IRQ3, IRQ11 on the 4020 is jumper selectable to bus IRQ4, and bus IRQ5 on the 4020 is jumper selectable to IRQ14.

W1: Interrupt Select		
Pins Jumpered	**Interrupt Source**	**CPU IRQ**
[1-2]*	Bus IRQ3	IRQ3
[2-4]	Bus IRQ3	IRQ10
[3-5]	COM3	IRQ7
[5-6]*	COM3	IRQ4
[5-7]	COM3	IRQ11
[6-8]	Bus IRQ4	IRQ4
[7-8]*	Bus IRQ4	IRQ11
[10-12]	Bus IRQ5	IRQ5
[9-10]*	Bus IRQ5	IRQ14
[11-12]*	Opto IRQ	IRQ5
[9-11]	Opto IRQ	IRQ14
[12-14]	Timer Channel 1 Out	IRQ5
[13-14]*	Timer Channel 1 Out	IRQ9

* = default

The 4020 also supports any operating system which requires the standard AT IDE disk device interrupt (IRQ14). This includes QNX, Novell, Windows and others. This is accomplished by redirecting bus IRQ5 to CPU IRQ14.

Remote Interrupts

The 4020 also provides for two remote, opto-isolated interrupts, IRQ5 and IRQ15. The opto-isolation allows the interrupt line to extend up to 50 feet from the card. Noise filtering is built-in. The isolation from the system ground is 500V. A 5V signal applied to the optical interrupt inputs (J5[3-4] for IRQ5 and J5[5-6] for IRQ15) will generate the appropriate interrupt. As discussed previously, IRQ5 can be re-routed to IRQ14. Refer to Figure 2-1 for the location of J5.

A voltage input greater than 4.1V @ 3.0 mA will guarantee an interrupt. A voltage less than 1.92V @ 1.05 mA will guarantee no interrupt.

LPT1 PARALLEL PORT

The LPT1 port has a 26–pin connector. It supports standard mode (unidirectional), bidirectional mode, and enhanced parallel port (EPP) mode. The I/O address and IRQ is selected with SETUP. The default setting is at 378H using IRQ7.

A number of devices are supported including a PC compatible printer, a multiline display, a matrix keypad or an opto rack with opto-isolated digital I/O modules.

CAUTION: The 26-pin header for the LPT1 printer port, J9, is located next to the 26-pin headers for the digital I/O ports, J3 and J6. Damage may occur to the 4020 if a printer is connected to the digital I/O ports or a digital I/O device is connected to the LPT1 port. Refer to Figure 2-1 for the locations of these connectors.

PRINTER

To install a printer:

1. Connect an Octagon VTC–5/IBM cable from the LPT1 port (J9) to the 25–pin connector on your printer cable.

2. Connect the cable to your printer.

J9 Parallel Printer Port, 26-pin Mating Connector:
Connector: Thomas & Betts #609-2630
Strain Relief: Thomas & Betts #609-2631

See the following table for the LPT1 printer port pinout.

J9: LPT1 Printer Port (26-Position Header)		
Pin #	**DB25 (Printer) Pin #**	**Function**
1	1	STB*
2	14	AFD*
3	2	DATA0
4	15	ERR*
5	3	DATA1
6	16	INIT*
7	4	DATA2
8	17	SLIN*
9	5	DATA3
10	18	Gnd
11	6	DATA4
12	19	Gnd
13	7	DATA5
14	20	Gnd
15	8	DATA6
16	21	Gnd
17	9	DATA7
18	22	Gnd
19	10	ACK*
20	23	Gnd
21	11	BUSY
22	24	Gnd
23	12	PE
24	25	Gnd
25	13	SLCT
26		+5V

* = active low

DISPLAY

The LPT1 port supports either 4x20 or 4x40 liquid crystal displays (LCD). To interface the displays to the 4020, use the Octagon 2010 interface board. A CMA–26 cable is required to connect the interface board to the 4020. The program DISPLAY.EXE (found on the 4020 utility disk) provides an easy method to use the display. Please refer to the file DISPLAY.DOC on the utility disk for information on initializing and using the display. Also, refer to the 2010 Product Sheet for information on the interface board. To install a display:

1. Connect a CMA–26 cable from the LPT1 port (J9) to J1 on the 2010.

2. Connect the display cable to either the 14–pin or 16–pin header on the 2010. The size of the display will determine which header to use.

3. Refer to the file DISPLAY.DOC for more information on initializing and using the display.

KEYPAD

LPT1 also supports 4x4 matrix keypads. To interface the keypad to the 4020, use the Octagon 2010 interface board. A CMA–26 cable is required to connect the interface board to the 4020. The program DISPLAY.EXE (found on the 4020 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. Also, refer to the 2010 Product Sheet for information on the interface board. To install a keypad:

1. Connect a CMA–26 cable from the LPT1 port (J9) to J1 on the 2010.

2. Connect the keypad cable to the 10–pin header on the 2010.

3. Refer to the file DISPLAY.DOC for more information on reading the keypad.

OPTO RACK

The Octagon MPB-16PC opto rack interfaces directly to the parallel printer port and can control high voltage/high current G4 opto-isolated modules. Of the 16 positions available, 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.

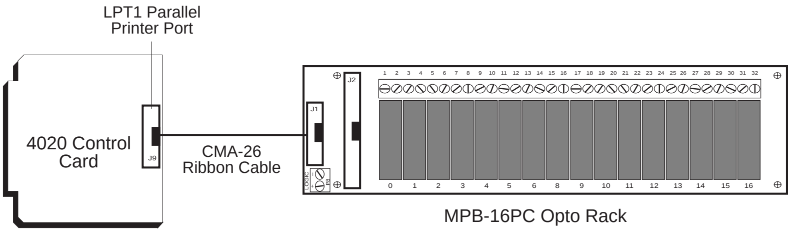

Figure 8-1 — LPT1 Port and Opto Rack

DIGITAL I/O LINES

Digital I/O lines can be used to interface with opto–module racks, operate switches, turn on low–current LEDs, and interface with other devices that have TTL input or output (for example, printers and scales). Figure 9–1 shows a typical opto–rack configuration.

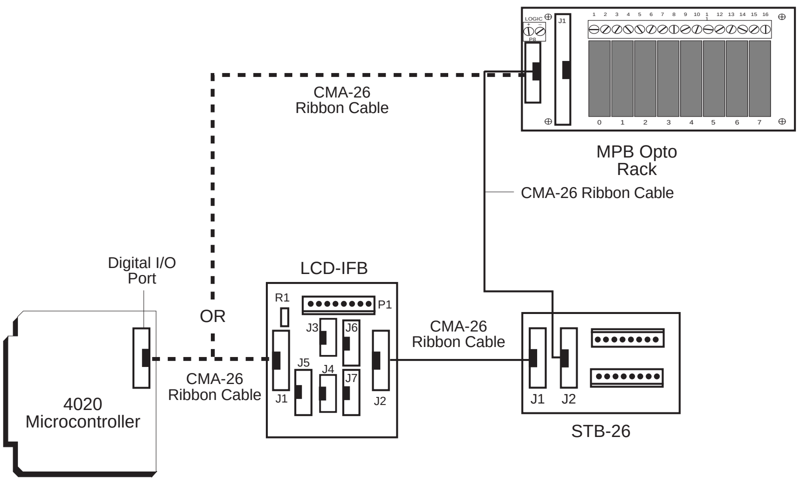

Figure 9–1—Typical Opto Rack Configuration

WARNING: Apply power to the 4020 Control Card before applying an input voltage to the digital I/O lines. This prevents excessive currents from flowing and damaging input devices. If you cannot apply power to the 4020 first, contact Technical Support for suggestions appropriate to your application.

CAUTION: The 26-pin headers for the digital I/O ports, J3 and J6, are located next to the 26-pin header for the LPT1 printer port, J9. Damage may occur to the 4020 if a digital I/O device is connected to the LPT1 port or a printer is connected to the digital I/O ports. Refer to Figure 2-1 for the locations of these connectors.

NOTE: Port B at J6 uses a ULN2804 high current Darlington array in IC socket U15. The array outputs are open collector and can drive loads as high as 100 mA at 50V. With the ULN2804 installed, port B can only be used as an output port. Port B can be converted to standard 0-5V I/O with the supplied jumper block shunt installed in socket U15. Install the jumper block shunt leaving pins 9 and 10 open.

CAUTION: If the jumper block shunt is incorrectly installed, VCC - pin 10, will be shorted to GND - pin 9.

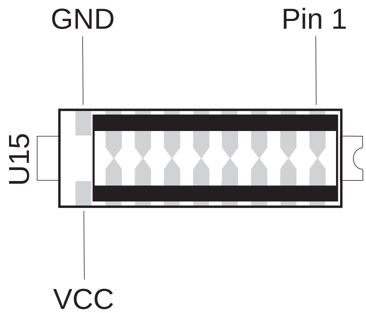

Figure 9–2—Jumper Block Shunt Installed

PULLING THE I/O LINES HIGH OR LOW

Jumper block W7 pulls all of the 24 I/O lines of the corresponding connector high or low. The default sets all of the I/O lines high.

W7: Pull-up/Pull-down Digital I/O	
Pins Jumpered	**Description**
[1-2]*	All lines in Digital Line #1 I/O are pulled to +5V through 10K Ohm
[2-4]	All lines in Digital Line #1 I/O are pulled to GND through 10K Ohm
[5-6]*	All lines in Digital Line #2 I/O are pulled to +5V through 10K Ohm
[6-8]	All lines in Digital Line #2 I/O are pulled to GND through 10K Ohm

* = default
NOTE: All lines on port B2 are pulled to +5V or GND through 47K Ohm resistors.

ORGANIZATION OF CONNECTORS AND PORTS

The digital I/O lines on the 4020 are supplied by two 82C55 chips (high current versions). One 82C55 is connected to J3, the other is connected to J6.

The digital I/O ports have a total of 48 lines: two sets of three groups, Ports A, B, and C. Each of these groups consists of 8 bits; one of these groups (Port C) can be specified as two groups of 4 bits. Any of the groups can be programmed as either input or output lines. Immediately after a reset, each of the groups becomes an input line. See Figure 9-3.

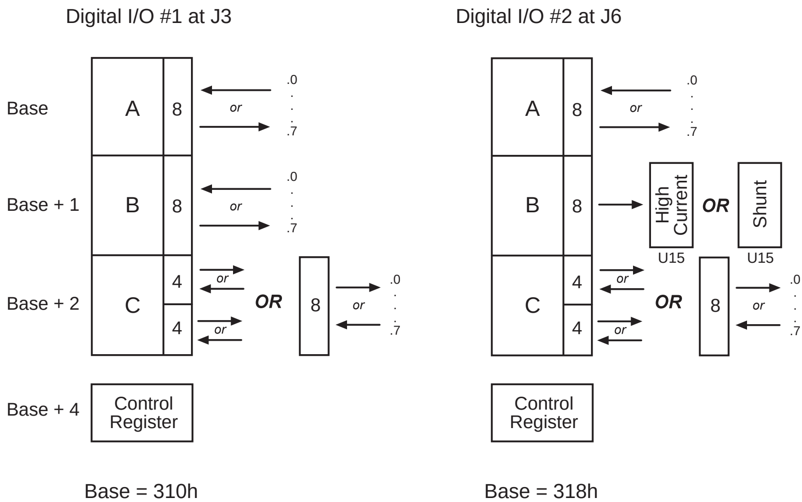

Figure 9-3 — Digital I/O Ports

J3: Digital I/O #1 (26-position header)		
Opto Position	**Name**	**Pin #**
8	Port A, Bit 0	19
9	Port A, Bit 1	21
10	Port A, Bit 2	23
11	Port A, Bit 3	25
12	Port A, Bit 4	24
13	Port A, Bit 5	22
14	Port A, Bit 6	20
15	Port A, Bit 7	18
16	Port B, Bit 0	10
17	Port B, Bit 1	8
18	Port B, Bit 2	4
19	Port B, Bit 3	6
20	Port B, Bit 4	1
21	Port B, Bit 5	3
22	Port B, Bit 6	5
23	Port B, Bit 7	7
0	Port C, Bit 0	13
1	Port C, Bit 1	16
2	Port C, Bit 2	15
3	Port C, Bit 3	17
4	Port C, Bit 4	14
5	Port C, Bit 5	11
6	Port C, Bit 6	12
7	Port C, Bit 7	9
	+5V	2
	Gnd	26

J6: Digital I/O #2 (26-position header)		
Opto Position	**Name**	**Pin #**
8	Port A, Bit 0	19
9	Port A, Bit 1	21
10	Port A, Bit 2	23
11	Port A, Bit 3	25
12	Port A, Bit 4	24
13	Port A, Bit 5	22
14	Port A, Bit 6	20
15	Port A, Bit 7	18
16	Port B, Bit 0	10*
17	Port B, Bit 1	8*
18	Port B, Bit 2	4*
19	Port B, Bit 3	6*
20	Port B, Bit 4	1*
21	Port B, Bit 5	3*
22	Port B, Bit 6	5*
23	Port B, Bit 7	7*
0	Port C, Bit 0	13†
1	Port C, Bit 1	16‡
2	Port C, Bit 2	15
3	Port C, Bit 3	17
4	Port C, Bit 4	14§
5	Port C, Bit 5	11§§
6	Port C, Bit 6	12
7	Port C, Bit 7	9
	+5V	2
	Gnd	26

* = Optional high current driver
† = Jumper: Optional clock input for counter/timer channel 1
‡ = Jumper: Optional clock input for counter/timer channel 2
§ = Jumper: Optional gate for counter/timer channel 1
§§ = Jumper: Optional gate for counter/timer channel 2

J3, J6 Digital I/O Ports, 26-pin Mating Connectors:
Connector: Thomas & Betts 609-2630
Strain Relief: Thomas & Betts 609-2631

CONFIGURING THE 82C55 DIGITAL I/O PORTS

On power–up and software or hardware reset, all digital I/O lines in J3 and J6 are configured as inputs.

Each of the digital I/O connectors, J3 and J6, has an 82C55 associated with it. Each 82C55 has three ports with eight parallel I/O lines (bits) per port. Each port has a unique I/O address. Port A and Port B can be programmed as all inputs or all outputs. Port C can be programmed in one group of eight lines (all inputs or all outputs) or as two groups of four lines (upper and lower C). The four lines in upper or lower C can each be programmed as all inputs or all outputs. You can alter which ports are inputs or outputs by writing a control command to the control register in the 82C55. When a line is configured as an output, it can sink a maximum of 2.5 mA at 0.4V and can source over 2.5 mA at 2.4V. When driving opto–modules, the output can sink 15 mA at 1.0V.

4020 Digital I/O Addressing		
82C55 Port	**J3 I/O Address**	**J6 I/O Address**
A	310h	318h
B	311h	319h*
C	312h	31Ah
Control Register	313h	31Bh

*Optional High Current Port

4020 Digital I/O Control Register Commands					
HEX	**DEC**	**Port A***	**Port B***	**Upper Port C***	**Lower Port C***
80H	128	OUT	OUT	OUT	OUT
81H	129	OUT	OUT	OUT	IN
82H	130	OUT	IN	OUT	OUT
83H	131	OUT	IN	OUT	IN
88H	136	OUT	OUT	IN	OUT
89H	137	OUT	OUT	IN	IN
8AH	138	OUT	IN	IN	OUT
8BH	139	OUT	IN	IN	IN
90H	144	IN	OUT	OUT	OUT
91H	145	IN	OUT	OUT	IN
92H	146	IN	IN	OUT	OUT
93H	147	IN	IN	OUT	IN
98H	152	IN	OUT	IN	OUT
99H	153	IN	OUT	IN	IN
9AH	154	IN	IN	IN	OUT
9BH	155	IN	IN	IN	IN

*Ports A and B must be either all inputs or all outputs. Each half of Port C is controllable. Upper C includes bits 4 through 7 and lower C includes bits 0 to 3.

For more information, see the Intel 82C55 Data Sheet or the NEC 71055 Data Sheet.

DIGITAL OUTPUT PROGRAM EXAMPLES

To configure J3 ports A, B and C as all outputs, issue the command:

OUT 313H, 80H (J3 82C55 control register)

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

OUT 310H, FFH (J3 82C55 port A)
OUT 311H, FFH (J3 82C55 port B)
OUT 312H, FFH (J3 82C55 port C)

or all "0"s after:

OUT 310H, 0 (J3 82C55 port A)
OUT 311H, 0 (J3 82C55 port B)
OUT 312H, 0 (J3 82C55 port C)

To configure J6 ports A, B and C as all outputs, issue the command:

OUT 31BH, 80H (J6 82C55 control register)

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

OUT 318H, FFH (J6 82C55 port A)
OUT 319H, FFH (J6 82C55 port B) see note
OUT 31AH, FFH (J6 82C55 port C)

or all "0"s after:

OUT 318H, 0 (J6 82C55 port A)
OUT 319H, 0 (J6 82C55 port B) see note
OUT 31AH, 0 (J6 82C55 port C)

NOTE: If the high current Darlington array is installed in socket U15, the outputs will be inverted. If the jumper block shunt is installed, the port will function as a normal digital I/O port.

DIGITAL INPUT PROGRAM EXAMPLES

To configure J3 ports A, B and C as all inputs, issue the command:

OUT 313H, 9BH	(J3 82C55 control register)

To read J3 ports A, B and C, issue commands:

PORTA = INP(310H)	(J3 82C55 port A)
PORTB = INP(311H)	(J3 82C55 port B)
PORTC = INP(312H)	(J3 82C55 port C)

To configure J6 ports A, B and C as all inputs, issue the command:

OUT 31BH, 9BH	(J6 82C55 control register)

To read J6 ports A, B and C, issue commands:

PORTA = INP(318H)	(J3 82C55 port A)
PORTB = INP(319H)	(J3 82C55 port B) see note
PORTC = INP(31AH)	(J3 82C55 port C)

NOTE: If the high current Darlington array is installed in socket U15, port B cannot be an input. The Darlington array is strictly an output device.

HIGH CURRENT PORTS

The high current port can be used as dedicated outputs to drive relays, LEDs, solenoids, and similar devices. The port includes eight I/O lines at J6, port B. These outputs switch loads to ground. If you do not use this port to drive high current devices, you can replace the output driver chip, U15, with a DIP shunt jumper and use the lines as general purpose digital I/O lines. The lines are TTL compatible with the DIP shunt in place. Refer to Figure 9-2. The base address of J6 is 318h.

On power–up, all high current driver inputs are pulled LOW. This forces all high current outputs OFF. The user program must reconfigure port B as outputs and then control the state of each bit of the port. The outputs of port B with the high current drivers installed, 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.

4020 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 9–4.

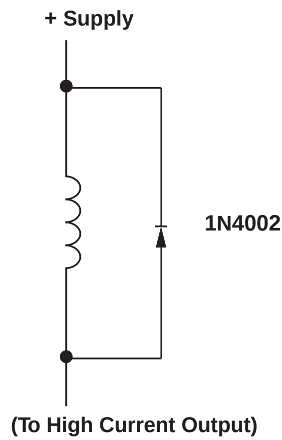

Figure 9–4—Inductive Load Protection Circuitry

- 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 J6, pin 26 and NOT the power ground. Failure to do so will produce a ground loop within the 4020 and can cause erratic operation.

The high current port uses 47K ohm resistors in order to pull up or pull down the lines. If W7[5-6] is jumpered, the lines are pulled up to +5V. If W7[6-8] is jumpered, the lines are pulled down to ground. The current driver uses a dip socket. This driver inverts the output logic level. A shunt jumper is also provided and is used in place of the current drivers to provide standard digital I/O. Refer to Figure 9-2. The high current port is located at J6, Port B, bit 0 through 7. Refer to table *J6: Digital I/O #2 (26-position header)*, earlier in this chapter.

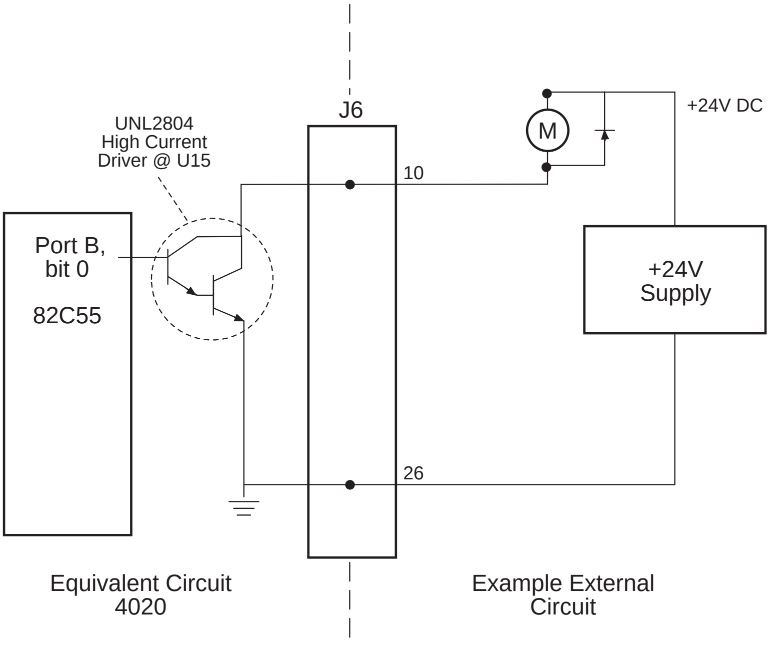

Figure 9–5—High Current Output Hook-up

OPTO-MODULE RACK INTERFACE

You can interface digital I/O lines from J3 or J6 to an 8–, 16–, or 24–position opto–module rack. One end of the CMA–26 cable plugs into J3 and J6 and the other plugs into an MPB–8, MPB–16, or MPB–24 mounting rack.

You can also use a CMA–26 cable to connect J3 or J6 on the 4020 to an STB-26 terminal board and then to the opto rack. The STB–26 has two 26–pin connectors, one of which plugs into J3 or J6; the other plugs into the opto rack. Refer to Figure 9-6.

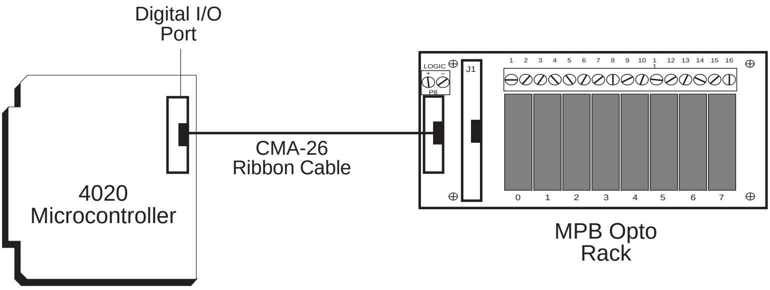

Figure 9–6—4020 Interfacing with a MBP Opto Rack

For either configuration, run a separate line to 5V and ground on the opto–module rack. Use the following table to determine the corresponding opto channel for a particular port:

4020 Opto Rack Interface			
Opto Channels	**82C55 Port**	**J3 I/O Address**	**J6 I/O Address**
0-3	Lower C	312h	31Ah
4-7	Upper C	312h	31Ah
8-15	A	310h	318h
16-23	B	311h	319h
	Control	313h	31Bh

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 82C55 digital port on the 4020 Control Card. All 82C55 lines have 10K pull–up/pull-down resistors. I/O lines at connector J3 can be connected to the STB–26 with a CMA–26 cable. Parallel I/O devices are then connected to the screw terminals on the STB–26. The eight lines on the high current port, J6-port B, use 47K ohm pull up/pull down resistors.

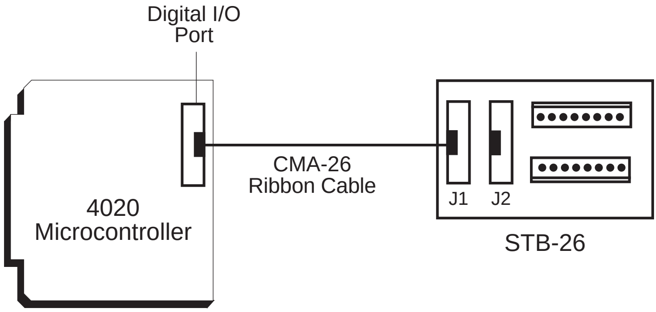

Figure 9–7—4020 Interfacing with an STB-26

Two 26-position IDC connectors are used, one for each set. The connector pinouts are compatible with MPB opto-isolator racks. Each set of 24 I/O lines can either be all pulled high or all pulled low via W7.

W7: Pull-up/Pull-down Digital I/O	
Pins Jumpered	**Description**
[1-2]*	All lines in Digital Line #1 I/O are pulled to +5V through 10K Ohm
[2-4]	All lines in Digital Line #1 I/O are pulled to GND through 10K Ohm
[5-6]*	All lines in Digital Line #2 I/O are pulled to +5V through 10K Ohm
[6-8]	All lines in Digital Line #2 I/O are pulled to GND through 10K Ohm

* = default
NOTE: All lines on port B2 are pulled to +5V or GND through 47K Ohm resistors.

COUNTER TIMER CONTROLLERS

The 4020 supports three counter/timer channels. Channel 0 input is connected to the 1.8432 MHz oscillator and is used as a pre-scalar. The gate of channel 0 is always enabled. The output of channel 0 is brought out to jumper block W6.

The clock inputs of channel 1 and 2 are also brought out to the same jumper block where they can be either connected to the output of channel 0 or to a specific digital I/O channel. The gate inputs of channel 1 and 2 are brought to the same jumper block and can be jumpered to be in a constant enabled state or to be controlled via a specified digital I/O port.

Counter Control and Clocking	
Gate 0	Always enabled
Gate 1	Either always enabled, controlled by digital I/O port C, bit 4 out, or by J6
Gate 2	Either always enabled, controlled by digital I/O port C, bit 5 out, or by J6
Clock 0	Always 1.8432 MHz
Clock 1	Either Channel 0 out, digital I/O port C, bit 0 out, or J6
Clock 2	Either Channel 0 out, digital I/O port C, bit 1 out, or J6

For more information about CTC modes of operation, see the *Intel 82C54 Data Sheet* or the *NEC 71054 Data Sheet*.

CAUTION: If using external signals to gate or clock counter/timer channel 1 or 2, the associated digital I/O port must be configured as an input. The base address of the counter timer chip is 300h.

The output of channel 1 is brought to a jumper block and can be connected to either IRQ5 or IRQ9. The output of channel 2 is connected to IRQ12 via jumper block W6.

W6: Counter Timer	
Pins Jumpered	**Description**
[1-3]*	Channel 1 Clock from Channel 0 Output
[2-4]*	Channel 1 Gate (enabled)
[3-5]	Channel 1 Clock from Digital I/O Port C, Bit 0 Out
[4-6]	Channel 1 Gate Digital I/O Port C, Bit 4 Out
[7-9]*	Channel 2 Clock from Channel 0 Output
[8-10]*	Channel 2 Gate (enabled)
[9-11]	Channel 2 Clock from Digital I/O Port C, Bit 1 Out
[10-12]	Channel 2 Gate from Digital I/O Port C, Bit 5 Out

* = default

See Figure 9-8 for a CTC functional diagram.

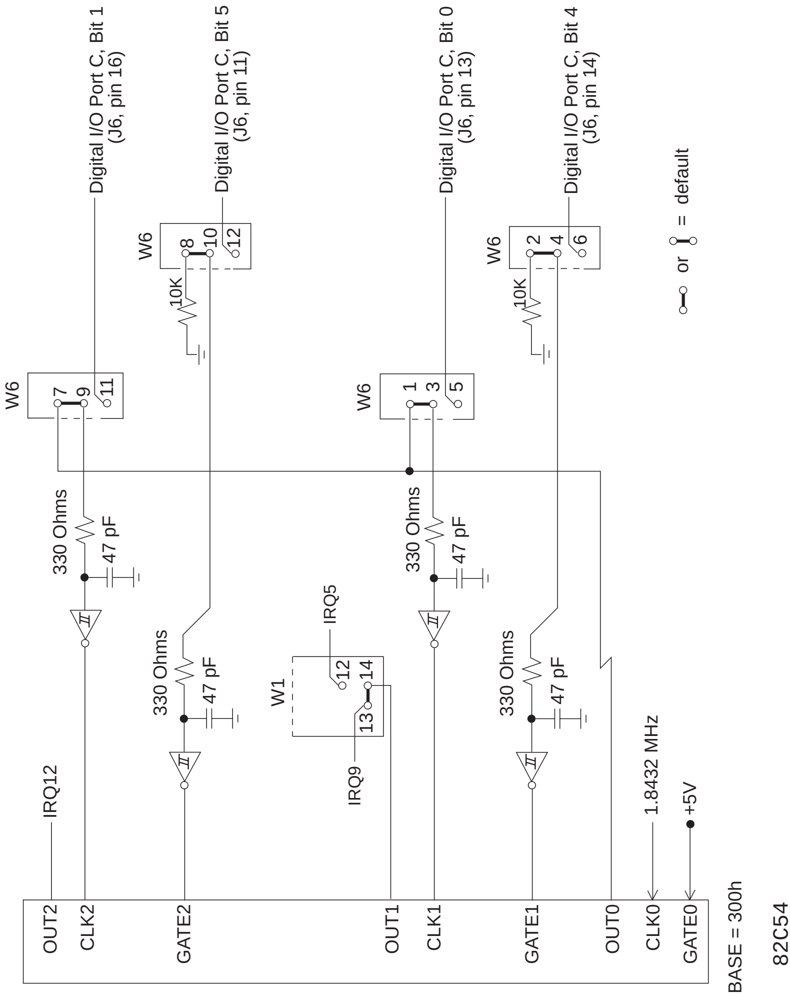

Figure 9–8—CTC Functional Diagram

NOTE: If you are using Port C to control the "GATE" of either Channel 1 or 2, a low level enables the counter function, while a high level disables the function.

COUNTER/TIMER PROGRAMMING

The 4020 card has a CTC (counter/timer circuit) and digital I/O ports on board. The CTC is intended to provide periodic interrupts to the CPU for time related I/O events. There is one CTC chip consisting of three counter/timer circuits. Counter 0, with a clock input of 1.8432 MHz, acts as a pre-scalar for counters 1 and 2. Clock and gate inputs to counter 1 and counter 2 are connected either to the output of counter 0, outputs from a digital I/O port or externally from J6. The outputs of counters 1 and 2 then provide interrupts to the CPU.

NOTE: The 82C54 is a very versatile component with six modes of operation, a Read Back command and Counter Latch command. The intent of the 4020 CTC is to provide periodic interrupts to the CPU. It is beyond the scope of the intent to discuss all of the CTC functions and only to concentrate on using the CTC to provide periodic interrupts to the CPU. For further information, refer to the *Intel Peripheral 82C54* data sheet or the *NEC 71054* data sheet.

This section provides an overview of the 4020 CTC and associated digital I/O. A programming example, 4020_CTC.CPP, is included on the 4020 utilities diskette which demonstrates using CTC counter 1 and CTC counter 2 to generate periodic interrupts. In addition, this section discusses the following functions:

- Address Mapping
- Interrupts
- Digital I/O
- Counter Timers

Address Mapping

The base address of the CTC is hardwired at 300H and the base address of the digital I/O port associated with the CTC is hardwired at 318H. These addresses cannot be changed. It is important that no other devices in the system be set for access at the same I/O locations as the 4020 CTC or digital I/Os.

The CTC and digital I/O mapped locations consist of four separate I/O addresses. Each address accesses a different function of the CTC or digital I/O.

Four I/O locations select the Counter/Timer:

300H - CTC Counter 0
301H - CTC Counter 1
302H - CTC Counter 2
303H - CTC Control Register

Four I/O locations select the 82C55 Digital I/O:

318H - Digital I/O Port A
319H - Digital I/O Port B
31AH - Digital I/O Port C
31BH - Digital I/O Control Register

Details of the function for each of the I/O locations is described in a following section that pertains directly to either the counter/timer or digital I/O.

Interrupts

The outputs of CTC counter 1 and CTC counter 2 are used to provide periodic interrupts to the 4020 processor. The output of CTC counter 1 can be routed to IRQ9 or IRQ5, and the output of CTC counter 2 is hardwired to IRQ12.

The interrupt selection of IRQ9 or IRQ5 is determined by the position of jumper block W1. W1[13-14] selects IRQ9 (default). W1[12-14] selects IRQ5. Select an interrupt that is not being used by another device in the system. Refer to Figure 9-7 for the CTC functional diagram and Figure 2-1 for the location of W1.

W1: Interrupt Select		
Pins Jumpered	**Interrupt Source**	**CPU IRQ**
[12-14]	Counter/Timer 1 Out	IRQ5
[13-14]*	Counter/Timer 1 Out	IRQ9
N/A	Counter/Timer 2 Out	IRQ12 (hardwired)

* = default

Digital I/O

The digital I/O section of the 4020 utilizes two 82C55 digital I/O chips. Each of these chips use three separate I/O locations for three 8-bit I/O ports. The fourth I/O location, the control register, is used to set up the mode (input or output) of each 8-bit port. Only the digital I/O chip located at address 318H is used to provide control to the CTC. The intended purpose of each of the 8-bit ports as they pertain to the 4020 CTC, are as follows:

Port A (318H) - All 8 bits can be configured as all inputs or all outputs at J6. Not used directly with CTC.

Port B (319H) - All 8 bits can be configured as all inputs or all outputs at J6. Not used directly with CTC.

Port C (31AH) - All 8 bits can be configured as all inputs or all outputs: the lower 4 bits can be inputs and the upper 4 bits can be outputs, or the lower 4 bits can be outputs and the upper 4 bits can be inputs.

All 8 bits are connected to J6, but 4 of the bits are also routed to the CTC. Therefore, port C can control the clock and gate inputs to the CTC. When used as clock or gate inputs to the CTC, port C is used as follows:

Bit 0 - Provides optional clock input for CTC counter 1
Bit 1 - Provides optional clock input for CTC counter 2
Bit 4 - Provides optional gate input for CTC counter 1
Bit 5 - Provides optional gate input for CTC counter 2

If only the CTC clock inputs are provided by the digital I/O, then lower port C must be configured as outputs and upper port C can be configured as either outputs or inputs. If only the CTC gate inputs are provided by the digital I/O, then upper port C must be configured as outputs and lower port C can be configured as either outputs or inputs.

External clock and gate inputs can also be provided for the CTC through connector J6. If external inputs are used, the section of port C that is tied to the external source must be configured as inputs.

CAUTION: If an external source is provided for the CTC, the section of port C that is tied to the external source must be configured as inputs. If this is not done, possible damage to the 82C55 will occur due to the outputs of the 82C55 being tied to the outputs of the external source.

In order to use port C as control for the CTC, the 82C55 must first be initialized. Refer to the previous section *Digital I/O* for initializing and controlling the 82C55. Refer also to the example program, 4020_CTC.CPP, on the 4020 utility diskette. After the control code is written to the 82C55 control register (31BH), port C (31AH) can be used to control the counter/timers.

OUT H31B, H80 - writes this control word to the DIO Control
Register, configuring the I/O ports.

OUT H31A, HF0 - writes this output data to the DIO port selected.

For additional information concerning the 82C55, please refer to the previous section *Digital I/O*, the *Intel Peripheral 82C55* data sheet or the *NEC 71055* data sheet.

Counter/Timers

The CTC includes three separate counter/timers. Three data registers are associated with the control register. After power-up, the state of the 82C54 is undefined because the mode, count value, and output of all counters have not been defined. How each counter operates is determined when it is programmed and each counter must be programmed before it can be used. Unused counters need not be programmed.

NOTE: Because the CTC is intended as an interrupt generating device, disable interrupts prior to programming the CTC and then re-enable the interrupts.

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: The OUT signal either toggles or pulses, depending on the mode, when the count value reaches 0.

Modes: Each of the counter/timer counters can operate in one of six different modes.

Counters are programmed by first writing a Control Word and then an initial count. Each counter must be programmed with the mode and then an initial count before it can be used.

The counter is programmed by writing a Control Word, in the form of a formatted byte, to the CTC Control Register (303H).

OUT H303, H76 - writes this control word to the CTC Control Register, configuring a selected counter.

OUT H300, HAA - writes this count data to the counter, determined in the 76H control word.

Control Word Definition

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

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

The primary function of the Control Word is to set a counter/timer counter to a specific mode of counting. Besides the various counting modes, the following setup should be considered:

Select Counter Bits

Two bits, SC1 and SC2, select the counter for which the control word is intended. When SC1 and SC0 select a specific counter, the remaining bits of the Control Word now apply to that counter.

Select Counter Bits		
SC0	**SC1**	**Description**
0	0	Select Counter 0
0	1	Select Counter 1
1	0	Select Counter 2
1	1	Read-Back Command*

*NOTE: For further information about 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, two bits, RW1 and RW0 are used to determine the format that data is either read from or written to the counters. The initial count must follow the count format specified by the RW bits. The least significant byte only, most significant byte only, or least significant byte and then most significant byte are the formats that can be specified.

Read/Write Bits		
RW1	**RW0**	**Description**
0	0	Counter Latch Command*
0	1	Read & Write least significant byte only
1	0	Read & Write most significant byte only
1	1	Read & Write least then most significant byte

*NOTE: For further information about 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 which the counter/timers can be set:

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

BCD Bit

The Binary Coded Decimal (BCD) Enable bit is used to set to counter into BCD or Binary counter modes.

Binary Coded Decimal Enable	
BCD	**Description**
0	Binary Counter 16-bits
1	Binary Coded Decimal Counter (4 Decades)

Definition of CTC Modes

Several CTC modes require the GATE to toggle in order to begin counting. The GATE of the 4020 CTC 0 is always enabled; therefore only Modes 0, 2, and 3 are effective for CTC0. The GATEs for CTC1 and CTC2 are controllable and all modes can be used. In the 4020 CTC design, all modes can be used, with noted exceptions, for the intended application of periodic interrupts. However, modes 2 and 3 will be most effective. The programming example, 4020_CTC.CPP demonstrates the use of modes 2 and 3.

Mode 0 - Terminal Count

The terminal count mode can be used when software events controlling digital I/O port C or external events from J6 need to be counted. An interrupt is generated when a certain number of events, or counts, have occurred. This mode can be used with any of the 4020 CTCs but is most useful with CTC1 and CTC2.

This mode is generally used for event counting. After writing the control word, OUT is set low and remains low until the counter reaches 0. OUT then goes high and remains high until a new count or a new Mode 0 control word is written.

- GATE input equal to 1, enables the counter.
- GATE input equal to 0, disables the counter.

If the GATE input is equal to 1 when the count and the control words are written to the counter, the count value is loaded into the counter on the next CLOCK pulse. This clock pulse does not decrement the count. For the initial count of N, OUT would not go high for N+1 clock pulses. Since the GATE of CTC0 is always equal to 1 and will never be 0, this situation always applies to CTC0.

If the GATE input is equal to 0 when the count and control words are written to the counter, the count value is loaded into the counter on the next CLOCK pulse. When GATE goes high, OUT goes high N CLOCKs later.

Counting can be disabled at any time if GATE input equals 0. As mentioned earlier, when the counter reaches 0, OUT goes high and remains high until a new count or a new Mode 0 control word is written. Since the GATE of CTC0 is always equal to 1 and will never be 0, this situation never applies to CTC0.

Because interrupts are typically positive edge triggered, the interrupt is generated when OUT goes high.

Mode 1 - Hardware Retriggerable One Shot

This mode can be useful by loading a count and then starting the count with either port C or an external connection from J6 controlling the GATE. Once the count has been reached, an interrupt is generated. This mode requires control of the GATE and, therefore, cannot be used for the 4020 CTC0.

After writing the control word, OUT goes HIGH. A count value N is then written to the counter. 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 goes LOW on the next negative CLOCK transition and remains LOW for N negative transitions of the CLOCK signal. When the COUNT value N reaches a value 0, OUT returns HIGH. The ONE SHOT is retriggerable; any positive transition on the GATE input reloads the ONE SHOT time, keeping OUT low for another N intervals of CLOCK transitions.

Because interrupts are typically positive edge triggered, the interrupt is generated when OUT goes high.

<u>Mode 2 - Rate Generator</u>

The rate generator mode is useful for generating an output pulse at a periodic rate. This mode is used most often for counter 0, which is the pre-scalar for counters 1 and 2. Since the GATE of counter 0 is always enabled, counter 0 will operate in this mode. This mode can also be useful by loading a count into counter 1 or counter 2 and then clocking the count with either port C or an external connection from J6. Once the count has been reached, an interrupt is 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 pulses. When the COUNT value reaches 0, OUT will go LOW for one CLOCK period and then return HIGH. The N value is then automatically reloaded into the counter and is decremented on subsequent CLOCK pulses.

The GATE input being HIGH 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 is reloaded on the next CLOCK pulse. The value is decremented on subsequent CLOCK pulses.

NOTE: In Mode 2, a COUNT value of 1 is illegal.

Because interrupts are typically positive 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 is used most often for counter 0, which is the pre-scalar for counters 1 and 2. Since the GATE of counter 0 is always enabled, counter 0 will operate this mode. Counters 1 and 2 can also use this mode to further divide the output of counter 0, the clock inputs provided by port C or an external event.

The OUT signal is HIGH after the control word is written. After the COUNT value of “N” is written, the OUT signal goes LOW on the negative edge of the next CLOCK pulse. If “N” is an EVEN number, OUT remains LOW for “N/2” CLOCK pulses, if “N” is an ODD number, OUT is LOW for “N/2 + 1 CLOCK” pulses. 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 goes HIGH immediately. The positive transition of GATE reloads the count value of “N” into the counter on the next CLOCK pulse. The COUNT value is then decremented on subsequent CLOCK pulses.

Because interrupts are typically positive edge triggered, the interrupt is not 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 CTCs. Once the count at CTC1 or CTC2 has been reached, an interrupt is generated.
This mode requires control of the GATE and, therefore, cannot be used for the 4020 CTC0.

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 pulse. The value is not decremented on this pulse. The OUT signal remains HIGH until the counter reaches a 0 value. OUT then pulses LOW for one CLOCK period. OUT then remains HIGH after this pulse until a COUNT value is re-written to the counter.

The GATE input equal to 1 enables the counter. A GATE input equal to 0 inhibits the counter. The GATE input does not affect the OUT signal in any other way.

Because interrupts are typically positive edge triggered, the interrupt is not 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 and then starting the count with either port C or an external connection from J6 controlling the GATE. Once the count has been reached, an interrupt is generated. This mode requires control of the GATE and, therefore, cannot be used for the 4020 CTC0.

This mode is useful in order to generate a one CLOCK pulse 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 pulse loads the COUNT value into the counter, and subsequent CLOCK pulses decrement the counter. When the counter reaches a value of 0, the OUT pulses LOW for one CLOCK period. GATE does not inhibit the counter or affect the OUT signal. Any POSITIVE transition of the GATE input reloads the COUNT value N into the counter and the counting continues.

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

Programming the CTCs

Counters are programmed by first writing a control word and then an initial count. Each counter must be programmed with the mode and then an initial count before it can be used.

The counter is programmed by writing a control word, in the form of a formatted byte, to the CTC Control Register (303H).

OUT H303, H76 - writes this control word to the CTC Control Register, configuring a selected counter.

OUT H300, HAA - writes this count data to the counter determined in the 76H control word.

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

Examples of a CTC Control Word:

00110000 = 30 hex
Select Counter = Counter 0
RW = Least significant byte then most significant byte
Mode = Mode 0 terminal count
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

The selected counter may then require the GATE to change states before counting begins. Refer to Definition of CTC Modes above.

A programming example, 4020_CTC.CPP, is included on the 4020 utilities diskette which demonstrates using CTC counter 1 and CTC counter 2 to generate periodic interrupts.

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.

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
    }
```

DESCRIPTION

You can use a video card with a monitor and a keyboard with the 4020 instead of using your PC keyboard and monitor over a serial communications link. The keyboard lines are brought out to a PS–2 type connector. Any PS–2 compatible keyboard may be used.

J11: Keyboard Port	
Pin #	**Function**
1	Keyboard data
2	Gnd
3	Gnd
4	+5V
5	Keyboard clock
6	Gnd

The speaker is interfaced via a 3–pin connector at J10. You may use any external speaker from 8–50 ohms.

If an amplifier/speaker is used, Speaker Data, +5V, and Gnd are supplied for the amplifier. If only a speaker is used, attach directly to Speaker Data and +5V.

J10: Speaker Connector	
Pin #	**Function**
1	Gnd
2	Speaker data
3	+5V

J10 Speaker, 3-pin Mating Connector:
Connector housing: DuPont BERG #65039-034
Crimp terminals: DuPont BERG #48235-000

USING A VIDEO MONITOR AND KEYBOARD

You will need the following equipment (or equivalent) to use your 4020 with a video and keyboard:

4020 PC Control Card
Micro PC Card Cage
Power Module
5420 Video Card and Monitor
AT Compatible Keyboard with PS–2 type Connector
VTC–9F Cable
Null Modem Adapter

1. Configure the 4020 for a video card by installing jumper W2[1–2]. Also configure the system to boot from the BIOS drive.

2. Install the 5420 video card into the card cage.

3. Install the 4020 into the card cage.

4. Connect the keyboard to J11 on the 4020 card.

5. Connect the video monitor to the video card.

6. Power on the 4020. The BIOS messages should appear on your video monitor:

```
Octagon 4020-386-25MHz-1MB BIOS Vers x.xx
Copyright (c) 1996 Octagon Systems, Corp. (TM)
All Rights Reserved
```

Saving a Program to the 4020

The following steps detail the procedures for transferring files to the 4020 and programming the flash memory in SSD1 using the DISKSEND and DISKSAVE programs. The DISKSAVE program resides on the BIOS drive of the 4020 and the DISKSEND program resides on the 4020 utility disk.

1. Do an XCOPY of the utility disk to your hard drive:

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

2. Change to the 4020 directory to allow access to DISKSEND:

   `CD \MPC\4020`

3. Connect a VTC–9F cable with a null modem adapter between COM1 of your PC to COM1 of the 4020. Refer to Figure 2-4.

4. On the 4020, execute the DISKSAVE program by typing:

   `4020 C:\>` **`DISKSAVE /DSSD1 /X`**

5. From your PC, execute the DISKSEND program by typing:

   `C:>` **`DISKSEND \MPC\DEMO`**

   The system will then erase and program the flash. This may take several minutes.

Transferring Files to the 4020

The following steps detail the procedures for transferring files from your PC to the virtual drive on the 4020. In order to transfer files from your PC to the 4020, you must execute the TRANSFER program from both the 4020 and your PC.

1. Connect a VTC–9F cable with a null modem adapter between COM1 of your PC to COM1 of the 4020. Refer to Figure 2-4.

2. Execute the TRANSFER program from the 4020 to receive a file from your PC.

   `4020 C:\>` **`TRANSFER /COM1 /R /V <drive>`*`filename.ext`***

   `<drive>` is the virtual drive on the 4020 where the file will be transferred.

   `filename.ext` is the name of the file on the 4020 which you are receiving 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 4020.

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

   `filename.ext` is the name of the file on the PC which you are sending to the 4020.

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. Example: /B57600.

Transferring Files from the 4020

In order to transfer files from your PC to the 4020, you must execute the TRANSFER program from both the 4020 and your PC.

1. Connect a VTC–9F cable with a null modem adapter between COM1 of your PC to COM1 of the 4020. Refer to Figure 2-4.

2. Execute the TRANSFER program from the 4020 to send a file to your PC.

   `4020 C:\>` **`TRANSFER /COM1 /S /V`** ***`filename.ext`***

   `filename.ext` is the name of the file on the 4020 which you are sending 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 4020.

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

   `filename.ext` is the name of the file on the PC which you are receiving from the 4020.

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. Example: /B57600.

DESCRIPTION

You can use your 4020 Control Card 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.

For each of the devices below, the first step is to install the 4020 Control Card into the Micro PC backplane. Refer to the instructions in Chapters 4–5 if you will be booting from the BIOS drive or from SSD1 using ROM–DOS. If you are booting up using your own DOS, refer to the instructions in Chapter 13.

You can boot your 4020 from a floppy or hard disk. However, SSDDRIVE.SYS must be placed in your CONFIG.SYS file in order for the system to access the memory device in SSD1, SSD2 and the BIOS drive.

FLOPPY DISK DRIVES

You can add two floppy disk drives by using the 5800A Floppy/ Hard Disk Card with your 4020 card or add one 1.44 MB floppy drive with the 5815 Disk Drive Card (the 5815 also has a 2.5" IDE hard drive interface).

1. Install the 4020 Control Card.

2. Install the 5800A Floppy/Hard Disk Card or 5815 Disk Drive Card, following the instructions included with these products.

3. Plug the card cage power cable into an AC outlet. Turn on the power supply. This supplies power to the floppy disk drive (via the ribbon cable) as well as to the cards in the card cage.

4. Run SETUP to set the number of floppy drives and their size.

   NOTE: Two drive designators will be assigned regardless of how many drives you specify in SETUP.

5. When you boot from either the BIOS or SSD1 drives using ROM–DOS, the floppy drive designations will be A: and B:.

   NOTE: When you boot from SSD1 using your own DOS, only one floppy drive will be available, since DOS thinks that SSD1 is drive A:. Connect your floppy disk drive to the second floppy connector on the 5800A (FDC drive B) and access it as B:. On the 5815 configure the drive with a jumper. See the 5815 user's documentation.

6. If, in SETUP, you entered 0 drives, access to either A: or B: will immediately generate an error message:

   ```
   ABORT RETRY FAIL?
   ```

   Press <A> or <F> to cancel your request.

   If, in SETUP, you entered 1 drive, you can access drive A. Requests to access drive B: result in the following prompt:

   ```
   INSERT FLOPPY INTO DRIVE B: AND PRESS ANY KEY
   ```

   Insert another floppy disk and press a key. The program then accesses your one drive as drive B:. When another request for drive A occurs, a prompt gives you the opportunity to replace the original A: floppy. In this way, systems with only one drive can copy files from one floppy to another.

   If, in SETUP, you entered 2 drives, access to either drive A: or drive B: work just as they would in a PC.

If you want to boot from the floppy disk using your own DOS or a full ROM-DOS refer to Chapter 13, *Using Your Own DOS*.

HARD DISK DRIVE

The 5800A and 5815 Micro PC Floppy/Hard Disk Drive Cards support IDE type hard drives. The disk drive designation for the first hard drive will be C:. If you boot from ROM–DOS in SSD1 or the BIOS drive, the ROM-DOS drive will be D:.

The hard drive BIOS on the 4020 requires IRQ14 for the hard drive. The 5800A floppy/hard drive controller and the 5815 disk drive card are 8 bit cards, using IRQ5 on the bus. Therefore, jumper W1[9-10], which routes IRQ5 from the bus to IRQ14 on the 4020, must be installed. Without this change, the 4020 hard drive BIOS will not recognize the hard drive. This applies to all 8 bit hard drive controllers.

For additional information about interrupts, see Chapter 7.

This page intentionally left blank.

DESCRIPTION

Use these instructions instead of those in Chapter 2 if you are using your own DOS and not the ROM–DOS installed on the BIOS drive. You can boot from SSD1 or a floppy/hard disk when you use your own DOS. Initially, you will need to boot from the BIOS drive so that you can run SETUP and specify your system parameters, including where you want to boot from.

GETTING STARTED

1. Verify that power to the card cage is OFF and install your 4020 Control Card and peripheral equipment, except for the video card.

   WARNING: Plugging the card in backwards will destroy the card!

2. Install memory devices in SSD1 if it is not already in place. To install memory devices refer to Chapter 3, *EPROMs and Battery Backup*.

3. Connect one end of a VTC-9F cable to the null modem adapter and then to COM1 of your PC. Connect the other end to COM1 (J7) on the 4020. See Figure 2-4.

   NOTE: You must use COM1 on the 4020 in order to establish a serial communications link with your PC.

4. Start PC SmartLINK.

5. Power on the 4020.

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

```
Octagon 4020-386-25MHz-1MB BIOS Vers x.xx
Copyright (c) 1996 Octagon Systems, Corp. (TM)
All Rights Reserved
```

If you do not get the proper logon message:

- Remove W2[3–4]. If using COM1 as the console, check the serial parameters of your PC to make sure they are set correctly. The parameters should be 9600 baud, 8 data bits, no parity, and 1 stop bit.
- Make sure a video card is not installed.
- If the parameters are set correctly and the system still does not respond, refer to Chapter 16, *Troubleshooting*.

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

   `4020 C:\>` **`DIR`**

   A directory listing of ROM–DOS files stored in the BIOS socket should appear.

8. You are now ready to run SETUP to select boot, memory and drive options.

SELECTING BOOT, MEMORY, AND DRIVE OPTIONS

You must specify your system's parameters before you can save and run programs with the 4020 card. You define parameters by running the SETUP program. For a complete list of the options included in SETUP, please refer to Chapter 4, *SETUP*. As shipped, the BIOS drive is selected as the default boot device.

Booting the 4020 from a Floppy/Hard Disk Drive

1. Type:

   `4020 C:\>` **`SETUP`**

2. Select the answer to each question by pressing the space bar until the correct information appears, then press <ENTER>. Press <ESC> if you want to exit SETUP without saving your answers (or changes to the answers).

   When you reach the "Boot from" option, press the spacebar until "Floppy or Hard Disk" appears then press <RETURN> until SETUP is complete. Make sure the floppy number and size and/or hard drive parameters are correct.

3. After completing the information for SETUP, insert your bootable disk (which contains your DOS) into the floppy disk drive or add a bootable IDE hard drive.

4. Reboot the system by typing:

   4020 C:> **RESET**

Booting from SSD1 with/without a Floppy Drive

1. Create a bootable floppy disk on your PC and copy your DOS version of COMMAND.COM, all device drivers and necessary application files onto the floppy.

2. Copy the file DISKSEND.EXE from the 4020 utility disk to your PC. Make sure the file is in your DOS PATH or current directory. DISKSEND.EXE may already exist if you previously copied the 4020 utilities to your C:\MPC\4020 directory.

   The two programs, DISKSAVE and DISKSEND, transfer and save the files on the floppy disk to SSD1. The DISKSAVE program resides on the BIOS drive of the 4020 and the DISKSEND program resides on the 4020 utility disk.

3. Establish a serial communications link between your PC and the 4020.

   NOTE: If you are using COM2 on your PC, you must use the /C2 switch with DISKSEND. Refer to the DISKSEND section in Appendix A for more information. Also, if you cannot communicate at 38400 baud, use the /Bxxx switch on both DISKSAVE and DISKSEND.

4. On the 4020, execute the DISKSAVE program by typing:

   4020 C:\> **DISKSAVE /DSSD1 /X**

   The systems displays the following message:

   ```
   Attempting connection with DISKSEND on the
   Desktop PC.
   ```

   If software handshaking is not established with DISKSEND within 40 seconds, DISKSAVE will timeout.

5. Exit to DOS and type the following:

   C:\MPC\4020> **DISKSEND /FA**

The system then erases and programs the flash. This may take several minutes.

6. Enter:

   `4020 C:\> `**`RESET`**

7. Display and verify the contents of SSD1:

   `4020 C:\> `**`DIR E:`**

8. Run SETUP and change your selection of the Boot options to:

   `SSD1 using User supplied DOS/OS`

9. Install jumper W2[3–4] and reboot your system by typing:

   `4020 C:\> `**`RESET`**

CHAPTER 14 USER-DEFINED JUMPER

Jumper W2[5-6] is a user-defined jumper. This jumper can be read by code in your program for program direction.

W2: User Option	
Pins Jumpered	**Description**
[5-6]*	User-defined jumper

* = default

ENHANCED INT 17H FUNCTION DEFINITIONS

This section provides the definition for the Read Jumpers function.

Read Jumpers

Function: fbh
Subfunction: 03h

Purpose: To read the on-board jumper settings.

Calling Registers: AH fbh
AL 03h
DX ffffh

Return Registers: AL Jumper setting (1=ON; 0=OFF)
Bit 2 = W2 5-6
Bit 1 = W2 3-4
Bit 0 = W2 1-2

Comments: This function returns the W2 jumper settings. The settings only reflect the ON/OFF states of the jumper during reset. If you change the jumpers after the system has come up, this function will not reflect those changes.

Programming Example:

```
/* The following example program reads the user
defined jumper */
unsigned char jumper;
/* Inline assembly code for Borland C++ 3.1 */
asm {
           mov    ax,0fb03h
           mov    dx,0ffffh
           int    17h
           mov    jumper,al
     }
    if(jumper & 4)        /* look at bit 2 */
        printf("W2 5-6 is ON\n");
    else
        printf("W2 5-6 is OFF\n");
```

CHAPTER 15 CPU POWER MANAGEMENT

DESCRIPTION

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. In order 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.

Octagon provides two power management software utilities, **SLEEP.COM** and **SLOW.COM**, with all CPU cards. Octagon has also developed an Advanced Power Management Terminate and Stay Resident (TSR) program with source code examples that can be modified for use within your application software. These files are available on the Octagon BBS (Tel. No.: 303-427-5368). The file is called *powermgt.zip* and is located in the Downloads area (3).

SLEEP.COM

The **SLEEP.COM** power management utility executes a halt (sleep mode) in the microprocessor. Execution of the **SLEEP.COM** utility reduces the MicroPC power consumption by approximately 65% to 73% in AT PC's and 30% to 34% in XT PC's (results will vary depending on the MicroPC model and memory configuration). Any hardware interrupt, except IRQ0 (the 54.9 mS Tick Timer is disabled during **SLEEP.COM**) wakes the microprocessor, returning it to its normal function and speed. Any external hardware used to generate the interrupts will add to the total power usage. A keyboard, for example, adds approximately 100 mA to your sleep mode current.

> **NOTE:** Some software applications will not work correctly when IRQ0 is disabled. See the *Advanced Power Management TSR* section below for an alternative to **SLEEP.COM**.

In AT CPU's, the CMOS Real Time Clock can be programmed to generate an interrupt (IRQ8) that will wake itself up after a preprogrammed period of time. The file *sleepat.asm* is included in the *powermgt.zip* download file. This file contains the code for building your own **SLEEP.COM**. The code includes everything **SLEEP.COM** performs (for AT CPU's only), and an example for programming the CMOS Real Time Clock to generate an IRQ8, as a self wake-up feature.

SLOW.COM

The **SLOW.COM** power management utility reduces the microprocessor clock speed by 50% in AT CPU's and 60% in XT CPU's. The execution of this utility also reduces the MicroPC power consumption by approximately 20% to 27%. Again results will vary depending on the MicroPC model and memory configuration. The microprocessor is returned to normal speed by executing **FAST.COM**.

IMPLEMENTATION

Software implementation of these utilities can be performed by two methods: in the application executable file, or in a batch file.

You can execute any power management utility from within your executable file by using the **SHELL** command in Microsoft QuickBASIC, or the **SYSTEM** command in Borland C++. The power management utilities can also be setup in a batch file for implementation after an application file has completed execution (see the example below).

```
"AUTOEXEC.BAT" :DOAGAIN          ! Start of Application loop
                 MYPROG1.EXE    ! First Application segment
                 SLEEP.COM      ! Waiting for interrupt to continue
                 MYPROG2.EXE    ! Second Application segment
                 SLOW.COM       ! Reduce processor speed for next segment
                 MYPROG3.EXE    ! Third Application segment
                 FAST.COM       ! Full processor speed for next segment
               GOTO DOAGAIN     ! Restart total application loop
```

ADVANCED POWER MANAGEMENT TSR

The Advanced Power Management TSR program, after successful installation, provides power management control via interrupt 15 calls from within the application software. This utility is similar to **SLEEP.COM**, except that all hardware interrupts including IRQ0 (Tick Timer) will wake the microprocessor, and return it to its normal function and speed. However, if IRQ0 is the interrupt detected, the microprocessor will only update the clock and return to sleep mode until the next interrupt (another 54.9 mS for IRQ0). The source code that is supplied with the TSR has examples in Assembly, C, and QuickBASIC. The source code demonstrates examples for: checking TSR status, TSR connection, CPU halt (sleep mode), TSR disconnect, and charge pump control for the COM port transmitters.

If your system is not working properly, check the following items:

No Screen Activity – Checking Serial Communications for Console

If you do not get the sign–on message after bootup:

1. Make sure all cards except the 4020 card are removed from the card cage. This ensures that other cards are not interacting with the 4020 and that a video card is not installed.

2. Install W2[1–2] or remove W2[3–4].

3. The VTC–9F serial cable turns the 4020 Control Card serial port into a 9–pin AT serial port. Make sure a null modem adaptor 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 J1 on the Control Card. See Figure 2-4.

4. Make sure your power module provides +5V (+/–0.25V).

5. After verifying the above conditions, you can monitor voltage levels by connecting an oscilloscope between the TxD* line on J7 (pin 5) and ground. After power–up, you should see a burst of activity on the oscilloscope screen. The voltage level should switch between +/–8V.

Garbled Screen Activity

If you do get activity on your screen but the message is garbled, check the following:

1. Remove W2[3–4] to force 9600, N, 8, 1 for COM1.

2. 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.

3. 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 4020 Control Card: 9600 baud, 8 bits, 1 stop bit, no parity.

System generates a BIOS message but locks up when booting from SSD1:

1. Remove W2[3–4] to force booting from the BIOS drive.

2. Press the reset button and reboot. Then note the drive designator for SSD1.

3. Display the directory of SSD1 and verify that all the necessary boot files exist. Copy any missing files to the floppy disk and re-execute DISKSEND and DISKSAVE.

4. If no files are missing, remake SSD1 to overwrite any files which may have become corrupted.

System boots from BIOS drive even though I specified boot from SSD1 using ROM–DOS:

1. Make sure SSD1 is programmed.

Booting from SSD1 with user-supplied DOS doesn't work:

1. If you made SSD1 using a floppy drive, test that you can boot using that disk on the floppy drive of your PC. Also, make sure all the necessary boot files are present. If the floppy is bootable and all files are present, re-execute DISKSAVE and DISKSEND.

Cannot save programs to flash

1. Make sure the flash is installed in SSD1 correctly and that there are no bent pins.

SSDDRIVE.SYS reports device not present with new flash installed.

1. If you use a 5V flash that does not operate in a read/write mode, you must program the flash using DISKSEND and DISKSAVE. Refer to the *SSDDRIVE.SYS* section in Appendix A, and Chapter 5, *Save and Run Programs*.

System will not recognize hard drive.

The hard drive BIOS on the 4020 requires IRQ14 for the hard drive. The 5800A floppy/hard drive controller and the 5815 disk drive card are 8 bit cards, using IRQ5 on the bus. Therefore, jumper W1[11-12] (bus IRQ5 jumpered to 4020 card IRQ5) must be moved to W1[9-10] (bus IRQ5 jumpered to 4020 IRQ14). Without this change, the 4020 hard drive BIOS will not recognize the hard drive. This applies to all 8-bit hard drive controllers.

Parity errors.

A Parity Error 1 message indicates a system memory (DRAM) problem.

A Parity Error 2 message indicates a NMI interrupt was generated. The NMI interrupt source is from the A1 position (-IOCHK) on the 8-bit ISA bus. Jumper W3[3-4] routes the -IOCHK signal to the interrupt controller.

The Parity Error 2 message is a generic, default message for the NMI interrupt handler. You must install your own interrupt handler to respond to the NMI interrupt.

System locks up on power up; 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 power down and to regulate properly under a no load condition.

System locks up after power down/power up.

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 power down 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, please call 303–426–4521.

TECHNICAL SPECIFICATIONS

CPU
80386SX

Clock
25 MHz

BIOS
AT compatible with industrial extensions with the exception using an 8–bit bus.

Interrupts
Flexible interrupt routing via jumper block W1.

DRAM
1 MB of DRAM (standard) is soldered onto the card.

Solid–State Disk 1
Supports a 256K, 512K, or 1 MB EPROM. Also supports a 128K or 512K flash.

Solid–State Disk 2
Supports 128K SRAM.

ROM–DOS
Combined with BIOS ROM; DOS 6.22 compatible.

Serial I/O
COM1, COM2 and COM3 are 16C550 compatible. COM3 can be either RS-232 or RS-485.

Parallel Port
LPT1 is PC compatible with multifunctional capability.

Counter Timers
3 channel counter timer device.

Digital I/O
48 digital I/O lines: 8 lines with high current driver capabilities.

Battery Backup
AT style battery. Order Octagon P/N 3186.

Power Requirements
5V at 600 mA typical (1 MB)
5V at 720 mA maximum

Environmental Specifications
–40° to 70° C operating
–55° to 90° C nonoperating
RH 5% to 95%, noncondensing

Size
4.5 in. x 4.9 in.

Watchdog Timer
Default timeout is 1.6 sec. typical (1.00 sec. min., 2.25 sec. max.), software enabled and strobed. Disabled on power–up and reset. Controls are through built-in, enhanced 17h function calls.

Bus Mastering
Bus mastering is not supported.

Mating Connectors
J2, J7, & J8 Serial Ports, 10-pin Mating Connector:
Connector: Thomas & Betts #609-1030
Strain Relief: Thomas & Betts #609-1031

J3 & J6 Digital I/O Port, 26-pin Mating Connector:
Connector: Thomas & Betts #609-2630
Strain Relief: Thomas & Betts #609-2631

J5 Opto-Isolated Reset, Interrupt & RS-485, 10-pin Mating Connector:
Connector: Thomas & Betts #609-1030
Strain Relief: Thomas & Betts #609-1031

J9 LPT1 Parallel Printer Port, 26-pin Mating Connector:
Connector: Thomas & Betts #609-2630
Strain Relief: Thomas & Betts #609-2631

J10 Speaker, 3-pin Mating Connector:
Connector Housing: DuPont BERG #65039-033
Crimp Terminals: DuPont BERG #48235-000

Memory Map

4020 Memory Map	
Address	**Description**
00000-9FFFFH	System memory
A0000-E7FFFH	Off-card memory
E8000-EFFFFH	Window for all SSDs
F0000-F7FFFH	Octagon extended BIOS
F8000-FFFFFH	On-card, system BIOS - SSD0

I/O Map

4020 I/O Map	
Hex Range	**Function**
0000-00FFH	Core logic I/O functions
0100-0207H	Off card
0208-020BH	Memory control byte #1 port
D7 R/W	Socket Select 1
D6 R/W	Socket Select 0
D5 R	EPROM
D5 W	DEV1
D4 R/W	UBANK19
D3 R/W	UBANK18
D2 R/W	UBANK17
D1 R/W	UBANK16
D0 R/W	UBANK15
020C-020FH	Memory control byte #2 port
D7 R/W	RESET
D6 R/W	SSDWREN
D5 R/W	XBIOS1
D4 R/W	XBIOS0
D3 R/W	WDE
D2 R/W	SIOEN
D1 R/W	SEECS
D0 W	LEDNLOCK
D0 R	Serial EEPROM data
020C-020FH	Strobes watchdog timer when watchdog enabled
0210-0213H	Off card
0214-0217H	Serial EEPROM read/write clock
0218-0219H	Reserved for SCAT chip
021A-02F7H	Off card
02F8-02FFH	COM2 serial port
0300-0307H	Counter/Timer
0308-030FH	COM3 serial port (W3[1-2], not jumpered)
0310-0317H	Digital I/O 1 Base
0318-031FH	Digital I/O 2 Base
0320-0377H	Off card
0378-037FH	LPT1 printer port
0380-03E7H	Off card
03E8-03EFH	COM3 serial port (W3[1-2], jumpered)
03F0-03F7H	Off card
03F8-03FFH	COM1 serial port

JUMPER SETTINGS

W1: Interrupt Select		
Pins Jumpered	**Interrupt Source**	**CPU IRQ**
[1-2]*	Bus IRQ3	IRQ3
[2-4]	Bus IRQ3	IRQ10
[3-5]	COM3	IRQ7
[5-6]*	COM3	IRQ4
[5-7]	COM3	IRQ11
[6-8]	Bus IRQ4	IRQ4
[7-8]*	Bus IRQ4	IRQ11
[10-12]	Bus IRQ5	IRQ5
[9-10]*	Bus IRQ5	IRQ14
[11-12]*	Opto IRQ	IRQ5
[9-11]	Opto IRQ	IRQ14
[12-14]	Timer Channel 1 Out	IRQ5
[13-14]*	Timer Channel 1 Out	IRQ9

* = default

W2: COM1, Video and BIOS Boot Options		
Pins Jumpered	**Video System**	**Description**
[1-2][3-4]*	No video card installed in system.	Video over COM1. System will boot SETUP boot device
[1-2]		Video over COM1. System will boot BIOS drive.
[3-4]		No COM1 video available. COM1 available for use in application. System will boot SETUP boot device.‡
[3-4]†	Video card installed in system.	Video on CRT. System will boot SETUP boot device.
[3-4] not jumpered†		Video on CRT. System will boot BIOS drive.

* = default

† = W2[1-2] is ignored

‡ = If SETUP boot device is BIOS drive, system will use video over COM1.

W2: User Option	
Pins Jumpered	**Description**
[5-6]*	User-defined jumper

* = default

W3: NMI Interrupt Source & COM3	
Pins Jumpered	**Description**
[1-2]*	COM3 Select Pins jumpered: COM3 at 3E8h Pins not jumpered: COM3 at 308h
[3-4]*	ISA Bus IOCHK NMI

* = default

W4: SSD2 Battery Backup	
Pins Jumpered	**Description**
[1-2]*	Battery backup for calendar/clock. No battery backup for SSD2.
[2-4]	Battery backup for calendar/clock & SSD2.

* = default

W5: COM3, RS-232 or RS-485	
Pins Jumpered	**Description**
[1-2]*	RS-232 Receive
[1-3]	RS-485 Receive
[5-6]	RS-485 (+) Terminated, idle line at a space
[7-8]	RS-485 (-) Terminated, idle line at a space
[5-7]*	RS-485 (+) Terminated, idle line at a mark
[6-8]*	RS-485 (-) Terminated, idle line at a mark
[7-9]	RS-485 Unterminated
[8-10]	RS-485 Unterminated

* = default

W6: Counter Timer	
Pins Jumpered	**Description**
[1-3]*	Channel 1 Clock from Channel 0 Output
[2-4]*	Channel 1 Gate (enabled)
[3-5]	Channel 1 Clock from Digital I/O Port C, Bit 0 Out
[4-6]	Channel 1 Gate Digital I/O Port C, Bit 4 Out
[7-9]*	Channel 2 Clock from Channel 0 Output
[8-10]*	Channel 2 Gate (enabled)
[9-11]	Channel 2 Clock from Digital I/O Port C, Bit 1 Out
[10-12]	Channel 2 Gate from Digital I/O Port C, Bit 5 Out

* = default

W7: Pull-up/Pull-down Digital I/O	
Pins Jumpered	**Description**
[1-2]*	All lines in Digital Line #1 I/O are pulled to +5V through 10K Ohm
[2-4]	All lines in Digital Line #1 I/O are pulled to GND through 10K Ohm
[5-6]*	All lines in Digital Line #2 I/O are pulled to +5V through 10K Ohm
[6-8]	All lines in Digital Line #2 I/O are pulled to GND through 10K Ohm

* = default
NOTE: All lines on port B2 are pulled to +5V or GND through 47K Ohm resistors.

CONNECTOR PINOUTS

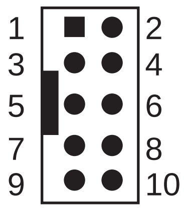

Figure 17–1—Typical 10–pin IDC Connector

J1: Optional Heat Sink Fan Power	
Pin #	**Function**
1	N.C.
2	Key
3	+5V
4	Gnd

J7: COM1, J8: COM2, & J2: COM3 Serial Ports			
Pin #	**COM1**	**COM2**	**COM3**
1	DCD	N.C.	N.C.
2	DSR	N.C.	N.C.
3	RxD	RxD	RxD†
4	RTS	RTS	RTS
5	TxD	TxD	TxD
6	CTS	CTS	CTS
7	DTR	N.C.	N.C.
8	RI	N.C.	N.C.
9	Gnd	Gnd	Gnd
10	+5V	+5V	+5V

† = All J2 inputs and outputs remain active in RS-485 mode, except for Receive Data. To receive RS-232 data, W5 must be configured to [1-2].

J3: Digital I/O #1 (26-position header)		
Opto Position	**Name**	**Pin #**
8	Port A, Bit 0	19
9	Port A, Bit 1	21
10	Port A, Bit 2	23
11	Port A, Bit 3	25
12	Port A, Bit 4	24
13	Port A, Bit 5	22
14	Port A, Bit 6	20
15	Port A, Bit 7	18
16	Port B, Bit 0	10
17	Port B, Bit 1	8
18	Port B, Bit 2	4
19	Port B, Bit 3	6
20	Port B, Bit 4	1
21	Port B, Bit 5	3
22	Port B, Bit 6	5
23	Port B, Bit 7	7
0	Port C, Bit 0	13
1	Port C, Bit 1	16
2	Port C, Bit 2	15
3	Port C, Bit 3	17
4	Port C, Bit 4	14
5	Port C, Bit 5	11
6	Port C, Bit 6	12
7	Port C, Bit 7	9
	+5V	2
	Gnd	26

J4: Battery Connector	
Pin #	**Function**
1	+Battery
2	Key
3	Gnd
4	Gnd

J5: Opto-Isolated Reset, Interrupt & RS-485	
Pin #	**Signal**
1	Reset Source
2	Reset Return
3	Opto IRQ5 Source
4	Opto IRQ5 Return
5	Opto IRQ15 Source
6	Opto IRQ15 Return
7	N.C.
8	RS-485 GND
9	RS-485 (+)
10	RS-485 (-)

J6: Digital I/O #2 (26-position header)		
Opto Position	**Name**	**Pin #**
8	Port A, Bit 0	19
9	Port A, Bit 1	21
10	Port A, Bit 2	23
11	Port A, Bit 3	25
12	Port A, Bit 4	24
13	Port A, Bit 5	22
14	Port A, Bit 6	20
15	Port A, Bit 7	18
16	Port B, Bit 0	10*
17	Port B, Bit 1	8*
18	Port B, Bit 2	4*
19	Port B, Bit 3	6*
20	Port B, Bit 4	1*
21	Port B, Bit 5	3*
22	Port B, Bit 6	5*
23	Port B, Bit 7	7*
0	Port C, Bit 0	13†
1	Port C, Bit 1	16‡
2	Port C, Bit 2	15
3	Port C, Bit 3	17
4	Port C, Bit 4	14§
5	Port C, Bit 5	11§§
6	Port C, Bit 6	12
7	Port C, Bit 7	9
	+5V	2
	Gnd	26

* = Optional high current driver
† = Jumper: Optional clock input for counter/timer channel 1
‡ = Jumper: Optional clock input for counter/timer channel 2
§ = Jumper: Optional gate for counter/timer channel 1
§§ = Jumper: Optional gate for counter/timer channel 2

J9: LPT1 Printer Port (26-Position Header)		
Pin #	**DB25 (Printer) Pin #**	**Function**
1	1	STB*
2	14	AFD*
3	2	DATA0
4	15	ERR*
5	3	DATA1
6	16	INIT*
7	4	DATA2
8	17	SLIN*
9	5	DATA3
10	18	Gnd
11	6	DATA4
12	19	Gnd
13	7	DATA5
14	20	Gnd
15	8	DATA6
16	21	Gnd
17	9	DATA7
18	22	Gnd
19	10	ACK*
20	23	Gnd
21	11	BUSY
22	24	Gnd
23	12	PE
24	25	Gnd
25	13	SLCT
26		+5V

* = active low

J10: Speaker Connector	
Pin #	**Function**
1	Gnd
2	Speaker data
3	+5V

J11: Keyboard Port	
Pin #	**Function**
1	Keyboard data
2	Gnd
3	Gnd
4	+5V
5	Keyboard clock
6	Gnd

P2: Power Connector	
Pin #	**Function**
1	+5V
2	Gnd

MICRO PC BUS PINOUTS

Micro PC "A"					
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

Micro PC "B"					
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	N.C.	Not used	B21	IRQ7	I
B6	DRQ2	I	B22	IRQ6	I
B7	-12V	Not used	B23	IRQ5	I
B8	Reserved	Not used	B24	IRQ4	I
B9	+12V	Not used	B25	IRQ3	I
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

INTRODUCTION

The 4020 ROM–DOS and Software Utility Disk comes with the utilities listed below. Some of these utilities are also available on the 4020 BIOS drive. This appendix describes the utilities and their use.

Support commands:

COM1CON.COM
DISKSAVE.EXE
DISKSEND.EXE
FAST.COM
FMTSSD.EXE
LPT1CON.COM
REMDISK.EXE
REMSERV.EXE
RESET.COM
SETUP.COM
SHOWTIME.COM
SLEEP.COM
SLOW.COM
TRANSFER.EXE

Support device drivers:

HIMEM.SYS
SSDDRIVE.SYS
VDISK.SYS

NOTE: Other utilities are included from ROM–DOS and are not mentioned in this section. Please refer to your ROM–DOS manual.

COM1CON.COM

COM1CON.COM Support Command

PURPOSE: Redirects video to the COM1 port when you have a video card and monitor installed in your system and restores COM1 serial parameters.

SYNTAX: **COM1CON**

REMARKS: Execute COM1CON from the command line. When you are finished using the console port, reset your system. After boot-up, the system reverts to using the video card and monitor.

Also, some programming languages may not restore the serial parameters after using the COM1 port. COM1CON.COM will restore the COM1 port as the console. You must include your program and COM1CON in a batch file and then execute the batch file to restore the console.

SEE ALSO: LPT1CON.COM

DISKSAVE.EXE

DISKSAVE.EXE: Support Command

PURPOSE: To program a disk into SSD1 (5V flash) or to create disk image files for SSD1 (EPROM).

SYNTAX: **DISKSAVE** [/**D***y*] [/**S***s*] [/**I**] [/**F***d* | *path* | *filespec* | /**X** [/**C***c*] [/**B***b*]]

PARAMETERS: /**D***y* specifies the destination device to be programmed. Currently, *y* can be SSD1. The default is SSD1.

/**S***s* specifies the output is an image file and specifies the size of the EPROM to be programmed. *s* can be either 512K or 1M. The default is 512K.

/**I** specifies the source for programming to be an image file.

/**F***d* specifies the source for programming to be a local drive. The disk image of the specified drive is used. *d* can be any DOS drive letter.

path specifies the source for programming to be a local tree of files.

filespec specifies the full path name of the image file to be used with the /**I** option.

/**X** specifies the source for programming is done through communication over a serial link connecting the 4020 to a remote host system running DISKSEND.EXE.

/**C***c* specifies the COM port *c* to be used. Use /**C** only when /**X** is used. *c* can be 1, 2, 3 or 4. The default is 1.

/B*b* specifies the baud rate *b* to be used. Use /**B** only when /**X** is used. *b* can be 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200. The default is 38400.

EXAMPLE 1: To program SSD1 from local drive A, enter:

DISKSAVE /FA /DSSD1

EXAMPLE 2: To program SSD1 from local subdirectory C:\DEMO\TEST, enter:

DISKSAVE C:\DEMO\TEST /DSSD1

EXAMPLE 3: To program SSD1 from remote drive A, first enter the following command on the 4020:

DISKSAVE /X /DSSD1

Then enter the following command on the remote host system:

DISKSEND /FA

EXAMPLE 4: To program SSD1 from a remote subdirectory C:\DEMO through COM2 at baud rate 9600, first enter the following command on the 4020:

DISKSAVE /X /DSSD1 /C2 /B9600

Then enter the following command on the remote host system:

DISKSEND C:\DEMO /B9600

EXAMPLE 5: To create a 1 MB image file for the SSD1 EPROM from local drive A, enter:

DISKSAVE /FA /DSSD1 /S1M

EXAMPLE 6: To create a 512K image file for SSD1 from a local subdirectory named C:\TEST, enter:

DISKSAVE C:\TEST /DSSD1 /S512K

EXAMPLE 7: To program SSD1 from an image file C: \TEST\SSD1.IMG, enter:

DISKSAVE /I /DSSD1 C:\TEST\SSD1.IMG

REMARKS: When the /**F***d* option is used, the drive specified must have a sector size of 512 bytes. Both 1.44M and 720K floppies have a sector size of 512 bytes.

To program an SSD which boots from a user-supplied DOS or full ROM–DOS, the source must be a bootable drive (use the /**F***d* option) from either a remote or local system.

When a subdirectory path is used as input to DISKSAVE.EXE, DISKSAVE creates a temporary file in the current directory. Consequently, the current directory cannot be included in the specified path and must not be write-protected.

The filename of the image file created for the SSD1 EPROM is SSD1.IMG.

The size of the disk image file generated with DISKSAVE.EXE is made only as large as required to minimize programming time.

SEE ALSO: DISKSEND.EXE, TRANSFER.EXE

DISKSEND.EXE

DISKSEND.EXE: Support Command

PURPOSE: To send a disk image through a serial link to the DISKSAVE.EXE program running on the 4020.

SYNTAX: **DISKSEND** [/**F***d* | *path*] [/**C***c*] [/**B***b*]

PARAMETERS: /**F***d* specifies the source for programming to be the local drive. The disk image of the specified drive is used. *d* can be any DOS drive letter. Use /**F***d* when not using path.

path specifies the source for programming to be a local tree of files. Use *path* when not using /**F***d*.

/**C***c* specifies the COM port *c* to be used. Use /**C** only when /**X** is used. *c* can be 1, 2, 3 or 4. The default is 1.

/**B***b* specifies the baud rate *b* to be used. Use /**B** only when /**X** is used. *b* can be 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200. The default is 38400.

EXAMPLE 1: To send a local disk image (that is to be programmed into SSD1) through the serial link to the 4020 running DISKSAVE.EXE, first enter the following command on the 4020:

```
DISKSAVE  /X  /DSSD1
```

Then enter the following command at the host system:

```
DISKSEND  /FA
```

EXAMPLE 2: To send the image of floppy drive A via COM2 at the host system, that is to be programmed into SSD1 via COM1 at the 4020, first enter the following command on the 4020:

```
DISKSAVE  /X  /DSSD1  /C1
```

Then enter the following command at the host system:

```
DISKSEND  /C2  /FA
```

REMARKS: When DISKSAVE.EXE is used in conjunction with DISKSEND.EXE, the /**X** option must be used.

When the /**F***d* option is used, the drive specified must have a sector size of 512 bytes. Both 1.44M and 720K floppies have a sector size of 512 bytes.

To program an SSD which boots from a user-supplied DOS or full ROM–DOS, the source must be a floppy drive (use the /**F***d* option).

The size of the disk image generated with DISKSEND.EXE that was sent over the serial link is made only as large as required to minimize transfer and programming time.

SEE ALSO: DISKSAVE.EXE, TRANSFER.EXE

FAST.COM Support Command

PURPOSE: To change CPU clock speed from 12.5 MHz to 25 MHz for the 4020.

SYNTAX: **FAST**

REMARKS: Enter the following command to change to the 25 MHz clock speed during system bootup for the 4020:

FAST

You can also enter <CTL><ALT><+> to switch to 25 MHz if you are using a keyboard and monitor with the 4020.

The default speed is **fast** after a reset.

FMTSSD.EXE

FMTSST.EXE	Support Command
PURPOSE:	To format a solid state disk (5V flash or static RAM).
SYNTAX:	**FMTSSD** [**SSD1** | **SSD2**] [*sizeK*]
PARAMETERS:	**SSD1** specifies the SSD1 device. **SSD2** specifies the SSD2 device. *sizeK* specifies the desired size (in kilobytes) of the SSD to be formatted. The default size is the maximum possible. *sizeK* specified must be smaller than the device size, but larger than 64.
REMARKS:	The 5V flash supported by this command are: Atmel: 29C010, 29C040, 29C040A SST: 28FS040, 29EE010 **NOTE:** You cannot format an AMD 29F040 5V flash with this command. You must use DISKSEND or DISKSAVE to program it.

HIMEM.SYS

HIMEM.SYS Device Driver

PURPOSE: To manage extended memory and the High Memory Area (HMA) in a 286, 386, or greater PS/2 system. HIMEM prevents programs from simultaneously using the same area of memory for two different purposes. HIMEM supports the eXtended Memory Specification (XMS) 2.0. HIMEM is installed as a device driver in CONFIG.SYS.

SYNTAX: **DEVICE=**[*d*:][*path*] **HIMEM.SYS**[/machine:*n*]

REMARKS: The HIMEM driver can be used to allow ROM-DOS to run in High Memory.

HIMEM supports a default of 32 handles.

HIMEM should not be used with older versions of VDISK. Current versions of VDISK will use XMS memory if it is available.

HIMEM recognizes PS/2 style machines A20 line control. HIMEM determines whether to use the PS/2 A20 control or the AT A20 control method automatically by calling INT 15h, function C0h (get system configuration).

The automatic detection can be overridden with the "/Machine:*n*" command line switch. Replacing "*n*" with 1 designates the PC AT A20 control method. Replacing "*n*" with 2 designates the PS/2 method.

EXAMPLE 1: `DEVICE=HIMEM.SYS`

The above command installs the XMS device driver. Once this driver is installed, accessing the HMA and Extended Memory (XMS) areas are legal. The Extended Memory area can contain up to 2 Gigabytes of memory. Typical systems have 4, 8, or 16 MB XMS memory installed.

EXAMPLE 2: `DEVICE=HIMEM.SYS /machine:1`

This example forces the use of the AT style A20 line control.

The HIMEM driver will fail to load if either the machine does not have memory above the 1 MB boundary or the BIOS does not provide support for it. It will also fail to load if another XMS manager has been installed previously.

LPT1CON.COM

LPT1CON.COM Support Command

PURPOSE: Redirects the video to the LPT1 port.

SYNTAX: **LPT1CON**

REMARKS: If you have an LCD-IFB or DP-IFB interface board and a display connected to LPT1, executing the DISPLAY.EXE and LPT1CON.COM programs allow you to use the display as the system console. You must reset your system to change the video to the original parameters.

SEE ALSO: COM1CON.COM, DISPLAY.DOC on the utility disk

REMDISK.EXE Support Command

PURPOSE: Allows access to a disk drive on a remote system via a serial cable and standard PC style (8250 uart) serial port.

SYNTAX: **REMDISK** [**/U**] [**/?**] [**/B*nnnnn***] [**+**] [**/COM*n***]

REMARKS: In a Remote Disk setup, one system, the one that will share its drives, is termed the Server. The other system, the one that will access and use the remote drives, is called the Client. The serial ports on both systems must be connected via null modem cable. A cabling diagram for a standard cable is shown below:

DB9 TO DB9	DB25 TO DB25	DB9 TO DB25
2----------3	2----------3	2----------3
3----------2	3----------2	3----------2
7----------8	4----------5	7----------4
8----------7	5----------4	8----------5
5----------5	7----------7	5----------7
6----------4	6----------20	6----------6
4----------6	20----------6	4----------20

Run REMDISK.EXE on the Client system. This program creates a new drive letter for the Client. REMDISK will use the next available system drive letter. For example, if the last assigned drive was D:, REMDISK will create a drive E:. This drive acts in all ways just like any other drive, except for the fact that it requires the serial port to do its job.

REMDISK.EXE can be installed using a **DEVICE=** command in CONFIG.SYS or from the DOS prompt.

/U tells REMDISK to unload itself from memory, thereby disabling the new drive letter and freeing the memory occupied by REMDISK. The option can only be used when REMDISK is installed from the DOS command line. A Remote Disk installed via CONFIG.SYS cannot be unloaded.

/? displays a short help screen for the REMDISK program. No other arguments are to be included on the command line when the **/?** is used.

/B*nnnn* selects the baud rate for transmission. Available baud rates are 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115k. The default baud rate is 115k.

+ is an optional argument which specifies packet style transmission. This is recommended for any baud rates over 19200. The default for this option is to include the **+** for packet transmission.

/COM*n* is an optional argument which selects the communication port. Available ports are 1 and 2. COM1 is the default port.

NOTE: To use the Remote Disk, both the REMDISK and the REMSERV programs must be running on their respective systems. Both programs must use the same baud rate and packet or non-packet style transmission. It does not matter which program is installed first.

EXAMPLE 1: To install the REMDISK program from CONFIG.SYS at 19200, on COM1, using packet style transmission, enter the following in CONFIG.SYS and then reboot the system (remember to include the full path to find REMDISK.EXE if not located in the root directory):

DEVICE=REMDISK.EXE /B19200 +

EXAMPLE 2: To display a help screen for REMDISK, enter the following at the DOS prompt:

REMDISK /?

EXAMPLE 3: To install REMDISK from the DOS prompt or from a batch file (like AUTOEXEC.BAT) at 9600 baud, without packet style transmission, on COM2, enter the following;

REMDISK /B9600 /COM2

EXAMPLE 4: To unload the REMDISK installed from the batch file or the DOS prompt, type:

REMDISK /U

SEE ALSO: REMSERV.EXE

REMSERV.EXE Support Command

PURPOSE: To make a single drive at a time on the server system available to the Client. The available drive can be changed at any time by quitting the REMSERV program and then running the program again with a new drive letter.

SYNTAX: **REMSERV.EXE** *d:* [**/B*nnnn***] [**+**] [**/COM*n***] [**/S**]

REMARKS: *d:* represents the letter of the drive that the Server will make available to the Client.

/B*nnnn* selects the baud rate for transmission. Available baud rates are 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115k. The default baud rate is 115k.

+ is an optional argument which specifies packet style transmission. This is recommended for any baud rates over 19200. The default for this option is to include the **+** for packet transmission.

/COM*n* is an optional argument which selects the communication port. Available ports are 1 and 2. COM1 is the default port.

/S instructs REMSERV to run silently, that is without any screen output.

/? is an unlisted option which is used to print a short help screen for the REMSERV program. If the **/?** is used, the drive letter argument is omitted, for example:

REMSERV /?

EXAMPLE 1: To select drive B: as the available Server drive at 115K baud, packet style transmission, using COM1, you would enter the following:

REMSERV B:

EXAMPLE 2: To set drive C: as the Server disk at 9600 baud, without packet style transmission, on COM2, you would enter the following:

REMSERV C: /B9600 /COM2

NOTE: The Server program can be terminated at any time by pressing the <ESC> key. The Client can then no longer access the Server's drive until the REMSERV program is run again.

SEE ALSO: REMDISK.EXE

RESET.COM

RESET.COM Support Command

PURPOSE: To enable the watchdog timer and allow timeout to expire, thus restarting the system.

SYNTAX: **RESET**

REMARKS: The RESET command also restarts all the expansion I/O cards on the bus. This differs from a <CTL><ALT><DEL> reboot of the system which only restarts the system but not the expansion cards. The RESET button on the 4020 also accomplishes the same thing as the RESET command.

SETUP.COM Support Command

PURPOSE: Configures various system parameters, including serial ports, a parallel port, and a floppy and hard drive.

SYNTAX: **SETUP** [**/D**]

PARAMETER: **/D** returns all setup values to default values.

REMARKS: From the directory where this utility file is located, enter:

SETUP

After the copyright message displays, the main menu appears:

```
OCTAGON SYSTEMS CORPORATION
4020 SETUP UTILITY V3.2
---------------------------
(Press SPACE to CHANGE, ENTER to
ACCEPT, ESC to EXIT)

COM1 Console baud rate: 1200
                        2400
                        4800
                        9600
                        19200
                        38400
                        57600
                        115200

Power on memory test:Enabled
                     Disabled

SSD1 Device       none
                  128K 5V FLASH
                  512K 5V FLASH
                  EPROM (27C0X0)

Boot from:   BIOS drive using ROM-DOS
             SSD1 using ROM-DOS
             Floppy or Hard drive
             SSD1 using user supplied
             DOS
```

```
On-card LPT port mode:
          Bi-directional mode
          EPP mode
          Disabled
          Standard (Uni-directional)
          mode

IRQ for LPT port:        IRQ7
                         IRQ5

On-board LPT address:  378H
                       278H
                       3BCH

UART 1 address:        3F8H
                       2F8H
                       338H
                       3E8H
                       2E8H
                       220H
                       238H
                       2E0H
                       228H
                       Disabled

UART 2 address:        3F8H
                       2F8H
                       338H
                       3E8H
                       2E8H
                       220H
                       238H
                       2E0H
                       228H
                       Disabled

Number of floppy drives:0
                        1
                        2

Floppy drive 1 size:    360K
                        1.2 MB
                        720K
                        1.44 MB

Number of line printers:Auto Check
                        0
                        1
                        2
                        3
```

```
Number of hard drives:  0
                        1
                        2

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

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.
```

SHOWTIME.COM

SHOWTIME.COM Support Command

PURPOSE: To display the current time and date.

SYNTAX: **SHOWTIME**

REMARKS: This commands displays the following, for example:

```
Current date/time is:  THU 12/1/1995
10:06:47
```

SLEEP.COM Support Command

PURPOSE: To conserve CPU power consumption.

SYNTAX: **SLEEP**

REMARKS: The command puts the processor in “sleep” mode, thus using less power. An interrupt awakens the processor and lets it resume its activities. The DOS clock is stopped while in sleep mode. The 18.2 per second timer tick is disabled during this time. All other interrupts (i.e., serial and keyboard) are left enabled. When the processor is awakened via an interrupt (usually via COM1 or keyboard), the timer tick is reenabled and the DOS time is updated from the CMOS clock.

SLOW.COM Support Command

PURPOSE: To change CPU clock speed from 25 MHz to 12.5 MHz for the 4020.

SYNTAX: **SLOW**

REMARKS: Enter the following command from the DOS prompt or in a batch file to change to the 12.5 MHz clock speed for the 4020:

SLOW

You can also press <CTL><ALT><–> to change to 12.5 MHz if you are using a keyboard and monitor with the 4020.

SEE ALSO: FAST.COM

SSDDRIVE.SYS

SSDDRIVE.SYS Device Driver

PURPOSE: This device driver is used when the user wishes to access the on–card SSDs.

SYNTAX: **DEVICE=SSDDRIVE.SYS** [**BIOS** | **SSD1** | **SSD2**] [*sizeK*] [**/FORMAT** | **/NOFORMAT**]

PARAMETERS: **BIOS** specifies the BIOS drive.

SSD1 specifies the SSD1 device.

SSD2 specifies the SSD2 device.

sizeK specifies the desired size (in kilobytes) of the SSD to be formatted. The default size is the maximum size possible. The specified *sizeK* must be smaller than the device size, but larger than 64.

/FORMAT instructs the driver to format the installed SSD device if it does not look like a DOS drive. This is the default setting.

/NOFORMAT instructs the driver NOT to format the installed SSD device even if it does not look like a DOS drive. The switch has no effect if the installed device looks like a DOS drive. The switch is useful if SSD is not used as a DOS drive. If formatting is desired later, use FMTSSD.EXE to format the SSD.

REMARKS: The following CONFIG.SYS entries allow the user to access on–card SSDs:

`DEVICE=SSDDRIVE.SYS BIOS`	Accesses BIOS Drive
`DEVICE=SSDDRIVE.SYS SSD1`	Accesses SSD1

This driver first checks the SSD to see if it looks like a valid disk. If it does, the system assigns a drive letter, after which time you can access the device as a normal disk. The drive letter for the virtual drive is dependent on the order of the devices listed in the CONFIG.SYS file. If the SSDDRIVE.SYS driver does not detect a valid programmed SSD, one of the following messages will be displayed:

EPROM installed:

```
SSDDRIVE.SYS V1.00 SSD not found
```

AMD 29F040 5V flash installed:

```
SSDDRIVE.SYS V1.00 SSD not found
```

Atmel 29C010, 29C040, or 29C040A;
SST 28FS040 or 29EE010 installed:

If the **/NOFORMAT** switch is used,

```
SSDDRIVE.SYS V1.00 SSD not found
```

If the **/FORMAT** switch is used (default), the SSD is formatted to *sizeK*. If *sizeK* is not specified, the SSD is formatted to its maximum size capacity.

SSDDRIVE.SYS supports the following flash devices:

AMD29040 (512K)	**read only** through SSDDRIVE.SYS; write through DISKSAVE.EXE.
SST PH29EE010 (128K)	read/write through SSDDRIVE.SYS; write through DISKSAVE.EXE.
SST PH28SF040 (512K)	read/write through SSDDRIVE.SYS; write through DISKSAVE.EXE.
Atmel 29C010 (128K)	read/write through SSDDRIVE.SYS; write through DISKSAVE.EXE.
Atmel 29C040 (512K)	read/write through SSDDRIVE.SYS; write through DISKSAVE.EXE.
Atmel 29C040A (512K)	read/write through SSDDRIVE.SYS; write through DISKSAVE.EXE.

Order Octagon P/N 4321: 512K 5V read/write flash.

EXAMPLE 1: `DEVICE=SSDDRIVE.SYS SSD1 /NOFORMAT`

This command entry specifies that SSD1 is not to be formatted even if it may not look like a valid drive.

EXAMPLE 2: `DEVICE=SSDDRIVE.SYS SSD2 100`

This command entry specifies that if SSD2 looks like a drive, it is not to be altered. If SSD2 does not look like a drive, it is to be formatted to 100K regardless of the SSD2 device size.

TRANSFER.EXE

TRANSFER.EXE Support Command

PURPOSE: To transfer files to or from the 4020 over a serial port.

SYNTAX: **TRANSFER** *filepath* [/**S** | /**R**] [/**B***b*] [/**V**] [/**COM***c*]

PARAMETERS: *filepath* specifies the file pathname to send or receive.

SWITCHES: /**S** specifies to send the file.

/**R** specifies to receive the file. This is the default.

/**B***b* specifies baud rate of transfer where *b* can be (300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115 (115200)). The default is 9600 when using a /**COM***c* switch. If COM1 is the console, the baud rate defaults to the current console baud rate.

/V enables the display of "R" when a block (128 bytes) is received, or "T" when a block is transmitted.

NOTE: Do not use **/V** when COM1 is the console device.

/**COM***c* specifies the serial port to use. *c* can be 1-4. The default is 1.

EXAMPLE 1: To send a file named C:\MPC\DEMO\DEMO.EXE on the 4020 when using COM1 as the console, enter the following command:

TRANSFER D:DEMO.EXE

On the remote PC executing SmartLINK, press <ALT> <D>, type C:\MPC\DEMO\DEMO.EXE, and then press ENTER.

EXAMPLE 2: To send a file named D:DEMO.BAS to the file C:\TEST.BAS on the remote PC when using COM1 as the console, enter the following on the 4020:

TRANSFER /S D:DEMO.BAS

On the remote PC executing SmartLINK, press <ALT> <U>, type C:\TEST.BAS, and then press <ENTER>.

EXAMPLE 3: To send a file named C:\DEMO\DEMO.EXE from a remote PC to the file named D:\DEMO.EXE on the 4020 at 57600 baud with a serial cable from COM2 on the remote PC and COM1 on the 4020, enter the following command on the 4020:

TRANSFER D:\DEMO.EXE /R /V /B57600

Then enter the following command on the remote PC:

TRANSFER C:\DEMO\DEMO.EXE /S /V /COM2 /B57600

To receive a file named D:\MYAPP.EXE from the 4020 and name it C:\APPS\MYAPP2.EXE on the remote PC over a serial cable connected to COM1 on both systems at 9600 baud, enter the following command on the 4020:

TRANSFER D:\MYAPP.EXE /S

Then enter the following command on the remote PC:

TRANSFER C:\APPS\MYAPP2.EXE

REMARKS: The TRANSFER command communicates with other XMODEM compatible file transfer programs.

The serial port on the 4020 requires a null modem adapter when connected to a serial port on the remote PC. See the section, *Serial Port*, in this manual for more information.

The maximum baud rate is dependent on the processor speeds of the remote PC and the 4020.

The received file size is rounded up to the nearest 128 byte boundary.

SEE ALSO: DISKSAVE.EXE, DISKSEND.EXE

VDISK.SYS Device Driver

PURPOSE: This device driver allows the user to use memory as a disk.

SYNTAX: **DEVICE= VDISK** [*size* [*secs* [*dirs*]]] [/**E**] [/**NOTIFEXT**]

REMARKS: VDISK allows the user to partition some of the computer's memory as a disk. This disk is called a RAM disk or Virtual Disk. A RAM disk is much faster than either a floppy or hard disk. The RAM drive can use either standard DOS program memory or extended memory (above 1 MB) for the disk.

Any data on the VDISK is lost when the system power is turned off.

The *size* argument specifies the size of the VDISK in kilo (K) bytes. The default is 64K if base memory is selected. Otherwise, if /E is entered, then the size of the VDISK is all available extended memory (size is 64K smaller if DOS is loaded HIGH). The memory selected will be allocated from the DOS memory pool, decreasing the amount of memory available for programs, unless the extended memory switch is used.

The *secs* argument specifies the sector size in bytes. The default is 512 bytes per sector. This value must be 128, 256, 512 or 1024. All other values are not valid and the default of 512 bytes will be used.

The *dirs* argument specifies the number of root directory entries. The default is 64 directory entries. There may be any number of root directory entries between 2 and 1024. If an odd number is given, it will be rounded up to the nearest multiple of 16, in order to fill the entire sector.

The /E argument causes VDISK to use extended memory (memory above the 1 MB boundary) instead of DOS program memory for the disk.

The /NOTIFEXT argument causes the virtual drive to not be installed if extended memory exists.

NOTE: Interrupts are turned off during the transfer of data from extended memory to conventional memory.

The VDISK increases the resident size of DOS.

EXAMPLE 1: `DEVICE=VDISK.SYS`

The above example builds a 64K RAM disk in DOS memory.

EXAMPLE 2: `DEVICE=C:\DOS\VDISK.SYS 220 /E`

This example builds a 220K RAM disk in extended memory. The VDISK device driver is loaded from the C: drive and the \DOS directory. VDISK assumes the default 512 byte sector size, and 64 directory entries.

EXAMPLE 3: `DEVICE=VDISK.SYS 45 128 18`

The above example builds a 45K RAM disk in DOS memory. There will be 128 byte sectors and 18 root directory entries.

EXAMPLE 4: `DEVICE=VDISK.SYS /E`

On a 2 MB system, the above example allocates a 1024K drive in extended memory (960K is allocated if DOS is loaded HIGH).

PROGRAMMING STANDARD EPROMS

The 4020 SSD1 socket accepts EPROMs as well as flash. You must program the EPROM before installing it on the 4020 card, since there is no on–card programmer.

To program an EPROM

1. Depending upon the type of image file you want to create, do one of the following:

   A. To create an image file of up to 1 MB for the SSD1 EPROM from local drive A, enter:

   DISKSAVE /FA /DSSD1 /S1M

   B. To create an image file of up to 512K for SSD1 from a local subdirectory named C:\TEST, enter:

   DISKSAVE C:\TEST /DSSD1 /S512K

2. Install the EPROM into the programmer and program the chip using the file SSD1.IMG.

CUSTOM COMMUNICATION CABLE

The 4020 card requires an RS–232 serial communications cable to interface to the PC. If you are not using a VTC series cable, you can make your own communications cable.

NOTE: This is a simple null modem cable. RxD and TxD are crossed. PC SmartLINK IV does not require signals other than transmit, receive and ground. If another terminal package is used, other signals, such as RTS, CTS, DSR and DTR may have to be tied to one another at the desktop PC to provide for a full null modem cable.

1. Determine if your PC requires a male or female connector.

2. Refer to the following table for cable connections for the 4020:

Custom RS-232 Cable				
COM1/COM2/ COM3	**Micro PC Signal Direction**	**DB-25**	**DB-9**	**PC Signal**
1	DCD Input*	8	1	DCD
2	DSR Input*	6	6	DSR
3	RxD Input	2	3	TxD
4	RTS Output	4	7	RTS
5	TxD Output	3	2	RxD
6	CTS Input	5	8	CTS
7	DTR Output*	20	4	DTR
8	RI Input*	22	9	RI
9	Gnd	7	5	Gnd
10	5	NC	NC	

*Not available on COM2 or COM3.

POWER SUPPLY

Octagon supplies are designed to ramp up fast (less than 50 ms), discharge fast on power down and to regulate properly under a no load condition.

Most desktop PC switching 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 desktop PC 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.

If large output capacitors are used, powering the system down and then up may lock up the Micro PC. If the power supply does not drain below 0.7V, the CMOS components on the Micro PC will act like diodes and forward bias.

If using a non-Octagon supply, select a supply that has a low or no minimum load requirement, comes up in less than 50 ms and discharges quickly on power down.

UPLOADING FILES FROM THE 4020

The TRANSFER program is also used to upload files from the 4020 card to your PC for editing or debugging. To upload a file:

1. Make sure a serial link is established between your PC and the 4020.
2. Start PC SmartLINK on your PC.
3. Execute the TRANSFER program from the 4020 to send a file to your PC.

   ```
   4020C:\> TRANSFER /COM1 /S <drive><path>
   filename.ext
   ```

   filename.ext is the name of the file on the 4020 which you are sending to your PC.

4. To receive the files from the 4020, execute the TRANSFER program from your PC using PC SmartLINK, for example:

   ```
   <ALT><U>
   filename.ext
   <ENTER>
   ```

   filename.ext is the name of the file on the PC which you are receiving from the 4020.

   Refer to the *PC SmartLINK User's Manual* for information on transferring files using the XMODEM protocol.

ASSIGNING DRIVE DESIGNATORS

ROM–DOS is a MS–DOS version 6.22 compatible operating system. Since it is stored in ROM, it is always present on power–up. During run time it requires only about 20K of RAM space if DOS is loaded high; 64K of RAM space if DOS is loaded low. When you boot from ROM–DOS in the BIOS socket, the system automatically assigns drive designators to the extended memory virtual drive and SSD1. However, if you boot from SSD1 or floppy/ hard drive you must add the appropriate device drivers to your CONFIG.SYS file and copy the files to your boot drive in order to access the BIOS drive and the extended memory virtual drive.

NOTE: Even though you provide information about memory devices during setup, you must still define drivers for these devices in your CONFIG.SYS file. The following is an example listing of CONFIG.SYS entries for the device drivers included with the 4020. Each of these device drivers is discussed in greater detail in Appendix A, *Software Utilities*:

`DEVICE=HIMEM.SYS`	Load memory manager
`DOS=HIGH`	Load DOS in high memory if possible
`DEVICE=VDISK.SYS 136 /NOTIFEXT`	Access the virtual drive in base memory if extended memory does not exist
`DEVICE=VDISK.SYS /E`	Accesses the virtual drive in extended memory
`DEVICE=SSDDRIVE.SYS BIOS`	Accesses the BIOS drive
`DEVICE=SSDDRIVE.SYS SSD2`	Accesses the SSD2 drive

When your system boots up, the 4020 device drivers will be listed with their drive designations. When you boot from ROM–DOS in the BIOS drive, drives D–E are defined in the CONFIG.SYS file. The drives are designated as:

A: floppy disk
B: floppy disk
C: BIOS socket
D: virtual disk
E: SSD1
F: SSD2

If your system has a hard drive, drive C: (in the example above) becomes the hard drive and drives C–F are now designated as D–G.

When you boot from SSD1 with ROM–DOS, the drives are designated as:

A: floppy disk
B: floppy disk
C: SSD1
D: first driver in CONFIG.SYS
E: second driver in CONFIG.SYS

Example:

In the following example of bootup messages, the system boots from the BIOS drive with 1 MB DRAM, 512K flash in SSD1 and 128K static RAM in SSD2. The system assigns the following drive designations:

```
VDISK V6.22 (Revision 2.10)
Copyright (c) 1989-1995 Datalight, Inc.
  Extended memory present.

VDISK V6.22 (Revision 2.10)
Copyright (c) 1989-1995 Datalight, Inc.
  Formatting 384K XMS memory as drive D:
SSDDRIVE.SYS V1.00 Assigning SSD1 (512K) as drive E:
SSDDRIVE.SYS V1.00 Assigning SSD2 (128K) as drive F:
```

This page intentionally left blank.

WARRANTY

Octagon Systems Corporation (Octagon), warrants that its standard hardware products will be free from defects in materials and workmanship under normal use and service for the current established warranty period. Octagon's obligation under this warranty shall not arise until Buyer returns the defective product, freight prepaid to Octagon's facility or another specified location. Octagon's only responsibility under this warranty is, at its option, to replace or repair, free of charge, any defective component part of such products.

LIMITATIONS ON WARRANTY

The warranty set forth above does not extend to and shall not apply to:

1. Products, including software, which have been repaired or altered by other than Octagon personnel, unless Buyer has properly altered or repaired the products in accordance with procedures previously approved in writing by Octagon.
2. Products which have been subject to power supply reversal, misuse, neglect, accident, or improper installation.
3. The design, capability, capacity, or suitability for use of the Software. Software is licensed on an "AS IS" basis without warranty.

The warranty and remedies set forth above are in lieu of all other warranties expressed or implied, oral or written, either in fact or by operation of law, statutory or otherwise, including warranties of merchantability and fitness for a particular purpose, which Octagon specifically disclaims. Octagon neither assumes nor authorizes any other liability in connection with the sale, installation or use of its products. Octagon shall have no liability for incidental or consequential damages of any kind arising out of the sale, delay in delivery, installation, or use of its products.

SERVICE POLICY

1. Octagon's goal is to ship your product within 10 working days of receipt.
2. If a product should fail during the warranty period, it will be repaired free of charge. For out of warranty repairs, the customer will be invoiced for repair charges at current standard labor and materials rates.
3. Customers that return products for repairs, within the warranty period, and the product is found to be free of defect, may be liable for the minimum current repair charge.

RETURNING A PRODUCT FOR REPAIR

Upon determining that repair services are required, the customer must:

1. Obtain an RMA (Return Material Authorization) number from the Customer Service Department, 303-430–1500.
2. If the request is for an out of warranty repair, a purchase order number or other acceptable information must be supplied by the customer.
3. Include a list of problems encountered along with your name, address, telephone, and RMA number.
4. Carefully package the product in an antistatic bag. (Failure to package in antistatic material will VOID all warranties.) Then package in a safe container for shipping.
5. Write RMA number on the outside of the box.
6. For products under warranty, the customer pays for shipping to Octagon. Octagon pays for shipping back to customer.
7. Other conditions and limitations may apply to international shipments.

NOTE: PRODUCTS RETURNED TO OCTAGON FREIGHT COLLECT OR WITHOUT AN RMA NUMBER CANNOT BE ACCEPTED AND WILL BE RETURNED FREIGHT COLLECT.

RETURNS

There will be a 15% restocking charge on returned product that is unopened and unused, if Octagon accepts such a return. Returns will not be accepted 30 days after purchase. Opened and/or used products, non-standard products, software and printed materials are not returnable without prior written agreement.

GOVERNING LAW

This agreement is made in, governed by and shall be construed in accordance with the laws of the State of Colorado.

The information in this manual is provided for reference only. Octagon does not assume any liability arising out of the application or use of the information or products described in this manual. This manual may contain or reference information and products protected by copyrights or patents. No license is conveyed under the rights of Octagon or others.

4010 User's Manual

Doc. #03810 Rev. 0198

OCTAGON SYSTEMS CORPORATION®

6510 W. 91st Ave. Westminster, CO 80030
Tech. Support: 303–426–4521

COPYRIGHT

Copyright 1994, 1998—Octagon Systems Corporation. All rights reserved. However, any part of this document may be reproduced, provided that Octagon Systems Corporation is cited as the source. The contents of this manual and the specifications herein may change without notice.

TRADEMARKS

Micro PC™, PC SmartLink™, Octagon Systems Corporation®, the Octagon logo and the Micro PC logo are trademarks of Octagon Systems Corporation. QuickBASIC® is a registered trademark of Microsoft Corporation. ROM-DOS™ is a trademark of Datalight.

NOTICE TO USER

The information contained in this manual is believed to be correct. However, Octagon assumes no responsibility for any of the circuits described herein, conveys no license under any patent or other right, and makes no representations that the circuits are free from patent infringement. Octagon makes no representation or warranty that such applications will be suitable for the use specified without further testing or modification.

Octagon Systems Corporation general policy does not recommend the use of its products in life support applications where the failure or malfunction of a component may directly threaten life or injury. It is a Condition of Sale that the user of Octagon products in life support applications assumes all the risk of such use and indemnifies Octagon against all damage.

IMPORTANT!

Please read 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. This section describes some of the common 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 power-up** - 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 power-up. This type of failure is typical on serial interface chips.

- **Serial and parallel** - Customers sometimes connect the serial and printer devices to the Micro PC while the power is off. This can cause the failure mentioned in the above section, *Failure upon power-up*. Even if they are connected with the Micro PC on, there can be another failure mechanism. Some serial and printer devices do not share the same power (AC) grounding. The leakage can cause the serial or parallel signals to be 20-40V above the Micro PC ground, thus, damaging the ports as they are plugged in. This would not be a problem if the ground pin is connected first, but there is no guarantee of this. Damage to the printer port chip will cause the serial ports to fail as they share the same chip.

- **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.

- **Using desktop PC power supplies** - Occasionally, a customer will use a regular desktop PC power supply when bringing up a system. Most of these are rated at 5V at 20A or more. Switching supplies usually require a 20% load to operate properly. This means 4A or more. Since a typical Micro PC system takes less than 2A, the supply does not regulate properly. Customers have reported that the output can drift up to 7V and/or with 7-8V voltage spikes. Unless a scope is connected, you may not see these transients.

- **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.

TABLE OF CONTENTS

PREFACE

This manual provides all the information required to install, configure, and operate the 4010 Micro PC Control Card. It is part of Octagon's Micro PC user manual series. To receive the Micro PC User Manual Binder, please return the reply card included with your Control Card.

By using this manual, you will be able to:

- Interface the 4010 Control Card to your PC and the Micro PC expansion cards.
- Set up communications between the 4010 card and a PC.
- Gain an understanding of the operation and various options allowed in the 4010 Control Card.

CONVENTIONS USED IN THIS MANUAL

1. Information which appears on your screen (output from your system, commands or data that you key in) is shown in a different type face.

   ```
   Octagon 4010 BIOS Vers x.xx
   Copyright (c) 1994 Octagon Systems, Corp.
   All Rights Reserved.
   ```

2. Italicized refers to information that is specific to your particular system or program, e.g.,

   Enter *filename*

   means enter the name of your file.

3. Warnings always appear in this format:

   WARNING: The warning message appears here.

4. Paired angle brackets are used to indicate a specific key on your keyboard, e.g., <ESC> means the escape key; <CTRL> means the control key; <F1> means the F1 function key.

5. All addresses are given in hexadecimal.

SYMBOLS AND TERMINOLOGY

Throughout this manual, the following symbols and terminology are used:

W[–]	Denotes a jumper block and the pins to connect.
Autoexecution	Automatic execution of a program on power–up or reset.
BIOS drive	The solid–state disk which contains the system BIOS and ROM–DOS.
Console Port	Video card or COM1 where BIOS and DOS messages appear and keyboard input is available.
Control Card	Contains the CPU, memory, and operating system and controls the operation of all the extension cards.
DRAM	Dynamic Random Access Memory devices. DRAMs provide volatile memory with unlimited read and write cycles.
Expansion Card	The expansion cards add I/O functions to the Micro PC system, such as analog input/output, digital input/output, motion control, display, and so on.
Flash memory	Electrically erasable EPROM which allows approximately 10,000 writes.
Memory device	The type of static RAM, DRAM, flash memory or EPROM specified for either volatile or nonvolatile memory.
PC SmartLINK	A serial communications software package designed by Octagon for use with the 4010 Control Card. Refers to all versions of PC SmartLINK.

ROM	Read Only Memory devices. ROMs provide nonvolatile memory, have a limited number of write cycles, and include EPROMs, EEPROMs, and flash memory.
ROM–DOS	DOS operating system included in Micro PC ROM.
Solid–State Disk (SSD)	A simulated disk using a high speed solid–state memory device, for example flash memory, EEPROM, or static RAM.
Static RAM	Static Random Access Memory device. Static RAMs provide volatile memory with unlimited read and write cycles. They may be used with a battery back–up module.
TTL Compatible	Transistor transistor logic compatible; 0–5V logic levels.
Virtual Drive	A disk created in DOS or extended memory which emulates an actual disk. Provides temporary storage for files. When power to the computer is turned off the virtual drive disappears.
XMODEM	A communications protocol which allows transfer of files between two computers.
XON/XOFF	A communications protocol for asynchronous connections. The receiver can pace the sender by sending the XOFF and XON characters to stop and continue the data flow.
H	The suffix “H” denotes a hexadecimal number. A decimal number has no prefix or suffix. For example, 1000H and 4096 are equivalent.

TECHNICAL SUPPORT

If you have a question about the 4010 Control Card and cannot find the answer in this manual, call Technical Support. They will be ready to give you the assistance you need.

When you call, please have the following at hand:

Your *4010 Control Card User's Manual*

A description of your problem.

The direct line to Technical Support is 303–426–4521.

DESCRIPTION

The 4010 is a low cost, single board PC for use in a wide variety of embedded applications. The 25 MHz 386SX and 486SLC processors have enough processing power for most control and data acquisition applications.

Despite its small size, the features include: DOS 5.0 in ROM; two serial ports; a parallel port; a dual floppy drive port; a hard drive port that supports 2.5 in. hard drives; a watchdog timer; 2 MB of DRAM; 512K of flash memory with integral programmer or 1 MB of standard EPROM; keyboard and speaker ports; two solid–state disks; and ISA and 8/16–bit, PC/104 connectors.

The card can be used in a stand–alone mode or installed in a passive ISA bus backplane. For very small systems one or two PC/104 expansion cards may be stacked on the 4010. The 4010 can also be installed in three or four slot card cages.

MAJOR FEATURES

Instant DOS
The 4010 is an “instant DOS” system. The card includes 5.0 compatible DOS in a solid–state disk. The system boots and operates the same way as your desktop PC.

Watchdog Timer
The watchdog timer resets the system if the program stops unexpectedly. The watchdog is enabled under software control. The timeout is 1.2 seconds.

Calendar/Clock
The 4010 has a built–in, AT style calendar/clock. An external AT clock battery plugs into the card and powers the clock during power–down.

Solid–State Disk Options

SSD0 contains the BIOS and DOS 5.0 in ROM. SSD1 is used for storage of the applications program. 128K or 512K flash memory (5V) may be used. The flash memory programmer is built–in allowing reprogramming locally or through a serial port. Standard EPROMs up to 1 MB may also be used. The solid–state disks look like disks to the user. All the necessary software is provided.

Speaker and Keyboard Port

The 4010 accepts any AT keyboard and has the small PS–2 style keyboard connector. The speaker port is a 3–pin connector for use with any external speaker from 8–50 ohms.

Mounting

There are several ways to mount the 4010:

1. Plug it directly into a Micro PC card cage.
2. Use the optional PC mounting bracket and plug it into any passive backplane.
3. Panel mount it using the four mounting holes. A screw terminal connector is used to supply the 5V power.
4. Stack it with other Micro PC cards.

COM1 and COM2 Serial Ports

COM1 and COM2 serial ports are 16C450 compatible. The baud rates are programmable from 150 to 115K baud. Both ports have a RS–232 interface. RS–232 voltages are generated on–card.

LPT1 Parallel Port

The LPT1 parallel port can be used for a printer port or for general purpose I/O. For embedded applications an interface board and software are available to interface with a 4–line LCD display and a 16–position keypad. The port can also be connected to the MPB–16PC, a 16–position opto module rack for driving high current AC and DC loads.

Floppy and hard disk support

The dual floppy port supports all 3.5 in. and 5.25 in. drives up to 1.44 MB. The hard drive interface is a 16–bit IDE controller with a 2 mm. connector for 2.5 in. drives.

Setup stored in serial EEPROM

The 4010 stores the setup information in nonvolatile EEPROM; as a result it is immune to battery or power failure. The user can also store additional information in the EEPROM. Up to 1,892 bytes are available.

Hardware Reset

You can reset the system without turning off the power using the hardware reset button or the RESET command. It also provides a more complete reset than the <CTL> <ALT> <DEL> method.

Boot sequence

A system can execute from the on–card, solid–state disk, floppy or hard disk.

Where to go from here:

Before you can begin developing your application program for the 4010, we recommend you read Chapters 2–4. These chapters give instructions for hardware installation, downloading and saving your program, and autoexecuting your application.

Chapter 2 Quick Start	Covers the basics of setting up a 4010 system. This chapter describes how to install the 4010 into the card cage, how to establish a serial communications link with your PC and how to download files to the 4010.
Chapter 3 EPROMs	Configuring and installing EPROMs.

Chapter 4 SETUP	Running the SETUP configuration program.
Chapter 5 Save & Run Programs	How to save your program files and autoexecute them from the 4010.
Chapter 6 Serial Ports	Using COM1 and COM2. Setting COM1 as the main console I/O for serial communications with your PC.
Chapter 7 Watchdog Timer	Enabling the watchdog timer and configuring the timeouts.
Chapter 8 LPT1 Parallel Port	Using the LPT1 parallel port for a printer, display or keypad.
Chapter 9 Serial EEPROM	How to read and write to the serial EEPROM.
Chapter 10 Video/Keyboard/Speaker	Configuring the 4010 with a video, keyboard and speaker.
Chapter 11 External Drives	Configuring the 4010 with a floppy drive or hard drive.
Chapter 12 PC/104	Using a PC/104 module.
Chapter 13 Using Your Own DOS	Configuring the 4010 with a version of DOS other than ROM–DOS.

Chapter 14 Troubleshooting	Problems encountered when using the 4010.
Chapter 15 Technical Data	Technical specifications, jumper configurations and connector pinouts.
Appendix A Software Utilities	Description and operation of software utility programs and device drivers.
Appendix B	Using non–Octagon cables, programming EPROMs, uploading files from the 4010, assigning drive designators and using interrupts.

This page intentionally left blank.

This chapter covers the basics of setting up a 4010 system and tells you:

1. How to panel mount or install the 4010 into the card cage;

2. How to set up a serial communications link between the 4010 and your PC; and

3. How to download files to the 4010 and run a program from the virtual drive.

WARNING: The 4010 may not be installed in a PC. These cards are designed to be independent CPU cards only, not accelerators or coprocessors.

HARDWARE INSTALLATION

Your 4010 Control Card can be installed in one of three ways:

1. Panel mount it using the four mounting holes;
2. Plug it directly into a Micro PC card cage;
3. Use the optional PC mounting bracket and plug it into any passive backplane.

Panel Mounting the 4010

To panel mount the 4010, you will need the following equipment (or equivalent):

4010 Control Card
5V Power Supply
VTC–9F Cable
Null modem adapter
4010 ROM–DOS & Utility Software Disk
PC SmartLINK w/manual
Your PC

If you are panel mounting the 4010, a screw terminal connector (P2) is provided to supply the 5V power. Refer to Figure 2–2 for the location of various connectors.

1. Use #4–40 standoffs and screws to bolt down the 4010. The following diagram shows the center to center mounting hole dimensions.

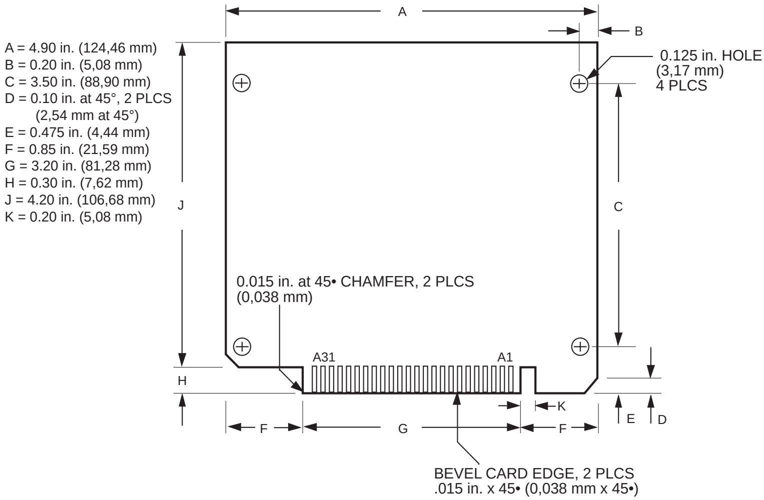

Figure 2–1—4010 Center to Center Hole Dimensions

2. Connect the proper ground and 5V wires to the terminal block at P2.

3. Connect one end of the VTC–9F cable to the null modem adapter. Connect the other end to COM1 (J1) on the 4010.

   NOTE: You must use COM1 on the 4010 in order to establish a serial communications link with your PC.

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

   NOTE: Please refer to the PC SmartLINK manual for more information on using a COM port other than COM1.

You are now ready to transfer files between your PC and the 4010, please continue with the section, “Establishing Communications with the 4010” in this chapter.

Using a Micro PC Card Cage

To install the 4010 in a Micro PC card cage, you will need the following equipment (or equivalent):

4010 Control Card
Micro PC Card Cage
Power Module
VTC–9F Cable
Null modem adapter
4010 ROM–DOS & Utility Software Disk
PC SmartLINK w/manual
Your PC

Please refer to Appendix B if you are making your own serial cable or using other non–Octagon components.

To install the 4010:

1. Please refer to Figure 2–2 for the location of various connectors before installing the 4010 Control Card.

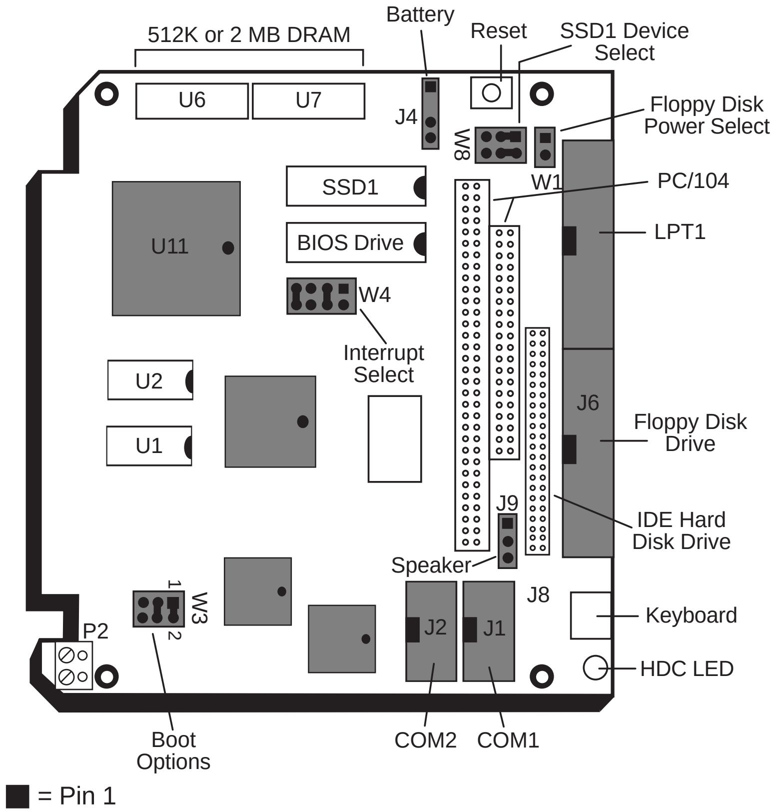

Figure 2–2 – 4010 Component Diagram

WARNING: The 4010 Control Card contains static–sensitive CMOS components. The greatest danger occurs when the card is plugged into a card cage. The 4010 card 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 4010 card.

- Disconnect power before removing or inserting the card.
- When programming a memory device, place the device in the socket before applying power.

Take care to correctly position the 4010 card in the card cage. The VCC and ground signals must match those on the backplane. Figure 2–3 shows the relative positions of the 4010 card as it is installed in the card cage.

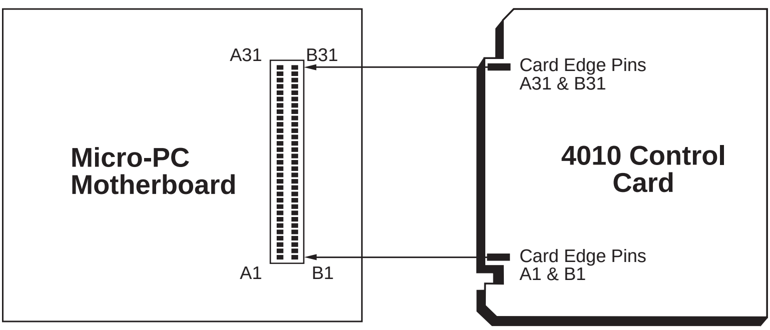

Figure 2–3 – Edge Connector Orientation

2. Attach the 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 4010 into the card cage. The ROM–BIOS label on the card should face to the left or up depending on the type of card cage.

WARNING: Plugging the card in 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 (J1) on the 4010.

   NOTE: You must use COM1 on the 4010 in order to establish a serial communications link with your PC.

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

   NOTE: Please refer to the PC SmartLINK manual for more information on using a COM port other than COM1.

ESTABLISHING COMMUNICATIONS WITH THE 4010

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 4010 files from the 4010 utility disk to a subdirectory on your PC hard drive.

3. Start PC SmartLINK. You are now ready to establish communications between your PC and the 4010 Control Card.

4. Power on the 4010.

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

```
Octagon 4010 BIOS vers x.xx
Copyright (c)1994 Octagon Systems, Corp.
All Rights Reserved
640K Base RAM
384K Shadow RAM
1024K Extended RAM
```

```
4010 MEMDRIVE.SYS V1.6, extended memory present
4010 MEMDRIVE.SYS V1.6, formatting extended memory (960KB) as
drive D:
4010 MEMDRIVE.SYS V1.6, memory device not found in SSD1
4010 DISK.SYS v3.5, 5805 SSD not found.
```

```
A:\>path D:\;A:\;
A:\>prompt 4010 $p$g
4010A:\>showtime
Current date/time is TUE 1/1/1980 1:00:00
```

If you don't get the proper logon message:

- Check the 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 Chapter 14, Troubleshooting.

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

```
DIR <return>
```

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

```
Volume in drive A is BIOS DRIVE
Directory of A:\

COMMAND    COM  27145   03-17-94  10:04a
FAST       COM    301   04-05-94   7:34a
RESET      COM    313   03-31-94   2:43p
SETUP      COM   3919   04-05-94   7:33a
SHOWTIME   COM    619   03-31-94   2:43p
SLOW       COM    301   04-05-94   7:34a
DISKSAVE   EXE  14297   04-05-94   7:34a
TRANSFER   EXE   9969   01-05-93   2:36p
CONFIG     SYS    113   04-05-94   2:48p
MEMDRIVE   SYS   4499   04-05-94   7:33a
AUTOEXEC   BAT     46   03-08-94   2:50p
   11 Files(s)        63255 bytes
                      0 bytes free
```

7. You are now ready to transfer files between your PC and the 4010.

TRANSFERRING FILES BETWEEN 4010 & YOUR PC

Once you have established communications between your PC and the 4010, you can download files to the virtual drive on the 4010. The virtual drive provides temporary storage for your files until you save them to a flash EPROM drive. The virtual drive also allows you to test and debug your application files before permanently saving them.

You can also upload files from your 4010 to your PC for editing and debugging. When booting from the BIOS drive, the MEMDRIVE.SYS driver allocates a virtual drive. The size of the virtual drive depends on the memory configuration of the 4010:

4010 Virtual Drives	
DRAM Installed	**Virtual Drive Size**
512K	136K uses MEMDRIVE.SYS BASE*
2 MB	1024K uses MEMDRIVE.SYS EMS

*This memory is taken out of DOS base memory.

NOTE: The drivers are optional when booting from SSD1. For example, if you do not need a virtual drive with a 512K system, do not use MEMDRIVE.SYS.

A utility program called TRANSFER.EXE resides on the BIOS drive and is used to send or receive files via the serial port (e.g., COM1) on the 4010. TRANSFER.EXE uses the XMODEM protocol, as does PC SmartLINK. The following information on downloading files between the 4010 and your PC uses the example programs, DEMO.EXE and DEMO.BAS. These files are on your 4010 utility disk in the DEMO subdirectory.

Downloading Files to the 4010

The following procedures assume you are using PC SmartLINK. For other communication programs, refer to information on sending a file from your PC to the target system.

1. Log into the directory on your PC which contains the file(s) you will download to the 4010.

2. Start PC SmartLINK and power on the 4010.

3. Execute the TRANSFER.EXE program from the 4010 by typing:

   ```
   TRANSFER D:DEMO.EXE <RETURN>
   ```

   The following message displays:

   ```
   Receiving D:DEMO.EXE
   ```

4. Press <ALT> + <D> to download a file.

5. Type in the name of the file to transfer, for example:

   ```
   DEMO.EXE
   ```

6. Select START. The progress of the transfer displays in the dialog box.

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

   ```
   Failed to receive d:DEMO.EXE
   Deleting d:DEMO.EXE
   ```

7. When the transfer is complete, type the following DOS command to view the virtual drive directory and confirm that your file has transferred to the 4010:

   ```
   DIR D:
   ```

The system will display the contents of drive D:

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

DEMO      EXE    27264  01-01-80     2:57p
              1 file(s) 27264 bytes
```

8. To execute the program you have just downloaded type:

   ```
   D:DEMO
   ```

9. The DEMO program displays a message on your PC.

DESCRIPTION

Before you can save and boot your application from the 4010, you must first configure the system for your particular application requirements.

SSD1

SSD1 generally contains the program to be executed on power–up. The program is automatically loaded into DOS memory and executed. SSD1 accepts either 128K/512K, 5V only, flash memory. Your application program can be saved to the flash memory using the on–card programmer. These devices are erased automatically during the programming process. You can write to the flash memory a limited number of times (about 100,000), if your application program requires changes. You can also use a 512K/1 MB standard EPROM. These EPROMs must be programmed with an off–card programmer. Please refer to Appendix B for more information.

To Install an EPROM

1. Set the jumpers at W8 for the correct memory device:

W8: SSD1 Memory Device Select	
Pins Jumpered	**Description**
[1-3][2-4]	Flash memory*
[3-5][4-6]	EPROM

* = default

2. Install the EPROM into socket SSD1.

WARNING: When installing the chip, be sure to match the notch in the chip with the notch in the silkscreen. Incorrect installation will destroy the chip!

NOTE: If installing a new flash memory, the driver MEMDRIVE.SYS will report “Device not present”. You must program the EPROM using the program DISKSAVE before the EPROM is recognized. Refer to the section in Chapter 5, “Saving Program and Support Files” and MEMDRIVE.SYS in Appendix A.

DRAM

The 4010 is shipped with either 512K or 2 MB of DRAM soldered onto the card.

DESCRIPTION

The SETUP program defines the 4010 system parameters. It is shipped with default configuration parameters stored in the EEPROM, U33. Changes are made by running the SETUP program. The SETUP program is stored on the BIOS drive and on the 4010 utility disk.

4010 SETUP Parameters	Description	Default
COM1 Console Baud Rate	Specifies communications rate between your PC and the 5025 when no video card is in use.	9600
Power-on Memory Test	Extensive memory testing performed on bootup.	Enabled
SSD1 Device	Specifies the type of memory device installed in SSD1.	512K Flash EPROM
Boot from	Specifies the default boot drive.	BIOS drive using ROM-DOS
Number of Floppy Drives	Specifies the number of floppy drives attached.	0
Floppy Drive Size	Specifies size of the first floppy drive.	1.44 MB
Shadow 0C000H-0C7FF	The system will shadow (write protect) this segment of RAM.	Yes
Shadow 0C800H-0CFFF	The system will shadow (write protect) this segment of RAM.	Yes
Move BIOS DRIVE high	Copies the contents of the BIOS drive into high memory freeing memory address EXXX	Yes
Number of line printers	System will automatically check to verify if line printer port(s) exist.	Auto check
Number of hard drives	Specifies the number of hard drives attached.	0
Drive 0 parameters	Specifies the cylinders, heads and sectors of drive 1.	Varies with each drive

If you are running SETUP for the first time and have not previously saved and autoexecuted your program, we recommend you keep the default setting, “Boot from: BIOS drive using ROM–DOS”. The 4010 continues to boot from the BIOS drive allowing you to verify your program files are successfully saved to SSD1. You can also test your program before setting the system to boot from your AUTOEXEC.BAT file. Once your program is tested and verified, you can run SETUP to configure the system to autoexecute your program.

RUNNING SETUP

1. Make sure you have established a serial communications link between the 4010 and your PC.

2. Type:

   ```
   A:SETUP
   ```

   NOTE: If you are not booting from the BIOS drive, the drive designator may differ.

3. The system will display the 4010 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.

   - COM1 Console Baud Rate:
     ```
     1200
     2400
     4800
     9600
     19200
     38400
     57600
     115200
     ```

     The following messages may appear:

```
NOTE:  To use COM1 as the console at a speed
other than 9600 baud, you must install the
BIOS boot jumper. (W3[3-4])
```

- Power on memory test:

```
Enabled
Disabled
```

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

- SSD1 device:

```
128K FLASH (29F010)
512K FLASH (29F040)
EPROM (27C0x0)
None
```

NOTE: After setting the SSD1 device, use DISKSAVE/ DISKSEND to program the flash memory.

NOTE: If SSD1 is not programmed, MEMDRIVE.SYS displays the message "Device not found" when the system comes up.

- Boot from:

```
BIOS drive using ROM-DOS
SSD1 using ROM-DOS
Floppy or Hard drive
SSD1 using User supplied DOS
```

NOTE: If NONE was selected for the SSD1 device type, the SSD1 boot options are not available.

We recommend that you do not change this option until you have saved and verified your program files in SSD1. If booting from the BIOS drive, the No Video jumper, W3[1–2], is ignored. If the BIOS boot jumper, W3[3–4], is not installed and you selected an option other than “Boot From BIOS Drive Using ROM–DOS”, the following message appears:

NOTE: To boot from the specified device you must install the BIOS boot jumper. (W3[3-4])

- Number of floppy drives:
  0, 1, 2

A maximum of 1 floppy drive is possible if booting from SSD1 and using your own DOS. See Chapter 13, Using Your Own DOS for details. The following message will appear if you select one floppy disk and you boot from SSD1 with your own DOS:

NOTE: Connect the floppy to the second floppy cable connector. The drive will be known as B:

- Floppy drive 1 size:
  360K
  1.2 MB
  720K
  1.44 MB

- Floppy drive 2 size:
  360K
  1.2 MB
  720K
  1.44 MB

These two options only display if you have specified that a floppy drive(s) is attached to the 4010.

- Shadow 0C000H–0C7FFH
  Yes
  No

This address is usually reserved for the video BIOS.

- Shadow 0C800H–0CFFFH
  Yes
  No

This address is usually reserved for network cards, SCSI controllers, etc.

The system defaults to shadowing RAM (write protecting) which enhances performance. However, some peripheral cards require access to RAM at these locations. Please refer to your peripheral card manual for specific information regarding RAM address locations.

NOTE: The shadow RAM options is not available on 512K DRAM systems.

- `Move BIOS DRIVE high:`
  `Yes`
  `No`

You may enable the system to copy the BIOS drive (normally at E000–F000) into extended memory on systems with 1 MB or more DRAM. This “frees” up the address space for other applications such as PCMCIA, SCSI and network cards.

NOTE: This option is not available on 512K systems.

- `Number of line printers:`
  - `Auto Check`
  - `0`
  - `1`
  - `2`
  - `3`

If you select Auto Check, the system automatically checks the available parallel printer interfaces to verify their existence by writing a pattern to the printer data lines during boot–up or reset. If you have a non–printing device attached to the LPT1 port, e.g., MPB–16PC and do not want data written to that port during boot–up, deselect the Auto Check option.

- `Number of hard drives`
  - `0`
  - `1`
  - `2`

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

```
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.
```

SETUP EXAMPLE

The following example configures a system with 512K flash memory in SSD1, no memory test, 9600 baud, and booting from SSD1 with ROM–DOS:

```
OCTAGON SYSTEMS CORPORATION
4010 SETUP UTILITY V2.7
(Press SPACE to CHANGE, ENTER to ACCEPT, ESC to
EXIT)

COM1 Console Baud Rate:  9600
Power on memory test:  Disabled
SSD1 device: 512K FLASH (29F040)
Boot from:  SSD1 using ROM–DOS
Number of floppy drives: 0
Shadow 0C000H–0C7FFH:  Yes
Shadow 0C800H–0CFFFH:  Yes
Move BIOS DRIVE high:  Yes
Number of line printers:  Auto check
Number of hard drives: 0

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

SAVE AND RUN YOUR PROGRAMS ON THE 4010

Once you have written, tested and debugged your application, you can then save it to either battery–backed static RAM or flash memory in SSD1. When you reboot the 4010, your program will automatically load into DOS memory and execute.

This chapter tells you:

1. How to save an application program to SSD1;
2. How to autoexecute the program from the 4010; and
3. How to override 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 SSD1, using your own DOS, when using programs with undocumented DOS calls. Refer to Chapter 13, Using Your Own DOS for more information on saving and autoexecuting programs.

This chapter also assumes you will be using the 4010 without a video card/monitor. If you are using these devices, refer to Chapter 10, Video and Keyboard for more information on transferring an saving programs.

SAVING PROGRAM AND SUPPORT FILES

In addition to your application program, you must also transfer support files to the 4010 to ensure proper operation. These files include the ROM–DOS COMMAND.COM, AUTOEXEC.BAT, CONFIG.SYS, and other files specific to your application. ROM–DOS COMMAND.COM is required to boot the 4010 with ROM–DOS from SSD1. AUTOEXEC.BAT defines the routine for autoexecution of your program.

CONFIG.SYS defines the various device drivers of your 4010 system. The following is an example listing of CONFIG.SYS entries for the device drivers included with the 4010. Each of these device drivers is discussed in greater detail in Appendix A, Software Utilities. Refer to Appendix B for more information on how the 4010 assigns drive designators.

`DEVICE=MEMDRIVE.SYS SSD1`	Accesses the SSD1 drive
`DEVICE=MEMDRIVE.SYS BIOS`	Accesses the BIOS drive
`DEVICE=MEMDRIVE.SYS EMS`	Accesses the virtual drive in extended memory
`DEVICE=MEMDRIVE.SYS BASE 136`	Accesses a virtual drive in DOS base memory

NOTE: We recommend you include in your CONFIG.SYS file the entry DEVICE=MEMDRIVE.SYS BIOS. This allows you to easily access utility programs (SETUP, TRANSFER, etc.) that are located on the BIOS drive.

To Save Files to the 4010 SSD1

The following information leads you through transferring, saving and autoexecuting a program using the DEMO application and a flash memory in SSD1. All the files for this application are located on the 4010 utility disk in the DEMO directory. The two programs, DISKSAVE and DISKSEND, transfer and save the files on the floppy disk to SSD1. The DISKSAVE program resides on the BIOS drive of the 4010 and the DISKSEND program resides on the 4010 utility disk. The following procedures assume you are using PC SmartLINK.

1. Do an XCOPY of the utility disk to your hard drive. This will copy all subdirectories on the utility disk.

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

2. Change to the 4010 directory to allow access to DISKSEND:

   ```
   CD \MPC\4010
   ```

3. Connect a serial cable between COM1 on the 4010 to a COM port on your PC.

4. Start PC SmartLINK and power on the 4010.

NOTE: If you are using PC SmartLINK from COM2 on your PC, you must use the /C2 switch with DISKSEND. Refer to the DISKSEND section in Appendix A for more information. Also, if you cannot communicate at 38400 baud, use the /Bxxx switch on both DISKSAVE and DISKSEND.

5. On the 4010, execute the DISKSAVE program by typing:

   ```
   A>DISKSAVE /X /DSSD1
   ```

   The systems displays the following message:

   ```
   Attempting connection with DISKSEND on remote
   host.
   ```

6. Exit to DOS and type the following:

   ```
   C>DISKSEND \MPC\DEMO
   ```

   The system then erases and programs the flash memory. This may take several minutes.

7. Restart PC SmartLINK.

8. Confirm that the “Boot from” option in SETUP shows "BIOS drive with ROMDOS". Then type:

   ```
   RESET
   ```

9. Display and verify the contents of SSD1:

   ```
   DIR E:
   ```

10. Test run the DEMO program:

    ```
    E:DEMO
    ```

11. If you want to boot from SSD1, run SETUP to specify this option.

AUTOEXECUTING YOUR PROGRAM

Once you have saved your program and other files to SSD1 you may boot from SSD1 and autoexecute your program.

1. Make sure jumper W3[3–4] is installed. (This is the default setting.)

2. Establish a serial communications link between your PC and the 4010.

3. Make sure the name of your application program is listed in the AUTOEXEC.BAT file, e.g., DEMO.

4. Run SETUP and specify “Boot from: SSD1 using ROM–DOS”.

   SETUP

5. Type:

   RESET

   The 4010 will reset and boot from SSD1. SSD1 now becomes drive C.

OVERRIDING PROGRAM AUTOEXECUTION FROM SSD1

If you want to make changes to your program and need to override autoexecution of your program, you must reboot the 4010 from the BIOS drive. There are two options available:

1. You can rerun SETUP to change the “Boot from” option to “BIOS drive with ROM–DOS”. If you include the line DEVICE=MEMDRIVE.SYS BIOS in your CONFIG.SYS file, you can access the SETUP program on the 4010 BIOS drive.

2. You can remove jumper W3[3–4]. However, this may be inconvenient and/or impossible if you are making program changes from an off–site location.

Running SETUP Again

1. Make sure you have established a serial link between your PC and the 4010.

2. To execute SETUP which is on the BIOS drive, type:

   ```
   E:SETUP
   ```

   NOTE: The drive designator may vary depending on the hardware configuration of the 4010.

3. Select the “Boot from BIOS drive using ROM–DOS” option.

4. Type:

   ```
   E:RESET
   ```

5. Make the necessary changes to your application and copy the new files to a floppy disk or RAM disk.

6. Rerun DISKSEND and DISKSAVE to save your new files to SSD1. Verify and test your program.

7. Rerun SETUP to change the default boot drive to “SSD1 using ROM-DOS”.

8. Reset the 4010.

Removing Jumper W3[3–4]

If the SETUP program is not accessible from SSD1, you must remove jumper W3[3–4]. This configuration uses video and boots from the BIOS drive using ROM–DOS. COM1 is configured for 9600, N, 8, 1. The following message appears when you reboot the 4010:

```
BIOS boot jumper (W3[3–4]) not installed, boot-
ing from the BIOS drive and ignoring the video
jumper setting.
.
.
4010 C:\>
```

After booting from the BIOS drive, use the DISKSAVE and DISKSEND programs to download new files to SSD1. Before rebooting the 4010, be sure to reinstall jumper W3[3–4] if you want the 4010 to boot a device other than the BIOS drive.

DESCRIPTION

The 4010 has two serial ports that are Intel 8250 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 115.2K.

J1: COM1 and J2: COM2 Serial Ports	
Pin #	**Function**
1	DCD
2	DSR
3	RxD*
4	RTS
5	TxD*
6	CTS
7	DTR
8	RI
9	Gnd
10	+5

* = active low

Use a VTC–9F cable to connect the ports to the external serial equipment. The pinout of the connector allows you to plug the cable directly into a 9–pin PC serial connector. When interfacing the 4010 to your PC, you will need to use a null modem adapter.

COM1 AS CONSOLE I/O

The default settings for the 4010 are as follows:

- W3[1–2] — Video enabled
- W3[3–4] — Boot using parameters defined by SETUP

<table>
<tr><th colspan="3">W3: COM1, Video and BIOS Boot Options</th></tr>
<tr><th>Pins Jumpered</th><th>Video System</th><th>Description</th></tr>
<tr><td>[1-2][3-4]*</td><td rowspan="3">No video card installed in system.</td><td>Video over COM1. System will boot SETUP boot device</td></tr>
<tr><td>[1-2]</td><td>Video over COM1. System will boot BIOS drive.</td></tr>
<tr><td>[3-4]</td><td>No COM1 video available. COM1 available for use in application. System will boot SETUP boot device.‡</td></tr>
<tr><td>[3-4]†</td><td rowspan="2">Video card installed in system.</td><td>Video on CRT. System will boot SETUP boot device.</td></tr>
<tr><td>[3-4] not jumpered†</td><td>Video on CRT. System will boot BIOS drive.</td></tr>
</table>

* = default

† = W3[1-2] is ignored

‡ = If SETUP boot device is BIOS drive, system will use video over COM1.

NOTE: When W3[3–4] is removed, the baud rate defaults to 9600. If a video card is present, jumper W3[1–2] is ignored.

Some programs which access the video memory directly will not work properly on the 4010 without a video card resident. Refer to the DEMO.BAS program on the utility disk for an example of required QuickBASIC modifications. Refer to Chapter 10, “Video/ Keyboard/Speaker” for more information on using a video as the console.

COM1 AS RS–232 I/O

When you have completed developing your application and programmed the 4010, you can use COM1 as an RS–232 serial port for connection to a printer, modem or other serial device. To access COM1 you have two options:

1. Configure the 4010 for no console port by removing jumper W3[1–2] and boot the system from SSD1 or floppy/hard drive (not the BIOS drive). If you do not remove W3[1–2], the BIOS sign on messages will be sent to your printer, modem or other device connected to COM1.

2. Add a video card and monitor to your 4010 system.

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

DISABLING INTERRUPTS

The PC Bus does not allow shared interrupts on the bus. You can, however, disable the COM1 and COM2 interrupts (IRQ4 and IRQ3) to allow for other devices which use these interrupts. If COM1 is the console, its interrupt (IRQ4) is in use. COM2 (IRQ3) is not used by the BIOS. To disable interrupts for COM1, write a 0 to 3FC bit 3. To disable COM2 write a 0 to 2FC bit 3.

NOTE: You can also use different interrupts for COM3 (IRQ11) and COM4 (IRQ10). IRQ9 and IRQ12 are also available. Refer to Appendix B for more information on interrupts.

USING QUICKBASIC TO COMMUNICATE VIA COM1

Several programming languages including QuickBASIC V4.5 assume a video card is present, and for system speed reasons write directly to the video hardware. This 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 V4.5.

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 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. Remove the video jumper W3[1–2].

2. Boot from a drive other than the BIOS drive, e.g. SSD1 with ROM–DOS.

3. 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 COM1 device number.

Method 2

1. Leave the video jumper W3[1–2] on.

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, 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 includes the following to execute a QuickBASIC V4.5 (or other language) application named USECOM1:

   ```
   USECOM1
   COM1CON
   ```

   Then execute TEST.BAT.

Method 3

1. Leave the video jumper W3[1–2] on.

2. Use the PRINTS, PRINTSL, KEYHIT$, INKEY2$ commands as found in the DEMO.BAS and DSQBTEST.BAS programs (included on the utility diskette). 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 2400 baud, 8 data bits, no parity, 1 stop bit.

DESCRIPTION

The watchdog timer is a fail-safe against program crashes or processor lockups. It times out every 1.2 seconds unless reset by the software.

The address for the watchdog timer enable port is 380H. The timer is software disabled when you write a “0” to address 380H. This is the default setting on power–up or reset.

When you want to start using the watchdog timer, write a “1” to address 380H. You must write any data to 201H within the timeout period to prevent the board from resetting. When you write to 201H, the timer resets and begins counting down again. The following table lists the software enable and strobe information:

Watchdog Timer Software & Strobe Addresses	
Enable Base Address 380H	**Strobe Base Address 201H**
Timer disabled = 0* Timer enabled = 1	Write any data to this address to reset timer

* = default

This page intentionally left blank.

DESCRIPTION

The LPT1 parallel port has a 26–pin connector. It can be used to support a number of devices including PC compatible printer, multiline display or matrix keypad.

J5: LPT1 Printer Port		
Pin #	**Function**	
1	Out	STB*
2	Out	AFD*
3	I/O	D0
4	In	ERR*
5	I/O	D1
6	Out	INIT*
7	I/O	D2
8	Out	SLIN*
9	I/O	D3
10	Gnd	Gnd
11	I/O	D4
12	Gnd	Gnd
13	I/O	D5
14	Gnd	Gnd
15	I/O	D6
16	Gnd	Gnd
17	I/O	D7
18	Gnd	Gnd
19	Out	ACK*
20	Gnd	Gnd
21	In	BUSY
22	Gnd	Gnd
23	In	PE
24	Gnd	Gnd
25	In	SLCT
26	+5	+5

* = active low

PRINTER

To install a printer:

1. Connect an Octagon VTC–5/IBM cable from the LPT1 port (J5) to the 25–pin connector on your printer cable.

2. Connect the cable to your printer.

DISPLAY

The LPT1 port supports either 4x20 or 4x40 liquid crystal displays (LCD). To interface the displays to the 4010, use the Octagon 2010 interface board. A CMA–26 cable is required to connect the interface board to the 4010. The program DISPLAY.EXE (found on the 4010 utility disk) provides an easy method to use the display. Please refer to the file DISPLAY.DOC on the utility disk for information on initializing and using the display. Also, refer to the 2010 Product Sheet for information on the interface board. To install a display:

1. Connect a CMA–26 cable from the LPT1 port to J1 on the 2010.

2. Connect the display cable to either the 14–pin or 16–pin header on the 2010. The size of the display will determine which header to use.

3. Refer to the file DISPLAY.DOC for more information on initializing and using the display.

KEYPAD

LPT1 also supports 4x4 matrix keypads. To interface the keypad to the 4010, use the Octagon 2010 interface board. A CMA–26 cable is required to connect the interface board to the 4010. The program DISPLAY.EXE (found on the 4010 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. Also, refer to the 2010 Product Sheet for information on the interface board. To install a keypad:

1. Connect a CMA–26 cable from the LPT1 port to J1 on the 2010.

2. Connect the keypad cable to the 10–pin header on the 2010.

3. Refer to the file DISPLAY.DOC for more information on reading the keypad.

DESCRIPTION

Up to 1792 bytes (that is, 896 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 software interrupt used is INT 17 subfunction 0FEH (read) and INT 17 subfunction 0FFH (write).

READING THE SERIAL EEPROM

The following Borland C example reads word 2:

```
_AH = 0xfe;        /* read */
_BX = 2;           /* index for word in serial EEPROM (0-895)*/
_DX = 0xffff;      /* always set to FFFFH */
geninterrupt(0x17);  /* do interrupt */
EEdata = _AX;  /* serial EEPROM data returned in AX */
```

WRITING TO THE SERIAL EEPROM

The following Borland C example writes 1234H to word 2:

```
_AH = 0xff;        /* write */
_BX = 2;           /* index for word in serial EEPROM (0-895)*/
_CX = 0x1234;  /* Data to write */
_DX = 0xffff;      /* always set to FFFFH */
geninterrupt(0x17);  /* do interrupt */
```

NOTE: During programming of the EEPROM, the power LED may momentarily flash.

This page intentionally left blank.

DESCRIPTION

You can use a video card with a monitor and a keyboard with the 4010 instead of using your PC keyboard and monitor over a serial communications link. The keyboard lines are brought out to a PS–2 type connector. Any PS–2 compatible keyboard may be used.

J3: Keyboard/ Port	
Pin #	**Function**
1	Keyboard data
2	NC
3	Gnd
4	+5V
5	Keyboard clock
6	NC

The speaker is interfaced via a 3–pin connector at J9. You may use any external speaker from 8–50 ohms.

J9: Speaker Connector	
Pin #	**Function**
1	Gnd
2	Speaker data
3	+5V

USING A VIDEO MONITOR AND KEYBOARD

You will need the following equipment (or equivalent) to use your 4010 with a video and keyboard:

4010 PC Control Card
Micro PC Card Cage
Power Module
PC/104 Video Display Module or 54xx Video Card and monitor
AT Compatible Keyboard with PS–2 type connector
VTC–9F Cable
CMA–10 Cable

1. Configure the 4010 for a video card by installing jumper W3[1–2]. Also configure the system to boot from the BIOS drive.

2. Install the PC/104 video display module or 54xx video card and monitor.

3. Connect the keyboard to J3.

4. Install the 4010 and video card into the card cage.

5. Power on the 4010. The BIOS messages should appear on your video monitor:

```
Octagon 4010 BIOS vers x.xx
Copyright (c) 1994 Octagon Systems, Corp.
All Rights Reserved
```

Saving a Program to the 4010

The following steps detail the procedures for transferring files to the 4010 and programming the flash memory in SSD1 using the DISKSEND and DISKSAVE programs. The DISKSAVE program resides on the BIOS drive of the 4010 and the DISKSEND program resides on the 4010 utility disk.

1. Do an XCOPY of the utility disk to your hard drive:

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

2. Change to the 4010 directory to allow access to DISKSEND:

   ```
   CD \MPC\4010
   ```

3. Connect a VTC–9F cable with a null modem adapter between COM1 of your PC to COM1 of the 4010.

4. On the 4010, execute the DISKSAVE program by typing:

   ```
   C>DISKSAVE /DSSD1 /X
   ```

5. From your PC, execute the DISKSEND program by typing:

   ```
   C>DISKSEND \MPC\DEMO
   ```

   The system will then erase and program the flash memory. This will take several minutes.

Transferring Files to the 4010

The following steps detail the procedures for transferring files from your PC to the virtual drive on the 4010. In order to transfer files from your PC to the 4010, you must execute the TRANSFER program from both the 4010 and your PC.

1. Connect a VTC–9F cable with a null modem adapter between COM1 of your PC to COM1 of the 4010.

2. Execute the TRANSFER program from the 4010 to receive a file from your PC.

   `TRANSFER /COM1 /R /V <drive>`*`filename.ext`*

   `<drive>` is the virtual drive on the 4010 where the file will be transferred.

   `filename.ext` is the name of the file on the 4010 which you are receiving 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 4010.

   `TRANSFER /COM1 /S /V <drive><path>`*`filename.ext`* *filename.ext* is the name of the file on the PC which you are sending to the 4010.

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. Example: /B57600.

Transferring Files from the 4010

In order to transfer files from your PC to the 4010, you must execute the TRANSFER program from both the 4010 and your PC.

1. Connect a VTC–9F cable with a null modem adapter between COM1 of your PC to COM1 of the 4010.

2. Execute the TRANSFER program from the 4010 to send a file to your PC.

   `TRANSFER /COM1 /S /V` *filename.ext*

   filename.ext is the name of the file on the 4010 which you are sending 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 4010.

   `TRANSFER /COM1 /R /V` *filename.ext*

   filename.ext is the name of the file on the PC which you are receiving from the 4010.

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. Example: /B57600.

DESCRIPTION

You can use your 4010 Control Card with one or two floppy disk drives and a hard disk drive. This chapter includes installation and operation instructions for each device. Also, refer to the instruction manuals included with each device.

You can boot your 4010 from a floppy or hard disk. However, MEMDRIVE.SYS must be placed in your CONFIG.SYS file in order for the system to access the memory device in SSD1 extended memory and the BIOS drive.

FLOPPY DISK DRIVES

The 4010 supports one or two 3.5 in. or 5.25 in. floppy drives via a 34–position IDC connector at J6. Both floppy drives use DMA channel 2.

Power Requirements

The 4010 requires +5V for operation. If you are using an Octagon 5814 Floppy Disk Drive, power is supplied directly from the floppy port. No external supply is required. If your floppy drive does not support power through the cable, you must supply power through an external source. Additionally, if you are interfacing to 5.25 in. floppy drives, external +12V is required. Refer to your floppy drive manual for specific instructions. Set the jumpers at W1 to specify the floppy drive power source:

WARNING: Jumpering W1 incorrectly will cause a power to ground short when connecting the drive.

W1: Floppy Drive Power Source	
Pins Jumpered	**Description**
Jumpered	Power supplied directly from floppy port. (+5V)
Not Jumpered*	Power supplied to drive through external power cable.

* = default

To install a floppy disk drive:

1. Install the 4010 Control Card.

2. Connect the floppy disk drive cable to J6 on the 4010. If you are using an Octagon 5814 Floppy Disk Drive, power is supplied directly from the floppy port. No external supply is required. If you are using a floppy disk drive other than the Octagon 5814, make sure the drive cable pinouts meet the following requirements:

J6: Floppy Drives			
Pin #	**Function**	**Pin #**	**Function**
1	NC	2	DSEL
3	NC	4	NC
5	NC	6	DRATE
7	+5V or Gnd	8	INDEX*
9	+5V or Gnd	10	MTR2 ON*
11	+5V or Gnd	12	DS1*
13	Gnd	14	DS2*
15	Gnd	16	MTR1 ON*
17	Gnd	18	DIR IN*
19	Gnd	20	STEP*
21	Gnd	22	WR DATA*
23	Gnd	24	WR GATE*
25	Gnd	26	TRK 00*
27	Gnd	28	WRITE PROTECT*
29	Gnd	30	RD DATA*
31	Gnd	32	SIDE 1*
33	Gnd	34	DISK CHANGE

* = active low

3. Run SETUP to set the number of floppy drives and their size.

   NOTE: Two drive designators will be assigned regardless of how many drives you specify in SETUP.

4. When booting from all modes except "SSD1 using your own DOS", the floppy drives are A: and B:.

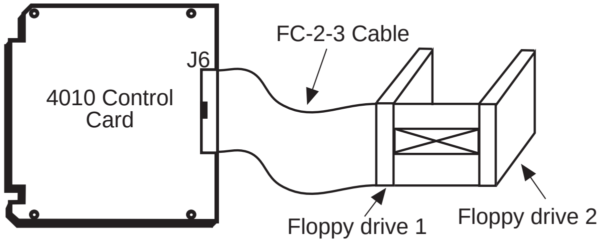

Figure 11–1—Two Floppy System

When you boot from SSD1 using your own DOS, only one floppy drive will be available, since DOS thinks that SSD1 is floppy drive A. Connect your floppy disk drive to the second floppy cable connector and access it with B:.

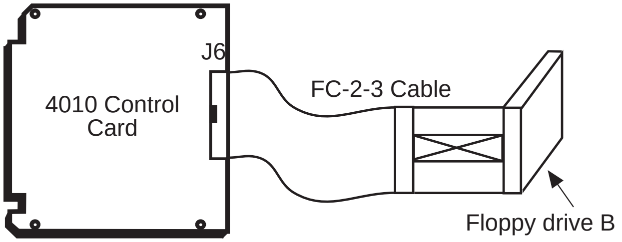

Figure 11–2—One Floppy System With User Supplied DOS

5. If, in SETUP, you entered 0 drives, access to either A or B will immediately generate an error message:

   ABORT RETRY FAIL?

   Press <A> or <F> to cancel your request. Run SETUP and change the number of floppy drives to the correct setting.

If, in SETUP, you entered 1 drive, you can access drive A. Request to access drive B results in the following prompt:

```
INSERT FLOPPY INTO DRIVE B AND PRESS ANY KEY
```

Insert another floppy disk and press a key. The program then accesses your one drive as drive B. When another request for drive A occurs, a prompt gives you the opportunity to replace the original A floppy. In this way, systems with only one drive can copy files from one floppy to another.

If, in SETUP, you entered 2 drives, access to either drive A or drive B work just as they would in a PC.

If you want to boot from the floppy disk using your own DOS, refer to Chapter 13, Using Your Own DOS.

HARD DISK DRIVE

The 4010 supports one standard 16–bit AT IDE hard drive. Connector J8 is a 44–pin connector which supports 2.5 in. hard drives. The hard drive BIOS is included in the 4010 BIOS.

To install a hard drive:

1. Connect the hard drive cable to J8 on the 4010 using a 44–pin connector. Make sure the drive cable pinouts meet the following requirements:

J8: Hard Drive			
Pin #	**Function**	**Pin #**	**Function**
1	RESET*	2	Gnd
3	DATA 7	4	DATA 8
5	DATA 6	6	DATA 9
7	DATA 5	8	DATA 10
9	DATA 4	10	DATA 11
11	DATA 3	12	DATA 12
13	DATA 2	14	DATA 13
15	DATA 1	16	DATA 14
17	DATA 0	18	DATA 15
19	Gnd	20	KEY
21	Reserved	22	Gnd
23	IOWR*	24	Gnd
25	IORD*	26	Gnd
27	NC	28	BALE
29	NC	30	Gnd
31	IRQ 14	32	IO16*
33	ADDR1	34	NC
35	ADDR0	36	ADDR2
37	HCSO*	38	HCSI*
39	LED	40	Gnd
41	+5 LOGIC	42	+5 MOTOR
43	Gnd	44	NC

* = active low

Power Requirements

5V is supplied from the 4010 to the hard drive through the disk drive cable.

You can use a video monitor and a keyboard with the 4010 via the PC/104 connector. This connector allows you to interface to a variety of PC/104 form factor modules including video, analog I/O, floppy/hard disks, etc. These modules can be stacked on top of the 4010 to form a highly integrated control system.

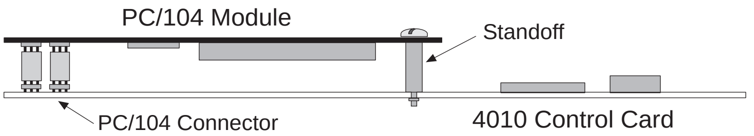

Figure 12–1—Typical PC/104 Module Stack

This page intentionally left blank.

DESCRIPTION

Use these instructions instead of those in Chapter 2 if you are using your own DOS and not the ROM–DOS installed on the BIOS drive. You can boot from SSD1 or a floppy/hard disk when you use your own DOS. Initially, you will need to boot from the BIOS drive so that you can run SETUP and specify your system parameters, including where you want to boot from.

GETTING STARTED

1. Verify that power to the card cage is OFF and install your 4010 Control Card and peripheral equipment, except for the video card.

   WARNING: Plugging the card in backwards will destroy the card!

2. Install memory devices in SSD1 if it isn't already in place. To install memory devices refer to Chapter 3, "EPROMs".

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

   ```
   Octagon 4010 BIOS vers x.xx
   Copyright (c) 1994 Octagon Systems, Corp.
   All Rights Reserved
   ```

   If you don't get the proper logon message:

   - Remove W3[3–4]. If using COM1 as the console, check the serial parameters of your PC to make sure they are set correctly. The parameters should be 9600 baud, 8 data bits, no parity, and 1 stop bit.

   - Make sure a video card is not installed.

   - If the parameters are set correctly and the system still does not respond, refer to Chapter 14, Troubleshooting.

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

   ```
   DIR <return>
   ```

   A directory listing of ROM–DOS files stored in the BIOS socket should appear (this is drive C:).

5. You are now ready to run SETUP to select boot, memory and drive options.

SELECTING BOOT, MEMORY, AND DRIVE OPTIONS

You must specify your system's parameters before you can save and run programs with the 4010 card. You define parameters by running the SETUP program. For a complete list of the options included in SETUP, please refer to Chapter 4, SETUP. As shipped, the BIOS drive is selected as the default boot device.

Booting the 4010 from a Floppy/Hard Disk Drive

1. Type:

   ```
   SETUP
   ```

2. Select the answer to each question by pressing the space bar until the correct information appears, then press <ENTER>. Press <ESC> if you want to exit SETUP without saving your answers (or changes to the answers).

   When you reach the "Boot from" option, press the spacebar until "Floppy or Hard Disk" appears then press <RETURN> until SETUP is complete. Make sure the floppy number and size and/or hard drive parameters are correct.

3. After completing the information for SETUP, insert your bootable disk (which contains your DOS) into the floppy disk drive or add a bootable IDE hard drive.

4. Reboot the system by typing:

```
RESET
```

Booting from SSD1 with/without a Floppy Drive

1. Create a bootable floppy disk on your PC and copy your DOS version of COMMAND.COM, all device drivers and necessary application files onto the floppy.

2. Copy the file DISKSEND.EXE from the 4010 utility disk to your PC. Make sure the file is in your DOS PATH or current directory.

   The two programs, DISKSAVE and DISKSEND, transfer and save the files on the floppy disk to SSD1. The DISKSAVE program resides on the BIOS drive of the 4010 and the DISKSEND program resides on the 4010 utility disk.

3. Establish a serial communications link between your PC and the 4010.

   NOTE: If you are using COM2 on your PC, you must use the /C2 switch with DISKSEND. Refer to the DISKSEND section in Appendix A for more information. Also, if you cannot communicate at 38400 baud, use the /Bxxx switch on both DISKSAVE and DISKSEND.

4. On the 4010, execute the DISKSAVE program by typing:

   ```
   A>DISKSAVE /DSSD1 /X
   ```

   The systems displays the following message:

   ```
   Attempting connection with DISKSEND on remote
   host.
   ```

5. If you are using PC SmartLINK IV, use the following steps. For other communication programs, skip to step 6.

   PC SmartLINK IV:

   - Press F9 or <ALT> + <X>

6. From the DOS command line, type the following:

   ```
   C>DISKSEND /FA
   ```

7. The system then erases and programs the flash memory. This may take several minutes.

   Restart PC SmartLINK.

8. Type:

   ```
   RESET
   ```

9. Display and verify the contents of SSD1:

   ```
   DIR E:
   ```

10. Run SETUP and change your selection of the Boot options to:

    ```
    SSD1 using User supplied DOS
    ```

11. Install jumper W2[3–4] and reboot your system by typing:

    ```
    RESET
    ```

If your system is not working properly, check the following items:

No Screen Activity – Checking Serial Communications for Console

If you do not get the sign–on message after bootup:

1. Make sure all cards except the 4010 card are removed from the card cage. This ensures that other cards are not interacting with the 4010 and that a video card is not installed.

2. Install W3[1–2] or remove W3[3–4].

3. The VTC–9F serial cable turns the 4010 Control Card serial port into a 9–pin AT serial port. Make sure a null modem adaptor 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 J1 on the Control Card.

4. Make sure your power module provides +5V (+/–0.25V).

5. After verifying the above conditions, you can monitor voltage levels by connecting an oscilloscope between the TxD* line on J1 (pin 5) and ground. After power–up, you should see a burst of activity on the oscilloscope screen. The voltage level should switch between +/–8V.

Garbled Screen Activity

If you do get activity on your screen but the message is garbled, check the following:

1. Remove W3[3–4] to force 9600, N, 8, 1 for COM1.

2. 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.

3. 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 4010 Control Card: 9600 baud, 8 bits, 1 stop bit, no parity.

System generates a BIOS message but locks up when booting from SSD1:

1. Remove W3[3–4] to force booting from the BIOS drive.

2. Press the reset button and reboot. Then note the drive designator for SSD1.

3. Display the directory of SSD1 and verify that all the necessary boot files exist. Copy any missing files to the floppy disk and re-execute DISKSEND and DISKSAVE.

4. If no files are missing, remake SSD1 to overwrite any files which may have become corrupted.

System boots from BIOS drive even though I specified boot from SSD1 using ROM–DOS:

1. Make sure SSD1 is programmed.

Booting from SSD1 with user-supplied DOS doesn't work:

1. If you made SSD1 using a floppy drive, test that you can boot using that disk on the floppy drive of your PC. Also, make sure all the necessary boot files are present.

Cannot save programs to flash memory

1. Make sure the EPROM is installed in SSD1 correctly and that there are no bent pins. Also, make sure that jumper W8 is set up correctly.

MEMDRIVE.SYS reports device not present with new flash memory installed.

1. You must program the EPROM using DISKSEND and DISKSAVE. Refer to Chapter 5, “Save and Run Programs”.

MEMDRIVE.SYS reports smaller size disk than device will hold in SSD1.

1. The size of the solid state disk generated with DISKSAVE.EXE is made only as large as required to minimize programming time.

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, please call 303–426–4521.

This page intentionally left blank.

TECHNICAL SPECIFICATIONS

CPU
80C386SX
80486SLC

Clock
12.5 or 25 MHz, 25 MHz is default; software selectable

BIOS
AT compatible with industrial extensions with the following exceptions:
- Uses 8–bit bus
- DMA 16–bit channels not available except via PC/104

Interrupts
IRQ3 & IRQ4 on bus are jumperable between 3 & 4 or 10 & 11 on–card.

DRAM
512K or 2 MB options. DRAM is soldered onto the card.

Solid–State Disk 1
Supports 128K or 512K, 5V only, flash memory for application program. Programmer built–in. Supports 512K or 1 MB EPROMs.

ROM–DOS
Combined with BIOS ROM; DOS 5.0 compatible.

Serial I/O
COM1 and COM2 are 8250 compatible

Printer Interface
LPT1 is PC compatible.

Power Requirements
4010-386-25MHz:
5V at 275 mA typical (512K); 5V at 285 mA typical (2 MB)

4010-486-25MHz:
5V at 885 mA typical (2 MB)

Environmental Specifications
–40° to 85° C operating
–55° to 90° C nonoperating
RH 5% to 95%, noncondensing

Size
4.5 in. x 4.9 in.

Watchdog Timer
Default timeout is 1.2 seconds, software enabled and strobed. Disabled on power–up and reset. Address of the enable timer is 380H; address of strobe is 201H.

Memory Map

4010 Memory Map	
Address	**Description**
00000-9FFFFH	System Memory
A0000-CFFFFH	Off-card memory
D0000-DFFFFH	SSD1/Switchable to off-card
E0000-EFFFFH	BIOS drive (optionally off-card with BIOS loaded high)
F0000-FFFFFH	DOS kernal & BIOS

I/O Map

4010 I/O Map	
Hex Range	**Function**
0000-00FFH	Core logic I/O functions
0100-01EFH	Off card
01F0-01F7H	Hard disk interface
01F8-0200H	Off card
0201-0207H	Watchdog strobe
0208-020FH	Bit port
0208H	Serial EEPROM CS
0209H	Serial EEPROM Data input
020AH	Serial EEPROM Clock
020BH	Serial EEPROM program enable
020CH	Not used
020DH	Not used
020EH	RS-232 charge pump powerdown
020FH	SSD bank switch A19
0210-02F7H	Off card
02F8-02FFH	COM2 serial port
0300-0377H	Off card
0378-037FH	LPT1 printer port
0380-0387H	Bit port
0380H	Watchdog enable
0381H	Not used
0382H	SSD bank switch A16
0383H	SSD bank switch A17
0384H	SSD bank switch A18
0385H	Not used
0386H	Power LED switch
0387H	SSD socket enable
0388-03EFH	Off card
03F0-03F7H	Floppy disk interface
03F8-03FFH	COM1 serial port

JUMPER SETTINGS

W1: Floppy Drive Power Source	
Pins Jumpered	**Description**
Jumpered	Power supplied to drive through Octagon FC-2-3 cable. (+5V)
Not Jumpered*	Power supplied to drive through external power cable.

* = default

W3: COM1, Video and BIOS Boot Options		
Pins Jumpered	**Video System**	**Description**
[1-2][3-4]*	No video card installed in system.	Video over COM1. System will boot SETUP boot device
[1-2]		Video over COM1. System will boot BIOS drive.
[3-4]		No COM1 video available. COM1 available for use in application. System will boot SETUP boot device.‡
[3-4]†	Video card installed in system.	Video on CRT. System will boot SETUP boot device.
[3-4] not jumpered†		Video on CRT. System will boot BIOS drive.

* = default

† = W3[1-2] is ignored

‡ = If SETUP boot device is BIOS drive, system will use video over COM1.

W4: Interrupt Select		
Pins Jumpered	**Bus IRQ**	**CPU IRQ**
[1-2]	IRQ4	IRQ11
[3-4]*	IRQ4	IRQ4
[5-6]	IRQ3	IRQ10
[7-8]*	IRQ3	IRQ3

* = default

NOTE: IRQ6 on bus is tied to IRQ12 on the CPU.

W8: SSD1 Memory Device Select	
Pins Jumpered	**Description**
[1-3][2-4]	Flash memory*
[3-5][4-6]	EPROM

* = default

CONNECTOR PINOUTS

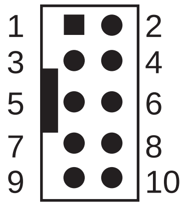

Figure 15–1—Typical 10–pin IDC Connector

J1: COM1 and J2: COM2 Serial Ports	
Pin #	**Function**
1	DCD
2	DSR
3	RxD*
4	RTS
5	TxD*
6	CTS
7	DTR
8	RI
9	Gnd
10	+5

* = active low

J3: Keyboard/ Port	
Pin #	**Function**
1	Keyboard data
2	NC
3	Gnd
4	+5V
5	Keyboard clock
6	NC

J4: Battery Connector	
Pin #	**Function**
1	+Battery
2	NC
3	Gnd
4	Gnd

J5: LPT1 Printer Port		
Pin #	**Function**	
1	Out	STB*
2	Out	AFD*
3	I/O	D0
4	In	ERR*
5	I/O	D1
6	Out	INIT*
7	I/O	D2
8	Out	SLIN*
9	I/O	D3
10	Gnd	Gnd
11	I/O	D4
12	Gnd	Gnd
13	I/O	D5
14	Gnd	Gnd
15	I/O	D6
16	Gnd	Gnd
17	I/O	D7
18	Gnd	Gnd
19	In	ACK*
20	Gnd	Gnd
21	In	BUSY
22	Gnd	Gnd
23	In	PE
24	Gnd	Gnd
25	In	SLCT
26	+5	+5

* = active low

J6: Floppy Drives			
Pin #	**Function**	**Pin #**	**Function**
1	NC	2	DSEL
3	NC	4	NC
5	NC	6	DRATE
7	+5V or Gnd	8	INDEX*
9	+5V or Gnd	10	MTR2 ON*
11	+5V or Gnd	12	DS1*
13	Gnd	14	DS2*
15	Gnd	16	MTR1 ON*
17	Gnd	18	DIR IN*
19	Gnd	20	STEP*
21	Gnd	22	WR DATA*
23	Gnd	24	WR GATE*
25	Gnd	26	TRK 00*
27	Gnd	28	WRITE PROTECT*
29	Gnd	30	RD DATA*
31	Gnd	32	SIDE 1*
33	Gnd	34	DISK CHANGE

* = active low

J7: PC/104 Bus Signal Assignments				
Pin #	**Row A**	**Row B**	**Row C**	**Row D**
0	--	--	OV	0V
1	IOCHCK*	0V	SBHE*	MEMCS16*
2	SD7	RESETDRV	LA23	IOCS16*
3	SD6	+5V	LA22	IRQ10
4	SD5	IRQ9	LA21	IRQ11
5	SD4	-5V	LA20	IRQ12
6	SD3	DRQ2	LA19	IRQ15
7	SD2	-12V	LA18	IRQ14
8	SD1	0WS*	LA17	DACK0*
9	SD0	+12V	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	0V
19	SA12	REFRESH*	(KEY)	0V
20	SA11	SYSCLK	--	
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	--	
30	SA1	OSC	--	
31	SA0	0V	--	
32	0V	OV	--	

* = active low

J8: Hard Drive			
Pin #	**Function**	**Pin #**	**Function**
1	RESET*	2	Gnd
3	DATA 7	4	DATA 8
5	DATA 6	6	DATA 9
7	DATA 5	8	DATA 10
9	DATA 4	10	DATA 11
11	DATA 3	12	DATA 12
13	DATA 2	14	DATA 13
15	DATA 1	16	DATA 14
17	DATA 0	18	DATA 15
19	Gnd	20	KEY
21	Reserved	22	Gnd
23	IOWR*	24	Gnd
25	IORD*	26	Gnd
27	NC	28	BALE
29	NC	30	Gnd
31	IRQ 14	32	IO16*
33	ADDR1	34	NC
35	ADDR0	36	ADDR2
37	HCSO*	38	HCSI*
39	LED	40	Gnd
41	+5 LOGIC	42	+5 MOTOR
43	Gnd	44	NC

* = active low

J9: Speaker Connector	
Pin #	**Function**
1	Gnd
2	Speaker data
3	+5V

MICRO PC BUS PINOUTS

Micro PC "A"					
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

Micro PC "B"					
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	-5V	Not used	B21	IRQ7	I
B6	DRQ2	I	B22	IRQ6	I
B7	-12V	Not used	B23	IRQ5	I
B8	Reserved	Not used	B24	IRQ4	I
B9	+12V	Not used	B25	IRQ3	I
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

INTRODUCTION

The 4010 ROM–DOS and Software Utility Disk comes with the utilities listed below. Some of these utilities are also available on the 4010 BIOS drive. This appendix describes the utilities and their use.

Support commands:

COM1CON.COM
DISKSAVE.EXE
DISKSEND.EXE
FAST.COM
LPT1CON.COM
RESET.COM
SETUP.COM
SLEEP.COM
SLOW.COM
TRANSFER.EXE

Support device drivers:

MEMDRIVE.SYS

NOTE: Other utilities are included from ROM–DOS and are not mentioned in this section. Please refer to your ROM–DOS manual.

COM1CON.COM

COM1CON.COM	Support Command
PURPOSE:	Redirects video to the COM1 port when you have a video card and monitor installed in your system and restores COM1 serial parameters.
SYNTAX:	**COM1CON**
REMARKS:	Execute COM1CON from the command line. When you are finished using the console port, reset your system. After boot-up, the system reverts to using the video card and monitor. Also, some programming languages may not restore the serial parameters after using the COM1 port. COM1CON.COM will restore the COM1 port as the console. You must include your program and COM1CON in a batch file and then execute the batch file to restore the console.
SEE ALSO:	LPT1CON.COM

DISKSAVE.EXE

DISKSAVE.EXE: Support Command

PURPOSE: To program a disk into SSD1 (5V-FLASH MEMORY) or to create disk image files for SSD1 (EPROM).

SYNTAX: **DISKSAVE** [/**D***y*] [/**S***s*] [/**I**] [/**F***d* | *path* | *filespec* | /**X** [/**C***c*] [/**B***b*]]

PARAMETERS:

/**D***y* specifies the destination device to be programmed. Currently, *y* can be SSD1. The default is SSD1.

/**S***s* specifies the output is an image file and specifies the size of the EPROM to be programmed. *s* can be either 512K or 1M. The default is 512K.

/**I** specifies the source for programming to be an image file.

/**F***d* specifies the source for programming to be a local drive. The disk image of the specified drive is used. *d* can be any DOS drive letter.

path specifies the source for programming to be a local tree of files.

filespec specifies the full path name of the image file to be used with the /**I** option.

/**X** specifies the source for programming is done through communication over a serial link connecting the 4010 to a remote host system running DISKSEND.EXE.

/C*c* specifies the COM port *c* to be used. Use /**C** only when /**X** is used. *c* can be 1, 2, 3 or 4. The default is 1.

/B*b* specifies the baud rate *b* to be used. Use /**B** only when /**X** is used. *b* can be 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200. The default is 38400.

EXAMPLE 1: To program SSD1 from local drive A, enter:

```
DISKSAVE  /FA  /DSSD1
```

EXAMPLE 2: To program SSD1 from local subdirectory C:\DEMO\TEST, enter:

```
DISKSAVE  C:\DEMO\TEST  /DSSD1
```

EXAMPLE 3: To program SSD1 from remote drive A, first enter the following command on the 4010:

```
DISKSAVE  /X  /DSSD1
```

Then enter the following command on the remote host system:

```
DISKSEND  /FA
```

EXAMPLE 4: To program SSD1 from a remote subdirectory C:\DEMO through COM2 at baud rate 9600, first enter the following command on the 4010:

```
DISKSAVE  /X  /DSSD1  /C2  /B9600
```

Then enter the following command on the remote host system:

```
DISKSEND  C:\DEMO  /B9600
```

EXAMPLE 5: To create a 1 MB image file for the SSD1 EPROM from local drive A, enter:

```
DISKSAVE  /FA  /DSSD1  /S1M
```

EXAMPLE 6: To create a 512K image file for SSD1 from a local subdirectory named C:\TEST, enter:

```
DISKSAVE  C:\TEST  /DSSD1  /S512K
```

EXAMPLE 7: To program SSD1 from an image file C: \TEST\SSD1.IMG, enter:

```
DISKSAVE /I /DSSD1  C:\TEST\SSD1.IMG
```

REMARKS: When the /**F***d* option is used, the drive specified must have a sector size of 512 bytes. Both 1.44M and 720K floppies have a sector size of 512 bytes.

To program an SSD which boots from a user-supplied DOS or full ROM–DOS, the source must be a bootable drive (use the /**F***d* option) from either a remote or local system.

When a subdirectory path is used as input to DISKSAVE.EXE, DISKSAVE creates a temporary file in the currect directory. Consequently, the current directory cannot be included in the specified path and must not be write-protected.

The filename of the image file created for the SSD1 EPROM is SSD1.IMG.

The size of the solid state disk generated with DISKSAVE.EXE is made only as large as required to minimize programming time.

SEE ALSO: DISKSEND.EXE, TRANSFER.EXE

DISKSEND.EXE

DISKSEND.EXE: Support Command

PURPOSE: To send a disk image through a serial link to the DISKSAVE.EXE program running on the 4010.

SYNTAX: **DISKSEND** [/**F***d* | *path*] [/**C***c*] [/**B***b*]

PARAMETERS: /**F***d* specifies the source for programming to be the local drive. The disk image of the specified drive is used. *d* can be any DOS drive letter. Use /**F***d* when not using path.

path specifies the source for programming to be a local tree of files. Use *path* when not using /**F***d*.

/**C***c* specifies the COM port *c* to be used. Use /**C** only when /**X** is used. *c* can be 1, 2, 3 or 4. The default is 1.

/**B***b* specifies the baud rate *b* to be used. Use /**B** only when /**X** is used. *b* can be 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200. The default is 38400.

EXAMPLE 1: To send a local disk image (that is to be programmed into SSD1) through the serial link to the 4010 running DISKSAVE.EXE, first enter the following command on the 4010:

```
DISKSAVE  /X  /DSSD1
```

Then enter the following command at the host system:

```
DISKSEND  /FA
```

EXAMPLE 2: To send the image of floppy drive A via COM2 at the host system, that is to be programmed into SSD1 via COM1 at the 4010, first enter the following command on the 4010:

```
DISKSAVE  /X  /DSSD1  /C1
```

Then enter the following command at the host system:

```
DISKSEND  /C2  /FA
```

REMARKS: When DISKSAVE.EXE is used in conjunction with DISKSEND.EXE, the /**X** option must be used.

When the /**F***d* option is used, the drive specified must have a sector size of 512 bytes. Both 1.44M and 720K floppies have a sector size of 512 bytes.

To program an SSD which boots from a user-supplied DOS or full ROM–DOS, the source must be a floppy drive (use the /**F***d* option).

The size of the disk image generated with DISKSEND.EXE that was sent over the serial link is made only as large as required to minimize transfer and programming time.

SEE ALSO: DISKSAVE.EXE, TRANSFER.EXE

FAST.COM

FAST.COM Support Command

PURPOSE: To change CPU clock speed from 12.5 MHz to 25 MHz for the 4010.

SYNTAX: **FAST**

REMARKS: Enter the following command to change to the 25 MHz clock speed during system bootup for the 4010:

FAST

You can also enter <CTL><ALT><+> to switch to 25 MHz if you are using a keyboard and monitor with the 4010.

The default speed is **fast** after a reset.

LPT1CON.COM

LPT1CON.COM Support Command

PURPOSE: Redirects the video to the LPT1 port.

SYNTAX: **LPT1CON**

REMARKS: If you have an LCD-IFB or DP-IFB interface board and a display connected to LPT1, executing the DISPLAY.EXE and LPT1CON.COM programs allow you to use the display as the system console. You must reset your system to change the video to the original parameters.

SEE ALSO: COM1CON.COM, DISPLAY.DOC on the utility disk

MEMDRIVE.SYS

MEMDRIVE.SYS Device Driver

PURPOSE: This device driver is used when the user wishes to access the on–card SSDs or virtual drives.

SYNTAX: **MEMDRIVE**

REMARKS: The following CONFIG.SYS entries allow the user to access on–card SSDs:

`DEVICE=MEMDRIVE.SYS BIOS`	Accesses BIOS Drive
`DEVICE=MEMDRIVE.SYS SSD1`	Accesses SSD1

This driver first looks at the SSD to see if it looks like a valid disk. If it does, the system assigns a drive letter, after which time you can access the device as a normal disk. The drive letter for the virtual drive is dependent on the order of the devices listed in the CONFIG.SYS file. If the driver does not see a valid device, it will do one of the following:

Flash memory: If the system does not find a valid disk (i.e., a flash memory which has been programmed with DISKSAVE/ DISKSEND) it displays the following message:

```
4010 MEMDRIVE.SYS V1.2, memory
device not found in SSD1.
```

NOTE: When booting from SSD1, you do not need a MEMDRIVE SSD1 entry in your CONFIG.SYS file.

NOTE: The SSD2 device type must be set to the proper device before MEMDRIVE.SYS will access it.

The following CONFIG.SYS entries allow the user to access part of the memory normally used by the computer for executing programs as a RAM disk. This RAM disk is initialized whenever the system is reset. For some DOS systems, this is often called a virtual drive. The default size for this drive is 128K. The size can be modified.

```
DEVICE=MEMDRIVE.SYS BASE nnn
```

Base memory (allocates nnnK)

```
DEVICE=MEMDRIVE.SYS BASE nnn /NOIFEMS
```

Base memory (allocates nnnK) but only on systems with less than 1 MB

The /NOIFEMS switch is optional. If it is included on 2 MB systems, the virtual drive will **not** be available. For 512K systems, the virtual drive is always available. These drives are always formatted on reset. Once the virtual drive is defined, it can be accessed as any other disk.

At boot–up, if the virtual drive is specified, the following message displays:

```
4010 MEMDRIVE.SYS V1.2 formatting
(136KB) drive in DOS memory as drive D:
```

The following CONFIG.SYS entries allow the user to access EMS memory. This is the memory above the 640K DOS memory limit.

```
DEVICE=MEMDRIVE.SYS EMS
```

All extended memory as a drive

```
DEVICE=MEMDRIVE.SYS EMS mmm sss
```

Extended memory as a drive of size mmmK. Starting address at 16K page # sss.

sss: 0 = start addr. 1MB
sss: 1 = start addr. 1MB+16K
sss: 2 = start addr. 1MB+32K

NOTE: Use ROM-DOS VDISK.SYS /e instead of MEMDRIVE.SYS EMS when using ROM-DOS HIMEM.SYS and/or DOS=HIGH. For example:

```
device=HIMEM.SYS
device=VDISK.SYS 512 /e
dos=high
```

See the ROM-DOS manual for more information.

The size of the virtual drive depends on the amount of DRAM in your system:

EMS Virtual Drives	
DRAM Installed	**Virtual Drive Size***
512K	0
2 MB	1024K

*Size assumes the BIOS drive is loaded low. Subtract 128K to obtain the virtual drive size if the BIOS drive is high.

RESET.COM

RESET.COM Support Command

PURPOSE: To enable the watchdog timer and allow timeout to expire, thus restarting the system.

SYNTAX: **RESET**

REMARKS: The RESET command also restarts all the expansion I/O cards on the bus. This differs from a <CTL><ALT><DEL> reboot of the system which only restarts the system but not the expansion cards. The RESET button on the 4010 also accomplishes the same thing as the RESET command.

SETUP.COM

SETUP.COM Support Command

PURPOSE: Modifies date and/or time for battery–backed clock, and modifies serial port parameters.

SYNTAX: **SETUP**

REMARKS: From the directory where this utility file is located, type:

```
SETUP <RET>
```

After the copyright message displays, the main menu appears:

```
OCTAGON SYSTEMS CORPORATION
4010 SETUP UTILITY V3.2
---------------------------
(Press SPACE to CHANGE, ENTER to
ACCEPT, ESC to EXIT)

COM1 Console baud rate:      1200
                     2400
                     4800
                     9600
                     19200
                     38400
                     57600

Power on memory test:Enabled
                     Disabled

SSD1 Device       none
                  128K 5V FLASH
                  (29F010)
                  512K 5V FLASH
                  (29F040)
                  EPROM (27C0X0)
```

```
Boot from:   BIOS drive using ROM–
             DOS
             SSD1 using ROM–DOS
             Floppy or Hard drive
             SSD1 using user sup-
             plied DOS

Number of floppy drives:0
                        1
                        2

Floppy drive 1 size:    360K
                        1.2 MB
                        720K
                        1.44 MB

Shadow 0C000H–0C7FFH:   Yes
                        No

Shadow 0C700H–0CFFFH:   Yes
                        No

Move BIOS DRIVE high:   Yes
                        No

Number of line printers:Auto Check
                        0
                        1
                        2
                        3

Number of hard drives:  0
                        1
                        2

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

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.
```

SLEEP.COM

SLEEP.COM Support Command

PURPOSE: To conserve CPU power consumption.

SYNTAX: **SLEEP**

REMARKS: The command puts the processor in “sleep” mode, thus using less power. An interrupt awakens the processor and lets it resume its activities. The DOS clock is stopped while in sleep mode. The 18.2 per second timer tick is disabled during this time. All other interrupts (i.e., serial and keyboard) are left enabled. When the processor is awakened via an interrupt (usually via COM1 or keyboard), the timer tick is reenabled and the DOS time is updated from the CMOS clock.

SLOW.COM

SLOW.COM Support Command

PURPOSE: To change CPU clock speed from 25 MHz to 12.5 MHz for the 4010.

SYNTAX: **SLOW**

REMARKS: Enter the following command from the DOS prompt or in a batch file to change to the 12.5 MHz clock speed for the 4010:

```
SLOW
```

You can also press <CTL><ALT><–> to change to 12.5 MHz if you are using a keyboard and monitor with the 4010.

SEE ALSO: FAST.COM

TRANSFER.EXE

TRANSFER.EXE Support Command

PURPOSE: To transfer files to or from the 4010 over a serial port.

SYNTAX: **TRANSFER** *filepath* [/**S** | /**R**] [/**B***b*] [/**V**] [/**COM***c*]

PARAMETERS: *filepath* specifies the file pathname to send or receive.

SWITCHES: /**S** specifies to send the file.

/**R** specifies to receive the file. This is the default.

/**B***b* specifies baud rate of transfer where *b* can be (300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115 (115200)). The default is 9600 when using a /**COM***c* switch. If COM1 is the console, the baud rate defaults to the current console baud rate.

/V enables the display of “R” when a block (128 bytes) is received, or “T” when a block is transmitted.

NOTE: Do not use **/V** when COM1 is the console device.

/**COM***c* specifies the serial port to use. *c* can be 1-4. The default is 1.

EXAMPLE 1: To send a file named C:\MPC\DEMO\DEMO.EXE on the 4010 when using COM1 as the console, enter the following command:

```
TRANSFER D:DEMO.EXE
```

On the remote PC executing SmartLINK, press <ALT> <D>, type C:\MPC\DEMO\DEMO.EXE, and then press ENTER.

EXAMPLE 2: To send a file named D:DEMO.BAS to the file C:\TEST.BAS on the remote PC when using COM1 as the console, enter the following on the 4010:

```
TRANSFER /S D:DEMO.BAS
```

On the remote PC executing SmartLINK, press <ALT> <U>, type C:\TEST.BAS, and then press <ENTER>.

EXAMPLE 3: To send a file named C:\DEMO\DEMO.EXE from a remote PC to the file named D:\DEMO.EXE on the 4010 at 57600 baud with a serial cable from COM2 on the remote PC and COM1 on the 4010, enter the following command on the 4010:

```
TRANSFER  D:\DEMO.EXE /R /V /B57600
```

Then enter the following command on the remote PC:

```
TRANSFER  C:\DEMO\DEMO.EXE /S /V
/COM2 /B57600
```

To receive a file named D:\MYAPP.EXE from the 4010 and name it C:\APPS\MYAPP2.EXE on the remote PC over a serial cable connected to COM1 on both systems at 9600 baud, enter the following command on the 4010:

```
TRANSFER  D:\MYAPP.EXE /S
```

Then enter the following command on the remote PC:

```
TRANSFER  C:\APPS\MYAPP2.EXE
```

REMARKS: The TRANSFER command communicates with other XMODEM compatible file transfer programs.

The serial port on the 4010 requires a null modem adapter when connected to a serial port on the remote PC. See the section, *Serial Port*, in this manual for more information.

The maximum baud rate is dependent on the processor speeds of the remote PC and the 4010.

The received file size is rounded up to the nearest 128 byte boundary.

SEE ALSO: DISKSAVE.EXE, DISKSEND.EXE

APPENDIX B

PROGRAMMING STANDARD EPROMS

The 4010 SSD1 socket accepts EPROMs as well as flash memory. You must program the EPROM before installing it on the 4010 card, since there is no on–card programmer.

To program an EPROM

1. Depending upon the type of image file you want to create, do one of the following:

   A. To create a 1 MB image file for the SSD1 EPROM from local drive A, enter:

   ```
   DISKSAVE  /FA  /DSSD1  /S1M.
   ```

   B. To create a 512K image file for SSD1 from a local subdirectory named C:\TEST, enter:

   ```
   DISKSAVE  C:\TEST  /DSSD1  /S512K
   ```

2. Install the EPROM into the programmer and program the chip using the file SSD1.IMG.

CUSTOM COMMUNICATION CABLE

The 4010 card requires an RS–232 serial communications cable to interface to the PC. If you are not using a VTC series cable, you can make your own communications cable.

NOTE: This is a null modem cable. RxD and TxD are crossed.

1. Determine if your PC requires a male or female connector.

2. Refer to the following table for cable connections for the 4010:

Custom RS-232 Cable				
COM1/COM2	**Micro PC Signal Direction**	**DB-25**	**DB-9**	**PC Signal**
1	DCD Input	8	1	DCD
2	DSR Input	6	6	DSR
3	RxD Input	2	3	TxD
4	RTS Output	4	7	RTS
5	TxD Output	3	2	RxD
6	CTS Input	5	8	CTS
7	DTR Output	20	4	DTR
8	RI Input	22	9	RI
9	Gnd	7	5	Gnd
10	+5	NC	NC	

POWER SUPPLY

If using a switching power supply, make sure you meet minimum load requirement for the power supply.

UPLOADING FILES FROM THE 4010

The TRANSFER program is also used to upload files from the 4010 card to your PC for editing or debugging. To upload a file:

1. Make sure a serial link is established between your PC and the 4010.

2. Start PC SmartLINK on your PC.

3. From the 4010 type:

```
A:TRANSFER /s D:DEMO.EXE
```

Refer to the *PC SmartLINK User's Manual* for information on transferring files using the XMODEM protocol.

ASSIGNING DRIVE DESIGNATORS

ROM–DOS is a MS–DOS version 5.0 compatible operating system. Since it is stored in ROM, it is always present on power–up. During run time it requires only about 20K of RAM space if DOS is loaded high; 64K of RAM space if DOS is loaded low. When you boot from ROM–DOS in the BIOS socket, the system automatically assigns drive designators to the extended memory virtual drive and SSD1. However, if you boot from SSD1 or floppy/hard drive you must add the appropriate device drivers to your CONFIG.SYS file and copy the files to your boot drive in order to access the BIOS drive and the extended memory virtual drive.

NOTE: Even though you provide information about memory devices during setup, you must still define drivers for these devices in your CONFIG.SYS file. The following is an example listing of CONFIG.SYS entries for the device drivers included with the 4010. Each of these device drivers is discussed in greater detail in Appendix A, Software Utilities:

`DEVICE=MEMDRIVE.SYS BIOS`	Accesses the BIOS drive
`DEVICE=MEMDRIVE.SYS SSD1`	Accesses the SSD1 drive
`DEVICE=MEMDRIVE.SYS EMS`	Accesses the virtual drive in extended memory
`DEVICE=MEMDRIVE.SYS BASE 136`	Accesses a virtual drive in DOS base memory

When your system boots up, the 4010 device drivers will be listed with their drive designations. When you boot from ROM–DOS in the BIOS drive, drives D–E are defined in the CONFIG.SYS file.

The drives are designated as:

A: floppy disk
B: floppy disk
C: BIOS socket
D: virtual disk
E: SSD1

If your system has a hard drive, drive C: (in the example above) becomes the hard drive and drives C–E are now designated as D–F.

When you boot from SSD1 with ROM–DOS, the drives are designated as:

A: floppy disk
B: floppy disk
C: SSD1
D: first driver in CONFIG.SYS
E: second driver in CONFIG.SYS

Example:

In the following example of bootup messages, the system boots from the BIOS drive with 1MB DRAM and 128K flash memory in SSD1. The system assigns the following drive designations:

```
4010 MEMDRIVESYS v2.0, formatting (384KB) in extended memory as
drive D:
4010 MEMDRIVE.SYS v2.0, assigning  SSD1(128 KB) as drive E:
```

EXTENDED MEMORY

Once you have installed 1 MB or more of DRAM in your system you can bypass the memory driver and extend the available memory past 640K by using the following instructions. This assumes you are not using the extended memory for a virtual drive.

NOTE: These instructions are written in 8086 assembly code.

Perform the following before your program accesses extended memory:

```
MOV DX,387H
```

(To prevent contention, disable access to the SSD, by writing a “1” to 387H.)

```
MOV AL,1
OUT DX,AL

MOV DX, 21AH
MOV AL, 80H       ;set auto increment
OUT DX, AL

MOV DX, 218H
```

Bit 15 is enable for current page. Bit 14–0 are A23–A14.
40H=A20=100000. 41H=A20+A14=104000.

```
MOV AX, 8040      ;first 16K starting at D000
OUT DX, AX

INC AX
OUT DX, AX        ;second 16K starting at D400

INC AX
OUT DX, AX        ;third 16K starting at D800

INC AX
OUT DX, AX        ;fourth 16K starting at DC00
```

Access the page by writing/reading through the EMS window:

```
MOV AX,0D000H
MOV ES,AX
```

(Sets ES to the window segment.)

```
XOR DI,DI
MOV ES:[DI],AH
```

(To store something in the window.)

```
MOV AH,ES:[DI]
```

(To retrieve something from the window.)

When your program has finished with the EMS memory:

```
MOV DX, 20AH
MOV AL, 80H        ;set auto increment for 218H/219H
OUT DX, AL

MOV DX, 218H
MOV AX, 0          ;make bit 15=0 to disable EMS page
OUT DX, AX         ;disable first 16K page
OUT DX, AX         ;disable second 16K page
OUT DX, AX         ;disable third 16K page
OUT DX, AX         ;disable fourth 16K page

MOV DX, 387H
OUT DX, AL         ;enable user sockets
```

Reenable the SSD::

```
MOV AL,0
```

(Enables the SSD.)

```
MOV DX,387H
OUT DX,AL
```

INTERRUPTS

The 4010 supports two additional interrupts: IRQ10 and IRQ11. This allows applications using expansion cards such as the Micro PC 5540 Multifunction Card or the Micro PC 5300 Counter Timer Card to use interrupts which have previously conflicted with the CPU. For example, using the 5540 with the 4010 allows you to support four COM port interrupts at one time: COM1 (IRQ4) and COM2 (IRQ3) on the 4010 and COM3 (IRQ10) and COM4 (IRQ11) on the 5540 card.

NOTE: The 5540 will still address COM3 as IRQ4 and COM4 as IRQ3 on the bus.

IRQ10 and IRQ11 are jumper selectable at W4 on the 4010. IRQ10 on the 4010 is jumper selectable to IRQ3 on the bus and IRQ11 on the 4010 is jumper selectable to IRQ4 on the bus.

W4: Interrupt Select		
Pins Jumpered	**Bus IRQ**	**CPU IRQ**
[1-2]	IRQ4	IRQ11
[3-4]*	IRQ4	IRQ4
[5-6]	IRQ3	IRQ10
[7-8]*	IRQ3	IRQ3

* = default

The 4010 also supports any operating system which requires the standard AT IDE disk device interrupt (IRQ14). This includes QNX, Novell, Windows and others.

Disabling Interrupts

The PC Bus does not allow shared interrupts on the bus. You can, however, disable the COM1 and COM2 interrupts (IRQ4 and IRQ3) to allow for other devices which use these interrupts. If COM1 is the console, its interrupt (IRQ4) is in use. COM2 (IRQ3) is not used by the BIOS. To disable interrupts for COM1, write a 0 to 3FC bit 3. To disable COM2, write a 0 to 2FC bit 3.

USING MICROSOFT WINDOWS 3.1

If you are using Microsoft DOS on the 4010, Microsoft Windows 3.1 is fully compatible and operates in Standard Mode only. Enhanced Mode is not supported due to the limitations of the processor chip. However, if you are using ROM–DOS 5.0 and Microsoft Windows on the 4010, there are some limitations:

- The Windows installation program may modify the AUTOEXEC.BAT and CONFIG.SYS files to include the SMARTDRV.EXE file:

AUTOEXEC.BAT

```
C:\WINDOWS\SMARTDRV.EXE
```

CONFIG.SYS

```
DEVICE=C:\WINDOWS\SMARTDRV.EXE  /DOUBLE_BUFFER
```

ROM–DOS 5.0 is not compatible with SMARTDRV.EXE and you must remove these entries.

- The ROM–DOS memory manager, HMA.SYS, will not work with Windows. You must use the HIMEM.SYS memory manager that comes with Windows 3.1.

- Windows only runs in Standard mode on the 4010. From the DOS prompt type:

  ```
  WIN /S
  ```

WARRANTY

Octagon Systems Corporation (Octagon), warrants that its standard hardware products will be free from defects in materials and workmanship under normal use and service for the current established warranty period. Octagon's obligation under this warranty shall not arise until Buyer returns the defective product, freight prepaid to Octagon's facility or another specified location. Octagon's only responsibility under this warranty is, at its option, to replace or repair, free of charge, any defective component part of such products.

LIMITATIONS ON WARRANTY

The warranty set forth above does not extend to and shall not apply to:

1. Products, including software, which have been repaired or altered by other than Octagon personnel, unless Buyer has properly altered or repaired the products in accordance with procedures previously approved in writing by Octagon.
2. Products which have been subject to power supply reversal, misuse, neglect, accident, or improper installation.
3. The design, capability, capacity, or suitability for use of the Software. Software is licensed on an "AS IS" basis without warranty.

The warranty and remedies set forth above are in lieu of all other warranties expressed or implied, oral or written, either in fact or by operation of law, statutory or otherwise, including warranties of merchantability and fitness for a particular purpose, which Octagon specifically disclaims. Octagon neither assumes nor authorizes any other liability in connection with the sale, installation or use of its products. Octagon shall have no liability for incidental or consequential damages of any kind arising out of the sale, delay in delivery, installation, or use of its products.

SERVICE POLICY

1. Octagon's goal is to ship your product within 10 working days of receipt.
2. If a product should fail during the warranty period, it will be repaired free of charge. For out of warranty repairs, the customer will be invoiced for repair charges at current standard labor and materials rates.
3. Customers that return products for repairs, within the warranty period, and the product is found to be free of defect, may be liable for the minimum current repair charge.

RETURNING A PRODUCT FOR REPAIR

Upon determining that repair services are required, the customer must:

1. Obtain an RMA (Return Material Authorization) number from the Customer Service Department, 303-430–1500.
2. If the request is for an out of warranty repair, a purchase order number or other acceptable information must be supplied by the customer.
3. Include a list of problems encountered along with your name, address, telephone, and RMA number.
4. Carefully package the product in an antistatic bag. (Failure to package in antistatic material will VOID all warranties.) Then package in a safe container for shipping.
5. Write RMA number on the outside of the box.
6. For products under warranty, the customer pays for shipping to Octagon. Octagon pays for shipping back to customer.
7. Other conditions and limitations may apply to international shipments.

NOTE: PRODUCTS RETURNED TO OCTAGON FREIGHT COLLECT OR WITHOUT AN RMA NUMBER CANNOT BE ACCEPTED AND WILL BE RETURNED FREIGHT COLLECT.

RETURNS

There will be a 20% restocking charge on returned product that is unopened and unused, if Octagon accepts such a return. Returns will not be accepted 30 days after purchase. Opened and/or used products, non-standard products, software and printed materials are not returnable without prior written agreement.

GOVERNING LAW

This agreement is made in, governed by and shall be construed in accordance with the laws of the State of Colorado.

The information in this manual is provided for reference only. Octagon does not assume any liability arising out of the application or use of the information or products described in this manual. This manual may contain or reference information and products protected by copyrights or patents. No license is conveyed under the rights of Octagon or others.