ICM

CPS-MS-1000

USER'S GUIDE

4015 Leaverton Court • Anaheim, California 92807-1692 • (714) 630-0964 • Telex: 821375 SUPPORT UD

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ICM

Dear User:

Hello, welcome to the world of ICM computers. ICM's purpose is to see that your system needs are met with complete satisfaction and the highest degree of reliability. ICM represents the finest in engineering of the latest designs available in computer technology today. We manufacture a complete line of networking components and single board computers for todays high tech office environments. Again, thank you for purchasing ICM products.

Sincerely,

INTERCONTINENTAL MICRO SYSTEMS CORPORATION

Bob Ruiz
President

InterContinental
Microsystems Corp.
4015 Leaverton Ct.
Anaheim, CA 92807-1692
(714) 630-0964
Telex: 821375-SUPPORT UD
Easylink #62562040
BBS (714) 632-8750

LIMITED WARRANTY

InterContinental Micro Systems warrants to the original purchaser of this ICM product that it is to be in good working order for a period of one year from the date of purchase from ICM or an authorized ICM dealer. Should this product, in ICM's opinion, malfunction during the warranty period, ICM will, at its option, repair or replace it at no charge, provided that the product has not been subjected to misuse, abuse, or non-ICM authorized alteration, modifications, and/or repairs.

Products requiring Limited Warranty service during the warranty period should be delivered to ICM with proof of purchase. If the delivery is by mail, you agree to insure the product or assume the risk of loss or damage in transit. You also agree to prepay shipping charges to ICM. ALL EXPRESS AND IMPLIED WARRANTIES FOR THIS PRODUCT INCLUDING, BUT NOT LIMITED TO, THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE ABOVE ONE YEAR PERIOD. Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.

UNDER NO CIRCUMSTANCES WILL INTERCONTINENTAL MICRO SYSTEMS BE LIABLE IN ANY WAY TO THE USER FOR DAMAGES, INCLUDING ANY LOST PROFITS, LOST SAVINGS OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF, OR INABILITY TO USE, SUCH PRODUCT. Some states do not allow the exclusion or limitation of incidental or consequential damages for consumer products, so the above limitations or exclusion may not apply to you.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH MAY VARY FROM STATE TO STATE.

The limited warranty applies to hardware products only.

WARRANTY REGISTRATION

name _____ company _____ phone _____

street _____ city _____ state _____ zip _____

product model no. _____ serial no. _____ purchase date _____

no. of PCs at this address _____ purchased from _____

System Configuration	**Manufacturers Name**
[ ] Multifunction/Memory	_____
[ ] Graphics (color?____)	_____
[ ] Data Communication	_____
[ ] Network Card	_____
[ ] Modem (_____ Baud)	_____
[ ] Hard Disk (_____ MB)	_____

Type of PC used _____

Please complete and return this card within (10) days of purchase. ICM products are warrantied for one year from date of purchase. If you encounter a problem with an ICM product that is under warranty, you should call ICM to receive a Return Authorization Number prior to returning the product for service. It is essential that we have your warranty card on file in order for us to provide repair service or replacement at no charge to you.

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Anaheim, CA 92807

ATTN: Sales and Marketing

BUSINESS SURVEY

ICM wants to keep up with your needs. You can help us by completing this product survey. In exchange for your help, we'll send you "BUSTALK", our bi-monthly newsletter with the latest information on ICM products.

YourName_____Company Name_____

Address_____

What Type Of Business Is Your Company In?_____

How Many Computers Do You Have In-house?_____

How Many Are ICM Computers?_____

What Do You Use Your ICM Product For? _____

How Did You Learn Of ICM? (If publication, which one?)_____

What Do You Like About ICM Products?_____

Product Model Number_____ Date Purchased_____

What Reseller Did You Purchase The Product From?

Name_____ City_____ State_____

Comments Regarding Service/Products_____

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The CPS-MS-1000 User's Guide

Intercontinental Micro Systems makes no representatives or warranties with respect to this guide. Further, we reserve the right to make changes in the specifications of this product at any time without notice and without obligation of Intercontinental Micro Systems to notify any person of such revision or changes.

Intercontinental Micro Systems 4015 Leaverton Court, Anaheim, CA 92807-1692 (714) 630-0964 Telex: 821375-SUPPORT UD

HOW TO USE THIS GUIDE

Thank You for buying ICM's CPS-MS-1000 Package!

ICM appreciates your purchase of CPS-MS-1000. This Guide is included as part of your package to help you install and use your CPS-MS-1000 as soon a possible.

Your CPS-MS-1000 User's Guide is actually made up of several separate Guides. Each individual Guide is treated as a Section within the CPS-MS-1000 User's Guide.

Section 1 provides general information about ICM's Technical Support policy and services. Pointers on how to solve common problems are in the section also.

Section 2 is a dictionary explaining terms used in this Guide you may be unfamiliar with.

Section 3 is the CPS-MS-1000 User's Guide. This section offers the basics of product installation and provides general information on the product package and features.

Section 4 is the CPS-16F User's Guide. This section provides general information about the CPS-16F Application Processor. The primary function of this section is to make it as easy as possible to install the CPS-16F and start using it.

Section 5 is the MS-1000 Software Technical Guide. The information contained in this section provides an in depth explanation of the MS-1000 software and it's function.

Section 6 is the TurboDOS/PC User's Guide. Software 2000 has rewritten this Guide specifically for MS-1000 use. This section tells you how to use TurboDOS/PC with MS-1000.

Section 7 is the CPS-16F Technical Guide. Similar to the CPS-16F User's Guide but much more technical in detail.

Section 8 is the M/STER User's Guide. This Guide provides information specific to the M/STER Terminal's use and installation. While Section 2 provides some general information on this subject, you'll probably want to reference this section for more detail.

Section 9 is the Appendix. Miscellaneous information that will provide some extra help is included in this section.

At the end of this User's Guide you'll find a **User's Comment Card.** Please take a few moments to let us know what you think of this Guide. Remember, we've written this Guide for you. We need your input to meet your needs.

TECHNICAL SUPPORT

Return Merchandise Authorization Policy (RMA)

- To receive credit products must be returned within 60 days of purchase date.
- A restocking fee is required on all returned products.(15% of the list price at the time of purchase).
- ICM (Intercontinental Micro System Corp.) is responsible only for products that have an ICM registered trademark.
- There is no repair charge for products still under ICM's one year warranty.
- If no repairs are required , there will be a minimum charge for 1 hour of labor.
- Repair charges are based on $50 per hour for labor plus parts.
- Customers pay shipping charges when sending repair merchandise under warranty to ICM for repair.
- ICM pays shipping charges when returning repair merchandise under warranty to a customer within the United States.
- Overseas customers pay shipping charges both ways for repair merchandise regardless of warranty status.
- When the warranty is no longer valid the Customer pays shipping charges both ways.
- Before merchandise can be sent to ICM for repair the Customer must call ICM at (714) 630-3714 to obtain an RMA number. The Customer should be prepared to provide the following information for ICM:

  Company name
  Contact person's name and phone number
  Exact product name
  Serial number
  Prom type for fileserver and arcnet board
  Amount of memory on board
  Specify any special modification or jumper setup

- No more than five items are to be returned per RMA number.
- Repairs carry a 90 day warranty.
- Allow a two week turn around for each RMA.

- "Test and Check" and "No Problem Found" RMAs will be charged 5% of the list price on the date of purchase.
- The Loan Board Policy applies only to boards under warranty.
- All loans must be authorized by technical support personnel.
- Loan Boards will be sent to the customer upon receipt of the repair merchandise. **If the customer is a non-credit approved customer a check for 30% of the original purchase price must accompany the repair merchandise.** ICM will return the check to the customer upon receipt of the Loan Board.

ANY CHANGES MADE TO A PRODUCT WILL VOID THE WARRANTY

BBS (714) 630-0964

ICM'S Bulletin Board System is available 24 hours a day 7 days a week. If you've used the system before, you're a registered user. You can upload or download information, leave messages for other users and access a wide range of information. If you're a first time user, you can become a registered user by entering "I" and typing a message to let the system operator know. ICM encourages you to use the BBS to leave messages for our personnel or to leave any suggestions regarding product or ways we can better serve. The BBS provides the following information:

Sales

- Newsletter
- Pricelist
- Product Information

Technical

- Engineering Changes
- Hardware Modifications
- Software Modifications
- Public Domain CP/M and TurboDos Utilities
- TurboDos Patches
- ICM Software Utilities
- STARTUP
- MEMTST16
- FCBTST
- MEX etc.
- Solutions for Common Problems

Communication Media

Telex

Telexes are another means of communication ICM offers you. Twice a day our Technical Representatives review Telex messages. All messages receive a response at the earliest convenience.

Mail

If you want to contact ICM personnel regarding invoices, shipping, or administrative functions, you may write to us at the following address:

4015 Leaverton Court
Anaheim CA 92807-1692

If you want to contact ICM personnel regarding marketing, sales or technical support matters , you may write to us at the following address:

4020 Leaverton Court
Anaheim CA 92807-1692

Phone

We also have technical staff to answer your technical questions, You can reach them by calling the following number.

(714) 630-3714 8:30 a.m.-- 12:00 noon
1:00 p.m. -- 5:00 p.m.

If our technical staff is not available when you call, leave a message and you'll receive a response within 24 hours.

What To Do If.....

1. You receive a product that doesn't work.

   Call Technical Support immediately and obtain an RMA number. Include the RMA number with the merchandise you're returning.

   If you have credit terms with ICM, we'll ship a replacement to you the same day you report the problem.

   If you do not have credit terms with ICM we'll ship the replacement upon receipt of the defective merchandise.

   All returned merchandise must be accompanied by an RMA number when shipped to ICM.

2. You receive the wrong parts.

   Call Technical Support immediately and obtain an RMA number. Include the RMA number with the merchandise you're returning.

   If you have credit terms with ICM, we'll ship a replacement to you the same day you report the problem.

   If you do not have credit terms with ICM we'll ship the replacement upon receipt of the wrong part(s).

   All returned merchandise must be accompanied by an RMA number when shipped to ICM.

3. Parts are missing from your package.

   Call Technical Support and report the incident. ICM will ship the parts to you.

DICTIONARY

Application Processor - Sometimes referred to as a "Slave Processor". Runs application software and calls on the Fileserver to perform functions that allow the use of application software.

Application Software - A program or group of programs written to solve a specific problem or perform a specific function. ie. word processing, accounts payable, inventory control etc. Application software must be compatible with the operating system to run properly.

Asynchronous - A data-communications term describing the method by which data between machines is timed as it's transmitted and received. Asynchronous is a low speed form of data-communications running in the range of 60-38.K bits per second.

Bit - The smallest unit of information. A bit has two states and is represented electronically by a pulse or absence of a pulse of static electricity .

Bus - A set of electrical conductors on a motherboard (printed circuit board) that carries electronic signals to the various components of a computer. The conductors as a whole are called a bus. They are broken down into three subsets called a "data bus", "address bus" and a "signal bus". The Fileserver and Application Processor are "plugged" into the Bus to receive the electronic signals that make them work.

Byte - A byte generally consists of 8 bits (1's or 0's), arranged in a pattern to convey information. This is much like using eight "letters" of the alphabet and arranging them in a pattern called a "word" to convey a specific meaning.

Clock Calendar Board - A personality board that provides a highly accurate real time clock. The time of year, month, day, hour, minute and second is maintained and may be read back by the CPU. Very useful for point-of-sales systems, inventory systems and other applications where continuous clock monitoring is required.

Configuration -

Hardware: Describes the way various devices (workstations, printer, hard disks, floppy disks, etc.) are connected (interact) with each other.

Software: A procedure performed to define what devices are linked together. (Generally referred to as Configuration Utilities.)

CPU - Central Processing Unit. The "brain" of a computer. It is made up of two major components: Arithmetic Logic Unit (ALU) and Execution Unit (EU). The EU fetches machine language instructions from memory and converts them into electronic signals that put the instructions into action. The ALU is controlled by the EU to perform all manipulations of data. It is through the interaction of the CPU's two major components and memory that all work within a computer is done.

Default Value - A value automatically assigned (usually by the manufacturer). The user may change the default value (which is part of the configuration procedure) or use it as is.

Discrete Refresh Circuitry - Circuitry that periodically refreshes the dynamic memory by reading row locations to charge up individual memory cells before memory is lost. This frees the CPU of this task.

DMA - Direct Memory Access. An architectural feature of some computers in which information read from disk is written directly to a specified location in the memory without interrupting the CPU, or read from memory to disk without assistance from the CPU. This enables the CPU to attend to other tasks while the disk operation is being performed.

Dynamic RAM - A type of semiconductor memory. Dynamic RAM holds information as charges of static electricity that tend to decay rapidly, threatening loss of information. A technique called "cycle stealing" is employed with dynamic RAM in which the computer's CPU periodically interrupts work and refreshes (recharges) the contents before they decay beyond redemption.

Fileserver - Sometimes called a Master Processor. Controls the network by downloading the operating system to the application processor. The fileserver also downloads system files to the application processor and controls the use of all common peripherals.

Handshake Lines - These lines are used to ensure data is passed correctly between two or more devices. This is done through the exchange of signals such as "data valid" and "acknowledge".

Intelligent I/O Processor - Doesn't have to be controlled by the fileserver because it has its own CPU. The fileserver just sends a message to the buffer which communicates with the CPU on the I/O board. It then functions independently of the fileserver.

I/O Ports - Locations at the top of ICM's boards called "serial" and "parallel" ports that enable input/output activity between the computer and peripherals.

Megabyte - 1,048,576 bytes.

MHz - Megahertz. One million cycles per second. Computer speed is measured in Mhz. The higher the number of Mhz, the faster the CPU can manipulate data.

Multi User System - An operating system that allows many users, at separate work stations to share a fileserver's files and peripherals such as printers, disks etc.

Operating System - Abbreviated OS. A large and highly complex program that controls the operation of a computer system. It is always present and active while the computer is running. An operating system is what enables application software to run. TurboDOS, MS-DOS and PC-DOS are all examples of operating systems.

Parallel - A form of data transmission, in which 8 or more bits are sent at a time.

Peripheral - Input/Output and data storage devices such as a printer, terminal, hard disk, etc. attached to a computer.

RAM - Random Access Memory. The semi-conductor memory of a computer which is erased when the electricity is turned off. The CPU uses RAM to perform "real time " calculations, computations, and temporary storage.

S-100 Bus - A 100 conductor (pin) bus adopted as a standard for microcomputers by the Electronic Industries Association.

Serial I/O - The most common form of data transmission, in which the bits of each character are sent one at a time over the line.

Synchronous - A data-communications term describing the way signals between machines are timed. In synchronous communications, a prearranged number of bits are expected to be sent across the line per second, e.g., 4800 bps (bits per second). Synchronous communications is generally at the higher end of the speed spectrum, from 2400 bps upward.

Z80 - The Z80 is a popular 8-bit microprocessor whose instruction set is a superset of the 8080 CPU.

8080 - The first of the 8-bit microprocessors introduced by the Intel Corporation in 1974.

8086 - The industry standard full 16-bit microprocessor also manufactured by the Intel Corporation.

INTRODUCING YOUR CPS-MS-1000 PACKAGE

InterContinental Micro Systems has created a package called CPS-MS-1000 that enables you to create an environment much like that of an IBM PC. To accomplish this ICM has designed a software component called a BIOS Emulator making it possible for you to run most of the popular Application Software written to IBM PC standards.

Your CPS-MS-1000 Package comes with the following:

- 1 M/STER Terminal
- 1 CPS-16F Single Board Application Processor.
- 1 RPB-200 Personality Board with a 16-pin flat ribbon cable. (Factory Configured for use with the M/STER Terminal.)
- MS-1000 Software Diskette
- PC-DOS Operating System - IBM Version 3.1
- TurboDOS/PC Version 1.08
- CPS-MS-1000 User's Guide

WARNING

Make sure the serial number on your CPS-MS-1000 Package matches the serial number of your TurboDOS operating system. If it doesn't match you won't be able to use CPS-MS-1000.

Tools and Equipment Checklist

Before you get started make sure you have the following tools and equipment available.

- Contents of the CPS-MS-1000 Package
- S-100 Chassis
- Either the 8-bit CPZ-4800X or the 16-bit CPZ-186 Fileserver (Master Processor).
- RPB-200 Personality Board with 16 pin ribbon cable
- 4 pair (8 wire) twisted shielded 22 gauge RS-232 cable
- 2 male DB-25 connectors
- M/STER Terminal
- TurboDOS operating system
- Voltage Meter to test the chassis and connectors
- Screwdriver to install the Personality Board to the back of the chassis
- Nutwrench to install Jack screws on the Personality Board
- Wire unwrapping tool to change wire wrap jumpers on the CPS-16F or RPB-200 board if necessary
- Jumper shunts to set new jumper selections on the CPS-16F or RPS-200 board if necessary

HARDWARE

Voltage Verificaiton Test

ICM recommends that a voltage verification test be performed on the S-100 Bus before you install the CPS-16F. Voltage that is too high could result in a burnt out regulator or damaged devices. Low voltage can create intermittent problems that are difficult to trace. Very low voltage (below 5) will cause your system not to boot or to crash.

NOTE: DETAILED INSTRUCTIONS ON HOW TO PERFORM THE VOLTAGE VERIFICATION TEST CAN BE FOUND IN THE CPS-16F USER'S GUIDE.

WARNING!

Only individuals familiar with voltage measurement equipment and procedures should perform the voltage verification test!

Hardware Configuration

Jumper options apply to three locations on the board. Figure 1.0 shows the locations of each.

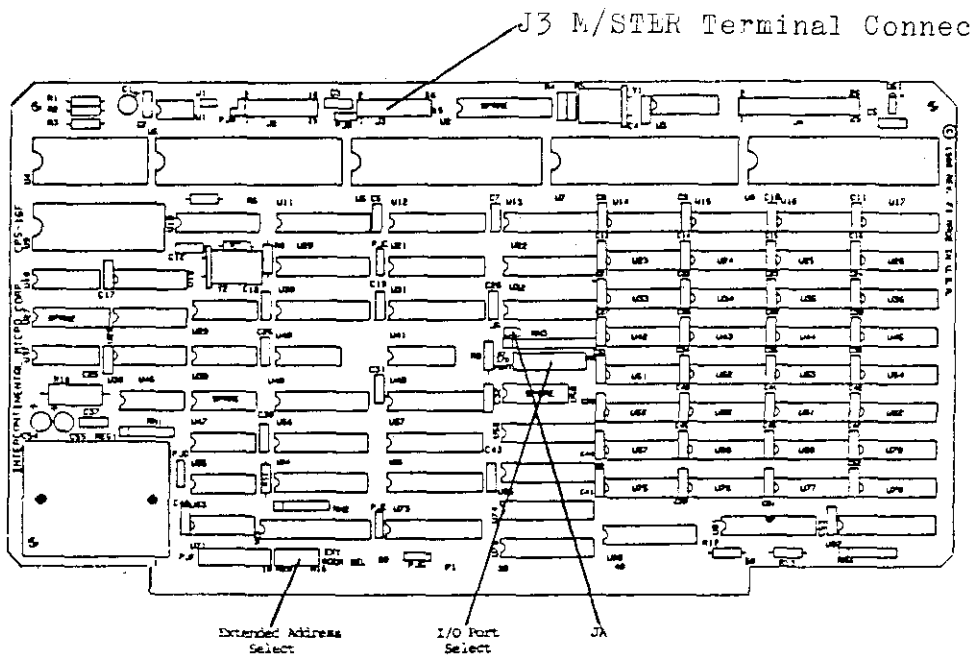


FIGURE 1.0

1. Configure the CPS-16F Application Processor as follows:

Extended Address Selection

The default setting for the CPS-16F is illustrated in Figure 1.1. This setting is used with the 16-bit CPZ-186 fileserver.

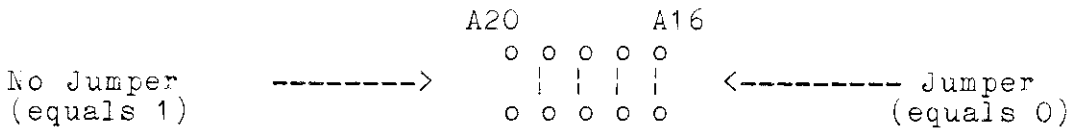


FIGURE 1.1

If you want to use the CPS-16F Application Processor with an 8-bit CPZ-4800X fileserver, set the address as illustrated in Figure 1.2.

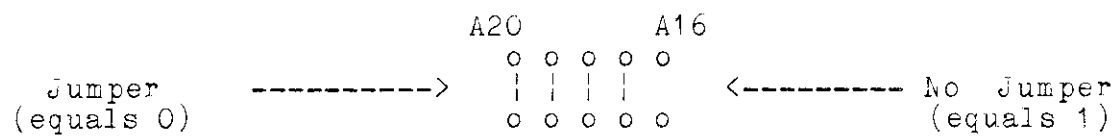


FIGURE 1.2

I/O Port Selection

The I/O Port Selection setting can be used with either the 8 or 16-bit fileserver.

If the CPS-16F is the only 16-bit application processor you're using, leave the setting at the default value (3F hexadecimal), illustrated in Figure 1.3.

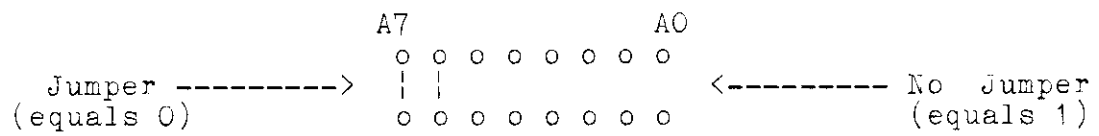


FIGURE 1.3

If you are installing two or more 16-bit application processors, refer to **Figure 1.4** in the CPS-16F User's Guide. This chart will show you how each additional processor should be configured.

JA Mode Selection

Set the JA Mode Selection setting for use with the PC Monochrome mode, as illustrated in Figure 1.5.

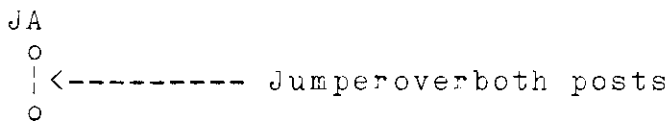


FIGURE 1.5

Connecting The CPS-16F To The S-100 Bus

1. With the power to the bus OFF, insert the CPS-16F application processor firmly into the S-100 Bus. **The board must be firmly locked into the S-100 Bus. If it isn't, severe damage could result.**

2. Repeat the voltage verification test with all the boards replaced.

Connecting The RPB-200 Personality Board

1. Make sure the chassis power is OFF.

2. Install the Personality Board as illustrated in Figure 1.6.

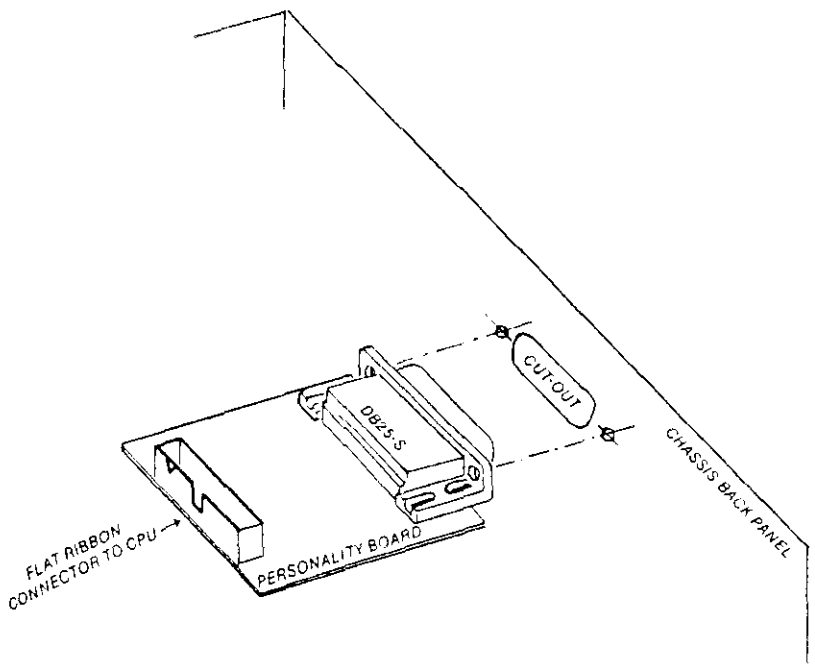


FIGURE 1.6

3. Plug the flat 16 pin ribbon cable into the box connector so that the red stripe of the ribbon cable is plugged into pin 1 of the serial port connector J3. The location of J3 is shown in Figure 1.0.

4. If you want to enable the signal on pin 20 DTR for handshaking, move the jumper from the second to the third position on the 2x6 block. Figure 1.7 illustrates the location of the 2x6 block on the personality board.

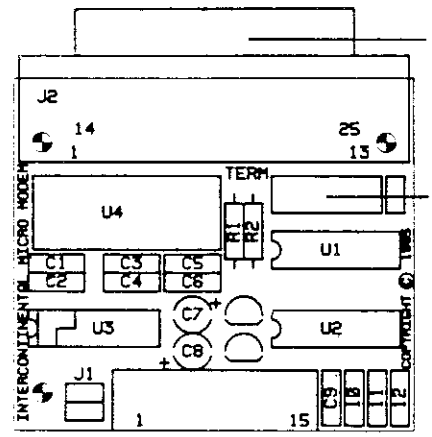


FIGURE 1.7

5. To connect the Video terminal to the RPB-200 personality board, solder or crimp the wires at each end of the RS-232 cable to the DB-25 male connectors. Figure 1.8 illustrates the pinwire pin assignment. **Tie pin 1 on the Video Terminal end ONLY.**

NOTE: Pin 20 is used for handshaking only. If you don't require handshaking it isn't necessary to connect the wires to these pins. **Note that ICM's Terminal does not support software handshaking.**

PIN/WIRE ASSIGNMENT

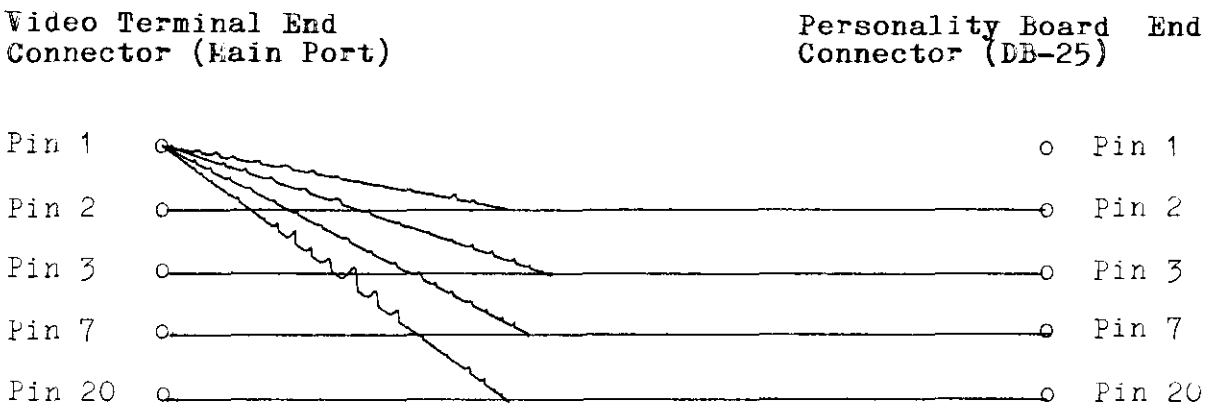


FIGURE 1.8

6. Plug the DB-25 male connector wired for the Video Terminal into the Main Port location at the rear of the terminal, as illustrated in Figure 1.9.

Rear View of M/STER Terminal

FIGURE 1.9

7. Plug the other DB-25 male connector into the DB-25 female connector on the RPB-200 Personality Board on the rear panel of the S-100 chassis. Reference Figure 1.6 for the correct location.

M/STER Terminal Configuration

1. After you've hooked up your M/STER Terminal:

   Turn the power ON

   Press the control and both shift keys at the same time.

The Default Menu illustrated in Figure 1.10 will appear. These values support TurboDOS.

NOTE: REFER TO THE M/STER USER'S GUIDE FOR INSTRUCTIONS ON HOW TO INSTALL THE M/STER TERMINAL.

Default Menu Screen
Configured For Terminal Operation

Next Item = ^ Prior = v Next Value = > Prior Value = <
Exit = E Save = S Restore = R

Intercontinental Micro Systems Version 1.0

Main:	Terminal	Aux:	Printer
Baud Rate:	19200	Baud Rate:	1200
Data Bits:	8	Data Bits:	7
Stop Bits:	2	Stop Bits:	2
Parity:	NONE	Parity:	NONE
Handshake:	DTR	Handshake:	DTR

Communications:	Full Duplex	Auto Newline:	ON
Emulation:	TVI915	Return:	CR
Columns:	80	Auto Scroll:	ON
Cursor Type:	Underline	Refresh:	60 Hz
Cursor Blink:	Blink	Line Term.:	US
Video:	Normal	Block Term.:	CR
Brightness:	12	Edit Keys:	Off
Screen Saver:	ON	Status Line:	Off
Keyclick:	Off	Func Key Line:	Off
Bell Volume:	2	Protect Att.:	Half Intensity
Bell Tone:	2	Attributes:	Character
Function Key Delay:	0	Font:	2

FIGURE 1.10

2. When MS-1000 is used the values will automatically convert to those shown in Figure 1.11.

Default Menu Screen
Configured For MS-1000 Operation

Next Item = ^ Prior = v Next Value = > Prior Value = <
Exit = E Save = S Restore = R

Intercontinental Micro Systems Version 1.0

Main:	Terminal	Aux:	Printer
Baud Rate:	19200	Baud Rate:	1200
Data Bits:	8	Data Bits:	7
Stop Bits:	2	Stop Bits:	2
Parity:	NONE	Parity:	NONE
Handshake:	DTR	Handshake:	DTR

Communications:	Full Duplex	Auto Newline:	OFF
Emulation:	M/STER	Return:	CR
Columns:	80	Auto Scroll:	ON
Cursor Type:	Underline	Refresh:	60 Hz
Cursor Blink:	Blink	Line Term.:	US
Video:	Normal	Block Term.:	CR
Brightness:	12	Edit Keys:	Off
Screen Saver:	ON	Status Line:	Off
Keyclick:	Off	Func Key Line:	Off
Bell Volume:	2	Protect Att.:	Half Intensity
Bell Tone:	2	Attributes:	Character
Function Key Delay:	0	Font:	2

FIGURE 1.11

SOFTWARE

Software Summary

Before you start software installation, a brief summary of the software components on your MS-1000 software diskette is provided for a better understanding of their function. If you want more detail refer to the MS-1000 Technical Guide section.

BIOS Emulator

An integral part of the CPS-MS-1000 operation is known as the BIOS Emulator. This software contains the drivers necessary to emulate a PC environment for a program running in the application processor.

The BIOS EMULATOR is a group of hardware independent and dependent drivers linked together to form two configurations of code:

- MS-SLAVE.CMD, which is a program loaded into the application processor while executed under the TurboDOS Operating System.
- MS-SLAVE.SYS, which is loaded into the application processor as a system file during the TurboDOS system boot procedure.

TurboDOS/PC

TurboDOS/PC is documented by Software 2000. We've included a modified version designed specifically for CPS-MS-1000.

TurboDOS/PC is the software link between CPS-MS-1000 and the TurboDOS Operating System. Once PC-DOS has been downloaded into the application processor, TurboDOS/PC is run from the PC-DOS Image File. This enables the application processor to access system date and time, disk drives, printers and queues on the TurboDOS fileservers.

CFGMSS

The BIOS Emulator and TurboDOS/PC drivers are configured through this program. This utility offers the option of installing MS-1000 as either one of the configurations described below.

MS-SLAVE.CMD: This version installs MS-1000 as a program which enables you to run both TurboDOS and PC-DOS application software.

MS-SLAVE.SYS: This version installs MS-1000 as a system and supports PC-DOS application software only.

PCDU.CMD

CPS-MS-1000 supports the BIOS emulation of disk I/O during boot up through the use of an image download file (DOS psuedo file). This file is created and maintained through the use of a special utility known as PCDU. The image download file is used for downloading the components of DOS into the application processor at start-up time. The TurboDOS/PC program is then executed to attach to the network fileserver devices. PCDU is the utility used to create an image of a floppy diskette in the PCIMAGE.DSK file located on the TurboDOS fileserver. PCDU is used to move files in and out of PCIMAGE.DSK and manipulate them once they're in the file.

MS-1000 Software Configuration and Installation

1. Copy the contents of the MS-1000 distribution diskette to an empty user number area on your system hard disk. (Preferably user number 0 of a logical drive that's dedicated to MS-DOS/PC-DOS use.) Save the floppy distribution diskette for back-up.

2. Install the Security Module supplied on the MS-1000 distribution diskette, by adding the following two files to the GEN file in your TurboDOS master operating system.

8-bit fileserver:	16-bit fileserver:
MSSUSR.REL	**MSSUSR.O**

3. Install the user support modules supplied on your TurboDOS distribution diskette, by adding the following two files to the GEN file in your TurboDOS master operating system.

8-bit fileserver:	16-bit fileserver:
USRSUP.REL	**USRSUP.O**

4. Please note that these modules are transparent to your use of the operating system. Verify that your TurboDOS operating system is functioning as before.

NOTE: IF FURTHER HELP IN CONFIGURING YOUR SYSTEM IS NECESSARY REFER TO THE TURBODOS CONFIGURATION MANUAL FOR HELP. IF YOU DON'T HAVE THIS MANUAL, ONE CAN BE ACQUIRED THROUGH YOUR ICM REPRESENTATIVE.

5. Using the MS-1000 Installation Utility that you've installed on your disk enter:

   CFGMSS (CR)

The Configuration Utility Main Menu will appear as illustrated in Figure 1.12.

```
MS-SLAVE Configuration Utility (v1.0)

A - New installation MS-SLAVE command version
B - New installation MS-SLAVE system version
C - Re-installation MS-SLAVE command version
D - Re-installation MS-SLAVE system version
E - New installation TurboDOS/PC driver
F - Re-installation TurboDOS/PC driver
X - Exit back to OS

Enter installation option (<RET>=A):
```

FIGURE 1.12

Options A or B and E must be used for the first time installation. Default values will be displayed. You may install these or enter your own.

NOTE: ICM recommends that you use option A (command version), the first time you install MS-1000 software. This option will enable you to reset the application processor and return to the TurboDOS operating system if any problems occur

When options C or D and F are used the current configuration values will be displayed. They don't automatically return to default. This enables you to enter only the values you want changed.

NOTE: FOR MORE INFORMATION ON THE CFGMSS OPTIONS REFER TO THE MS-1000 TECHNICAL GUIDE AND READ THE SECTION ON MS-1000 INSTALLATION UTILITY. FOR MORE INFORMATION ON THE FILES THAT ARE CONFIGURED THROUGH THIS UTILITY REFER TO THE MS-1000 TECHNICAL GUIDE AND READ THE SECTION ON MS-1000 SOFTWARE TECHNICAL, "BIOS EMULATOR OPTIONS" AND TURBODOS/PC DRIVER OPTIONS".

6. Select the desired option and enter the values at the appropriate prompts.

7. Enter **X** to exit the Configuration Utility.

8. To create the DOS Image File, enter:

PCDU (CR)

The following help menu will appear:

```
DIRectory of files      Type file
COPY file(s)            DELete file(s)
COMPARE file(s)         Help menu display
REName file(s)          Image filename
FORMAT image file       Quit program
```

9. Enter **FORMAT** (CR)

10. At the prompt asking which image file size you want, enter:

1 (CR)

FOR MORE DETAIL ON THE IMAGE FILE SIZE OPTIONS REFER TO THE MS-1000 TECHNICAL GUIDE, SECTION "PC DISK UTILITY (PCDU) AND READ ABOUT THE FORMAT COMMAND.

When the image file size is selected the program will respond by finding the boot sector file and automatically copy the boot system, FAT, write the directory and format the file to create the image of a PC-DOS diskette. The following files will automatically be copied from the TurboDOS drive/user area.

IBMBIO.COM
IBMDOS.COM
COMMAND.COM

11. Copy the following two files into the DOS Image File by entering:

COPY d:TURBOPC2.COM *

COPY d:TURBOPC.DRV * (CR)

NOTE: "d:" represents the drive you're running the PCDU program on.

12. Enter **Q** to exit back to the operating system.

13. If you're executing MS-1000 as a program, enter:

MS-SLAVE (CR)

14. If you're executing MS-1000 as a system file, flush all disk buffers and reset the system or crash the application processor that will be downloaded.

As soon as MS-1000 is running, the following message will appear.

InterContinental Micro System, Inc.
BIOS emulation system v1.3

If MS-1000 hasn't been installed correctly one or more of the following error messages may appear. The following is a list of the potential error messages and corrective action.

Protection module not present in master

You must install the protection module in the fileserver's GEN file before you can proceed.

Invalid serial number

The serial number of your MS-1000 package is different from that of your TurboDOS operating system. These two numbers must match.

If either of the above error conditions occur, you must reset the application processor by pressing the **CTRL, ALT and DEL** keys at the same time. Correct the error and repeat step 1 or 2.

Invalid terminal type

You are trying to run MS-1000 on a terminal other than a M/STER Terminal. You must use a M/STER Terminal. (See your ICM Representative for more information on the M/STER Terminal.)

Executing MS-1000

If the log on routines were enabled during configuration, the following message will be displayed when MS-1000 has been executed correctly.

System log on

Enter user id:

1. Enter the same user id as the one in the USERID.SYS file of the TurboDOS operating system.

The following prompt will appear.

Enter Password:

The password must be the same as the password in the USERID.SYS file.

The following message will appear.

Downloading from image file OA:PCIMAGE.DSK

If the PCIMAGE.DSK file doesn't exist one of the following error messages will appear.

Can't open image file OA:PCIMAGE.DSK

Can't read FAT sector:

Can't read BOOT sector:

Physical disk error reported by file server:

When these error messages occur, downloading will be aborted and the processor halted.

These messages mean there's a physical error within the file. To continue you'll have to repeat the steps to create the DOS Image File. When you've done this, reset the application processor and repeat the necessary steps.

Further customization of PC-DOS can be performed from the file MS-AUTO.BAT. This file is located on your TurboDOS network drive in the root directory use number.

NOTE: The root directory user number is a TurboDOS/PC driver option configured with the CFGMSS Utility, option E or F.

CPS-MS-1000 LIMITATIONS

Since MS-1000 is not 100% IBM PC compatible, there are some limitations you should be aware of:

1. MS-1000 limits the number of directories to 32. (1 root directory plus 31 sub-directories per logical drive.)

2. MS-1000 will not support high resolution bit map graphics. It's only compatible with character oriented PC monochrome display adapter.

3. You're restricted to hard disk and floppy drives as managed under the TurboDOS operating system format rather than PC-DOS.

4. All multi user programs must be run under TurboDOS version 1.43 and TurboPC version 1.08 or they won't work.

5. Copy protected software won't work.

WARNING

TurboDOS will destroy an MS-DOS 5 1/4" floppy diskette if TurboDOS utilities such as DIR, COPY AND DRIVE etc. are allowed to access the floppy. To transfer data it's safest to set the floppy read only by OA}set B:;r, assuming B is the floppy TurboDOS won't write on the drive. Next, use the PCD8086 utility having gen'd in the CPZDSK1 driver to enable access to the MS-DOS 8 or 9 sector floppy.

6. PC type memory mapped display devices are not present in the application processor. Using the M/STER terminal, MS-1000 can emulate the PC's monochrome display adaptor which allows most of the popular PC software to execute when installed for the monochrome display. Programs that are installed for the monochrome display adaptor will use only the extended graphics characters associated with the controller and not any bit plot oriented graphics operations.

FOR MORE INFORMATION ON KNOW LIMITATIONS REFER TO THE TURBODOS/PC USER'S GUIDE, PROGRAMMER'S GUIDE SECTION.

HOW TO USE THIS GUIDE

Thank You for buying an ICM product! ICM knows your time is money and wants the use of our product to be as quick and easy as possible. That's why we've written this User's Guide!

Your Guide has the following sections;

Product Introduction introduces you to your ICM product. It tells you about the product features, what comes in the product package and provides specs on the required operating environment.

Product Installation "guides" you through product configuration and installation with easy to understand instructions and illustrations.

TABLE OF CONTENTS

INTRODUCING YOUR CPS-16F SINGLE BOARD APPLICATION PROCESSOR

The ICM CPS-16F Application Processor (Slave) is a fast, reliable computer, compatible with TurboDOS, CP/M, and PC-DOS operating systems. When used with ICM's 8-bit CPZ-4800X and 16-bit CPZ-186 Fileservers (Master), it offers high throughput, high performance and can run some of the popular monochrome PC-DOS application programs four times faster than typical personal computers. The CPS-16F also offers an economical solution to networking PC-DOS. These capabilities make the CPS-16F Application Processor one of the most versatile in the S-100 market today.

Your CPS-16F Package comes with the following:

- 1 CPS-16F Single Board Application Processor.
- 1 RPB-200 Personality Board with a 16-pin flat ribbon cable. (Factory Configuration is for use with a Terminal.)
- 1 CPS-16F User's Guide.

Operating Environment:

Temperature.....0 to 45 degrees Celsius (32 to 122 Degrees Fahrenheit)

Relative Humidity.....0 to 95%

Power Requirements:

Voltages.....+8VDC @ 2.4A (max)

+16VDC @ 0.15A (max)

-16VDC @ 0.15A (max)

Power.....24W.

The CPS-16F Application Processor includes these features:

- IEEE 696.1/D2 S100 Bus compliance.
- NEC uPD70116C-10 (V30) 10Mhz processor (CPU)
- Compatible with any Z80 based CPU Fileserver with extended address capability or 16-bit based CPU Fileserver complying with IEEE 696.1/D2 Bus specification.
- Faster execution of the 8086 (16-bit CPU) instruction set.
- An additional instruction set which includes high speed multiplication/division operations.
- 8080 (8-bit CPU) emulation mode.
- 2 Serial I/O Ports - synchronous or asynchronous, used to interface with Micro, Mini or Mainframe level peripherals such as terminals, modems and serial printers.
- 2 Parallel I/O Ports with two 8-bit ports and two handshake lines per port. This allows 2-way communication between the CPU and peripherals such as a battery backed clock calendar board, Centronics Parallel printer and OMTI or PRIAM hard disk controllers.
- Compatible with TurboDOS, CP/M and PC-DOS operating systems which enable you to use a wide variety of 8 AND 16-bit application software packages.
- 1 Megabyte of onboard dynamic RAM.
- 8 or 16-bit S-100 data transfer capability.
- Fileserver/Application Processor memory to memory transfers under DMA control at 571 Kbytes/sec transfer rate when used with the ICM's 16-bit Fileserver (CPZ-186 SBCP).
- Memory confiscation allows the Fileserver to download programs directly to the 16F's memory. This enables the 16F to function independently of the Fileserver. Confiscation also allows the master to perform diagnostics on the 16F.
- Can be used as a Memory Mapped Application Processor using the MMU (Memory Management Unit) available on the 8 or 16 bit Fileserver. This makes it twice as fast as a standard I/O mapped slave.
- Refresh Circuitry within the Dynamic RAM Controller relieves the CPU of having to refresh the memory. Putting the CPU into a DMA HOLD state will not result in memory loss.
- Software selectable baud rates which allows very flexible

peripheral interfacing and eliminates complicated hardware jumpering and switching to change baud rates. (110 baud to 38.4K baud available.)

Tools and Equipment Checklist

Before you get started make sure you have the following tools and equipment available.

- S-100 Chassis
- Either the 8-bit CPZ-4800X or the 16-bit CPZ-186 Fileserver (Master Processor).
- RPB-200 Personality Board with 16 pin ribbon cable
  - 4 pair (8 wire) twisted shielded 22 gauge RS-232 cable
  - 2 male DB-25 connectors
- RS-232 Terminal
- TurboDOS operating system
- TurboDOS Manual
- ICM's TurboDOS Configuration Manual
- Voltage Meter to test the chassis and connectors
- Screwdriver to install the Personality Board to the back of the chassis
- Nutwrench to install Jack screws on the Personality Board
- Wire unwrapping tool to change wire wrap jumpers on the CPS-16F or RPB-200 board if necessary
- Jumper shunts to set new jumper selections on the CPS-16F or RPS-200 board if necessary

HARDWARE

Testing the Power Supply

ICM recommends that a voltage verification test be performed on the S-100 Bus. Voltage that is too high could result in a burnt out regulator or damaged devices. Low voltage can create intermittent problems that are difficult to trace. Very low voltage (below 5) will cause your system not to boot or to crash.

WARNING!

Only individuals familiar with voltage measurement equipment and procedures should perform the following test!

1. Remove the mainframes power plug from the AC source.
2. Remove the chassis cover. Make sure you place the screws where they won't be lost.
3. Remove all boards from the S-100 Bus.
4. Plug the power cord back into the AC source and turn the chassis power ON.

   NOTE: Removing all the boards **MAY** cause voltage readings to be 2 to 3 VDC's higher than the values stated in the instructions.
5. Turn the Voltage Meter ON. Set the scale at a position capable of reading up to 12 VDC.
6. Place the common probe against pin 50 of any slot on the S-100 Bus and the positive probe against pin 1. The Voltage Meter should register between 8 to 9.5 VDC.
7. With the common probe still against pin 50, move the positive probe against pin 51. The Voltage Meter should register between 8 to 9.5 VDC.
8. Place the common probe against pin 100 and the positive probe against pin 1. The Voltage Meter should register between 8 to 9.5 VDC.
9. Leaving the common probe against pin 100 move the positive probe against pin 51. The Voltage Meter should register between 8 to 9.5 VDC.
10. Remove both probes and set the Voltage Meter at a position capable of reading 22 VDC.

11. Place the common probe against pin 50 and the positive probe against pin 2. The Voltage Meter should register between 16 to 18 VDC.

12. Remove the positive probe and place it against pin 52. The Voltage Meter should register between -16 to -18 VDC.

13. Remove both probes. Place the common probe against pin 100 and the positive probe against pin 2. The Voltage Meter should register between 16 to 18 VDC.

14. Leaving the common probe on pin 100 move the positive probe against pin 52. The Voltage Meter should register between -16 to -18VDC.

15. Place the common probe against pin 50 and the positive probe against pin 100. The Voltage Meter should register 0 VDC.

16. Turn the power OFF.

Hardware Configuration

Jumper options apply to three locations on the board. Figure 1.0 shows the locations of each.

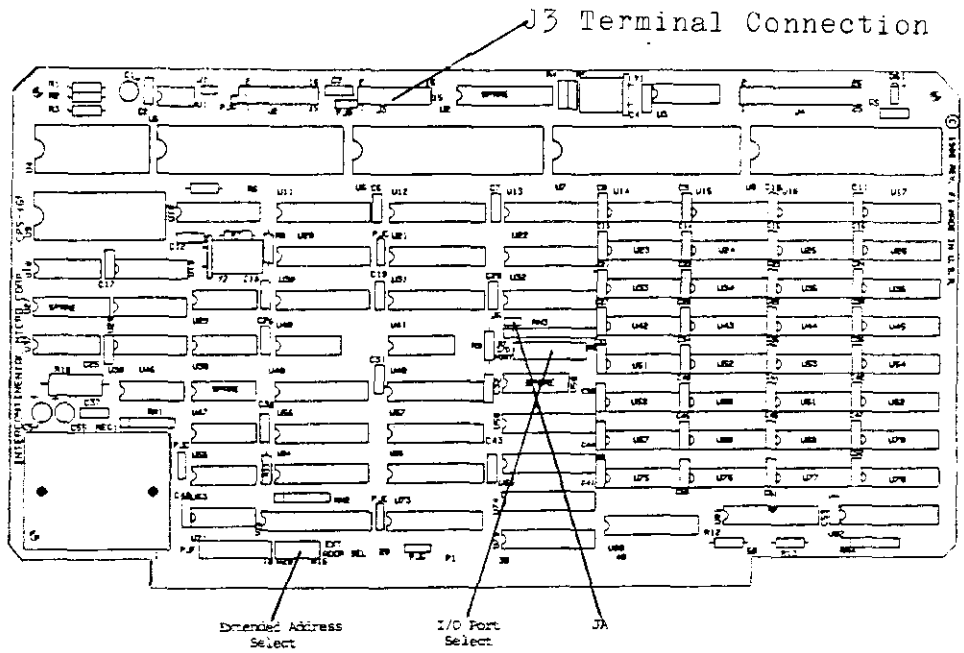


FIGURE 1.0

Default Values on the CPS-16F are set to use with a 16-bit (CPZ-186) fileserver. The hardware configuration is illustrated in figures 1.1, 1.2 and 1.3.

Extended Address Selection

Default is set for use with a 16-bit fileserver. Figure 1.1 illustrates how the Extended Address Selection will look when you receive the CPS-16F.

Default Setting

This setting places the CPS-16F's memory at the beginning of the second megabyte space of the S-100 memory map.

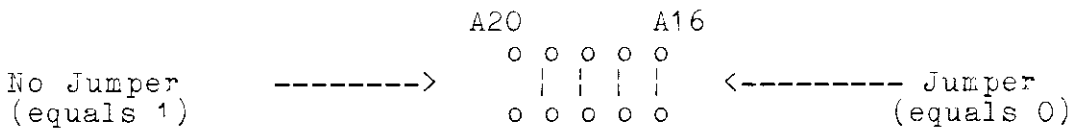


FIGURE 1.1

If you want to use the CPS-16F Application Processor with an 8-bit fileserver, remove the shunt (jumper) from A16 and place it on A20. Figure 1.2 illustrates how the Extended Address Selection should look when the jumpers are switched.

Setting for use with an 8-bit fileserver.

This setting places the CPS-16F's memory at the beginning of the second 64K byte space of the S-100 memory map.

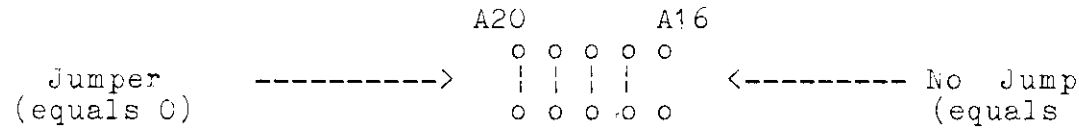


FIGURE 1.2

I/O Port Selection

The I/O Port Selection setting can be used with either the 8 or 16-bit fileserver.

If you're using one (1) 16-bit application processor (in this case, the CPS-16F) leave the setting at the default value (3F hexadecimal), illustrated in Figure 1.3.

Default Value

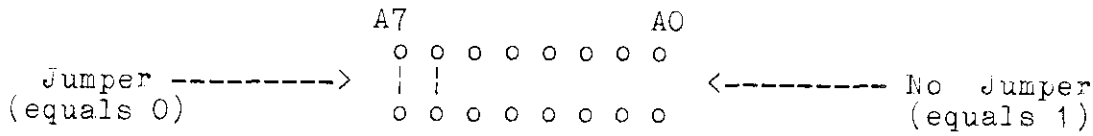


FIGURE 1.3

I/O Port Selection settings - two or more application processors.

The only reason for changing the I/O Port Selection setting is when two or more 16-bit application processors are being used with the same fileserver. Each application processor must have a unique I/O Address so the fileserver will know which one it's communicating with. Figure 1.4 on the next two pages illustrates how the I/O Port Selection settings for each application processor should look. As you install the CPS-16F make sure your hardware configuration matches the software configuration values in the PATCSA (Port Assignment Table).

NOTE: FOR MORE INFORMATION ON SOFTWARE CONFIGURATION, REFER TO ICM'S TURBODOS CONFIGURATION MANUAL.

I/O Port Selection for 16-bit Application Processors

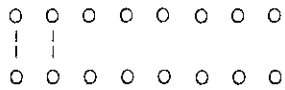
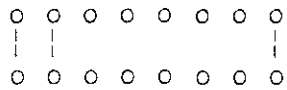
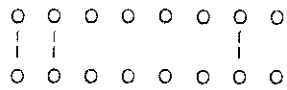
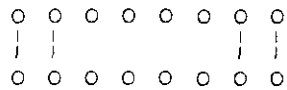
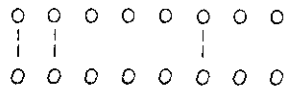
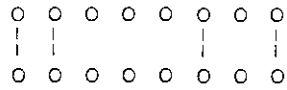
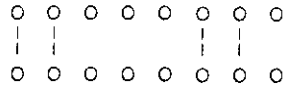
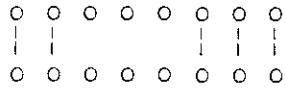
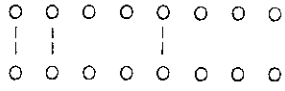
Slave #	Hardware Configuration	Software Configuration
1		3F
2		3E
3		3D
4		3C
5		3B
6		3A
7		39
8		38
9		37

FIGURE 1.4

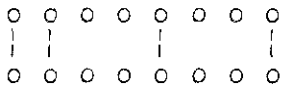
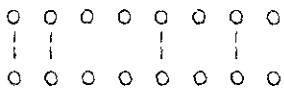
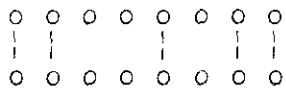
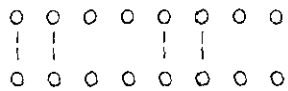
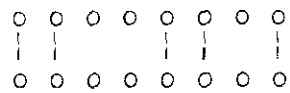
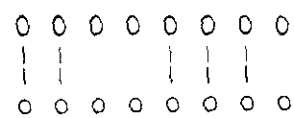
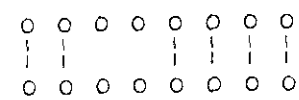
Slave #	Hardware Configuration	Software Configuration
10		36
11		35
12		34
13		33
14		32
15		31
16		30

FIGURE 1.4 (cont.)

JA Mode Selection

The JA Mode Selection setting depends on which version of the TurboDOS Operating System you're using. TurboDOS Version 1.43 or higher is compatible with the PC Monochrome mode.

PC Monochrome Mode or CPS-16X Mode with TurboDOS Version 1.43 and higher

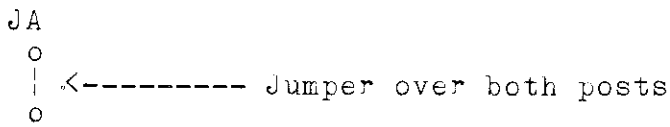


FIGURE 1.5

CPS-16X Mode with TurboDOS Version 1.42 and lower

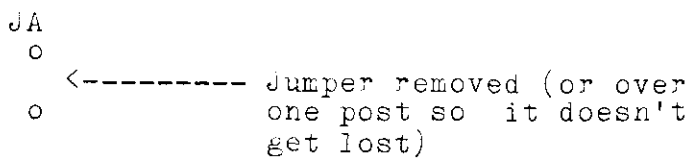


FIGURE 1.6

Connecting the CPS-16F to the S-100 Bus

1. With the power to the bus OFF, insert the CPS-16F application processor firmly into the S-100 Bus. **The board must be firmly locked into the S-100 Bus. If it isn't, severe damage could result.**

2. Replace and reconnect all the boards previously removed for the voltage verification test and repeat steps 1 - 13 of the Testing the Power Supply Section. The readings should be within the ranges stated in the instructions. No allowance should be made now that the boards have been replaced.

Connecting the RPB-200 Personality Board.

1. Make sure the chassis power is OFF.

2. Locate the DB-25 connector cut out at the rear of the chassis and insert the RPB-200 personality board.

3. Install the #6 nuts, washers and screws, inserting the screws through the holes on each side of the personality board's DB-25 connector as illustrated in Figure 1.7.

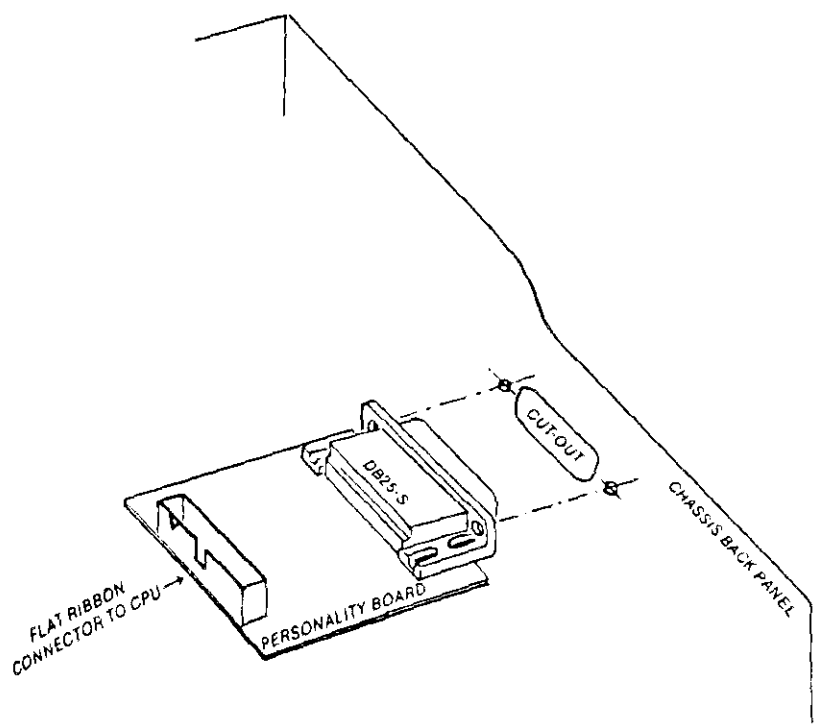


FIGURE 1.7

4. Plug in the box connector so that the red stripe of the ribbon cable is plugged into pin 1 of the serial port connector J3. (J3 is silkscreened on the CPS-16F board.)

5. If you want to enable the signal on pin 20 DTR, for Clear-to-Send handshaking, move the jumper from the second to the third position on the 2x6 block. The 2x6 block is the only one on the personality board with a jumper. The 2x6 block is located close to the DB-25 connector as illustrated in Figure 1.8 on the next page.

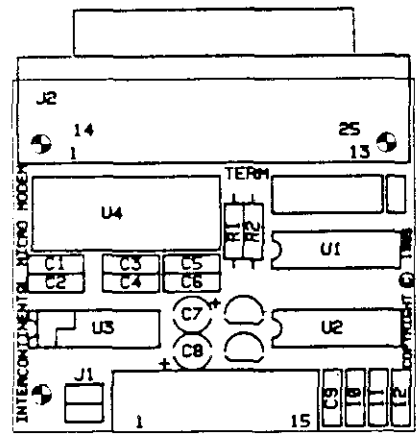


FIGURE 1.8

To connect the video terminal to the RPB-200 personality board, ICM recommends you use 4 pair (8 wire) twisted shielded 22 gauge RS-232 cable to wire the DB-25 male connectors. If you're not going to use "handshaking", 3 pair (6 wire) twisted shielded 22 gauge RS-232 cable is fine. Figure 1.9 indicates the pin/signal assignment.

PIN/SIGNAL ASSIGNMENT

Male DB-25 connector that plugs into the RPB-200		**Male DB-25 connector that plugs into the Video Terminal**
Signal	Pin #	Signal
	1	*Chassis Ground
Receive Data	2	Transmit Data
Transmit Data	3	Receive Data
Signal Ground	7	Signal Ground
Data Terminal Ready	20	Data Terminal Ready

FIGURE 1.9

6. Solder or crimp the wires at each end of the RS-232 cable to the DB-25 male connectors. Figure 1.10 illustrates the pin-wire pin assignment. ***Pin 1 is the shield. Tie pin 1 on the Video Terminal end ONLY.**

NOTE: Pin 20 is used for handshaking only. If you don't require handshaking it isn't necessary to connect the wires to these pins.

Note that ICM's Terminal does not support software handshaking.

PIN/WIRE ASSIGNMENT

Video Terminal End Connector (Main Port)		Personality Board End Connector (DB-25)
Pin 1	o———	o Pin 1
Pin 2	o———	o Pin 2
Pin 3	o———	o Pin 3
Pin 7	o———	o Pin 7
Pin 20	o———	o Pin 20

FIGURE 1.10

APPENDIX C LISTS THE PIN SIGNALS FOR THE DB-25 FEMALE CONNECTORS ATTACHED TO THE RPB-200 PERSONALITY BOARD AND THE MAIN PORT LOCATION ON THE VIDEO TERMINAL.

7. Plug the DB-25 male connector wired for the Video Terminal into the Main Port location at the rear of the terminal, as illustrated in Figure 1.11

Rear View of M/STER Terminal

FIGURE 1.11

8. Plug the other connector into the RPB-200 personality boards DB-25 connector located at the back of the S-100 chassis. See Figure 1.7.

9. Turn the chassis' power ON to proceed with software configuration.

Software Configuration

Systems integration offers a variety of configuration options. **IF YOU'RE INSTALLING MORE THAN EIGHT APPLICATION PROCESSORS REFER TO YOUR ICM TURBODOS CONFIGURATION MANUAL FOR MORE DETAIL.**

ICM now has a menu driven software product called START-UP that makes software configuration easy. All you have to do is enter information as the prompts request it. Contact your ICM Representative for a free copy of START-UP. (Note: If you're looking for this on your ICM pricelist, the name to look for is TBDOS CONFIG.)

To install the CPS-16F with a CPZ-186 (16-bit) fileserver:

1. Insert the Config "I" diskette into drive A. This diskette contains the GEN and PAR files you'll be linking.

   FOR MORE INFORMATION ON GEN AND PAR FILES READ CHAPTER 6 IN ICM'S TURBODOS CONFIGURATION MANUAL.

2. Boot-up the Config "I" diskette. The TurboDOS sign-on message and prompt will appear.

   IF YOU HAVE PROBLEMS GETTING THE DISKETTE TO BOOT-UP, REFER TO CHAPTER 2 IN ICM'S TURBODOS CONFIGURATION MANUAL.

3. Create an operating system for the CPS-16F application processor by entering:

   TLINK CPSSLV16 OSSLAVEZ.SYS (CR)

4. Regenerate your fileservers' operating system by entering:

   TLINK CPZMST16.SYS (CR)

5. Load the multi-user system by entering:

   OSLOAD CPZMST16 (CR)

NOTE: The A} prompt will no longer appear on the terminal attached to the fileserver (the one you're using), it'll appear on the terminal attached to the CPS-16F application processor. If the A} prompt doesn't appear on the terminal attached to the application processor, check to see if the fileserver is operating correctly by doing the following:

Edit the CPZMST16.GEN file.

Insert a ; in front of the module CONREM.

Remove the ; in front of the module CON96.

Repeat steps 4 and 5.

The A} prompt will display on the terminal attached to the fileserver. This indicates the jumper settings on the application processor are incorrect. Correct the settings and repeat step 5. The A} should appear on the terminal connected to the application processor. When these steps have been completed successfully, return the CPZMST16.GEN file to its original configuration. Repeat steps 4 and 5.

To complete the procedure perform the following steps on the terminal attached to the application processor.

6. Rename the files by entering:

RENAME CPZMST16.SYS OSMASTER.SYS (CR)

This enables the terminal attached to the CPS-16F to boot automatically when it's switched on.

7. Flush the Buffers by entering:

CHANGE A

8. Turn the power to the chassis OFF. Replace the chassis cover.

To install the CPS-16F with a CPZ-4800X (8-bit) fileserver:

1. Insert the Config "G" diskette into drive A. This diskette contains the GEN and PAR files you'll be linking.

   FOR MORE INFORMATION ON GEN AND PAR FILES READ CHAPTER 6 IN ICM'S TURBODOS CONFIGURATION MANUAL.

2. boot-up the Config "G" diskette. The TurboDOS sign-on message and prompt will appear.

   IF YOU HAVE PROBLEMS GETTING THE DISKETTE TO BOOT-UP, REFER TO CHAPTER 2 IN ICM'S TURBODOS CONFIGURATION MANUAL.

3. Regenerate your fileservers' operating system by entering:

   GEN CPZMASTR.SYS (CR)

4. Load the multi-user system by entering:

   OSLOAD CPZMASTR (CR)

NOTE: The A} prompt will no longer appear on the terminal attached to the fileserver (the one you're using), it'll appear on the terminal attached to the CPS-16F application processor. If the A} prompt doesn't appear on the terminal attached to the application processor, check to see if the fileserver is operating correctly by doing the following:

Edit the CPZMASTR.GEN file.

Insert a ; in front of the module CONREM.

Remove the ; in front of the module CON96.

Repeat steps 3 and 4.

The A} prompt will display on the terminal attached to the fileserver. This indicates the jumper settings on the application processor are incorrect. Correct the settings and repeat step 4. The A} should appear on the terminal connected to the application processor. When these steps have been completed successfully, return the CPZMASTR.GEN file to its original configuration. Repeat steps 3 and 4.

To complete the procedure perform the following steps on the terminal attached to the application processor.

5. Rename the files by entering:

   RENAME CPZMASTR.SYS OSMASTER.SYS (CR)

This enables the terminal attached to the CPS-16F to boot automatically when it's switched on.

6. Flush the Buffers by entering:

   CHANGE A

7. Turn the power to the chassis OFF. Replace the chassis cover.

TABLE OF CONTENTS

PC Disk Utility (PCDU)

MS-1000 SOFTWARE TECHNICAL

This section will give you an overview of how the software has been integrated to execute the PC-DOS operating system on your slave processor. The major software areas are as follows:

BIOS emulator

PC-DOS operating system

Download image file

TurboDOS/PC networking

Cold start procedure

MS-AUTO.BAT procedure

Software distribution

BIOS Emulator

A most basic part of the MS-1000 operation is known as the BIOS emulator. This piece of code contains the necessary drivers which emulate the PC's ROM BIOS environment for a program running in the slave processor. By definition, this code supports the hardware interface routines accessed by interrupts hex 10 through hex 1F. Through these vectors, PC console output, keyboard input, printer output, serial I/O, and disk I/O are performed.

The BIOS emulator was developed as a group of hardware independent and hardware dependent (drivers) modules that are linked together to form two configurations of a BIOS. One configuration is in the form of a TurboDOS program (.CMD file) while the other is compatible with a TurboDOS downloaded slave operating system (.SYS file). The later may be copied into your system file area on your hard disk into the appropriate OS slave download filename.

Default configurations of the program and system file executable versions are pre-linked at ICM into un-initialized unique filenames known as "MS-SLVU.CMD" and "MS-SLVU.SYS". These files can be used directly if all defaults are accepted, or else the installation program "CFGMSS" may be executed to change any of the options.

NOTE: The options are documented and shown with their default in the section concerning the installation program.

The BIOS emulator is grouped into the following sections:

Command or System file execution module

BIOS control kernel

BIOS logon routines

PC-DOS EXEC routines

Keyboard driver

Monochrome display adaptor emulator

Initialization module

Relative time clock driver

Circuit driver for PC-DOS downloading

Parallel printer driver

Asyncronous communications driver

This extremely flexible design layout of the BIOS emulator was chosen to allow new features to be easily added to the BIOS as they are developed.

Other terminal types for example, could be supported by MS-1000 but may not be fully compatible with the 256 characters that are supported by an IBM-PC.

NOTE: Special custom configurations of the BIOS emulator are also available through ICM for a non-refundable fee for both the feasibility study and software developement.

Command or System File Execution Module

These two modules allow the other modules to be linked together to create the two configurations of MS-1000, command file executable or system file executable.

BIOS Control Kernel

This hardware independent module is the control kernel for the BIOS level of compatibility. It is responsible for setup of the BIOS vectors used in the machine, the equipment flags and memory size presented from the BIOS, and the BIOS signature. The BIOS kernal calls out to initialization of the hardware dependent drivers, then initiates PC-DOS downloading through it's bootstrap routine.

The BIOS control kernel is also responsible for the support of sub-routines used by the drivers.

BIOS Logon Routines

The hardware independent BIOS logon routines are responsible for interaction with the master processor for the purpose of user logon. When user logon is enabled, the user must logon to the system in a fashion compatible with the TurboDOS logon procedure before PC-DOS downloading will continue in the slave.

PC-DOS EXEC Routines

The PC-DOS EXEC routines are present in the BIOS emulator to allow the operation of PC-DOS version 3.xx, where the PC-DOS EXEC function is resident within the operating system and not transient within the command line interpreter (COMMAND.COM). This module is hardware independent by nature.

Keyboard Driver

The keyboard driver accepts serially transmitted scan code information from the terminal and converts these to IBM compatible codes that are returned from the BIOS to PC-DOS and other application programs.

Monochrome Display Adaptor Emulator

The monochrome display adaptor emulator is the driver responsible for maintaining a simulation of this device for both PC-DOS and application programs. This driver allows both BIOS interrupt access and well as direct access to the video display memory found within an IBM-PC. Once display buffer information changes, by way of PC-DOS or application programs, the emulator translates the changes into serial information and transmits this to the terminal.

Initialization Module

This hardware dependent module is responsible for the initialization sequence of all the drivers. It also captures direct access to I/O ports found in the IBM-PC to allow software simulation.

Relative Time Clock Driver

This hardware dependent driver maintains the current time and date, performs the user periodic tick interrupt, and dispatches other dedicated functions with the BIOS emulator.

Circuit Driver For PC-DOS Downloading

This hardware dependent driver provides the circuit interface for the slave processor side of the network. Used primarily for PC-DOS downloading purposes, the circuit driver is also used by the logon routines.

Parallel Printer Driver

This hardware dependent driver provides BIOS level compatability for the PC's parallel printer device. Using an ICM Centronics personality board, a local printer could be connected and used by the MS-1000 user. The PRINT LOCAL command under TurboDOS/PC could be used to switch to the local printer when using the TURBOPRN.COM print and spooling filter.

Asyncronous Communications Driver

This hardware dependent driver allows BIOS level support for a COM1 serial communication device. Using an ICM serial personality board, a MODEM could be connected to the spare serial channel and used by application software that references the MODEM through the PC-DOS COM1 I/O channel.

NOTE: Most popular communications packages will attempt to operate the COM1 hardware device directly. These are NOT supported under the MS-1000 system.

PC-DOS Operating System

A copy of the PC-DOS operating system is distributed with the MS-1000 product. Currently, both PC-DOS version 2.10 and version 3.10 are available from ICM. Version 3.20 will be available soon after the initial release of the MS-1000 product.

PC-DOS has already been transfered from it's 5-1/4 inch PC-DOS compatible format to your ICM TurboDOS format distribution of MS-1000. IBM-PC hardware specific programs that do not execute under the MS-1000 system have not been transfered.

NOTE: A copy of the PC-DOS user guide is also distributed with the MS-1000 package.

Download Image File

The download image file is used exclusively to bootstrap the PC-DOS operating system into the slave processor. Once this has been performed, the download image file is never accessed again.

The download image file is quite simply a psuedo file which looks like a 9-sector PC-DOS compatible floppy diskette, either single sided (180K capacity) or double sided (360K capacity). The file components for bootstap of PC-DOS and startup of TurboDOS/PC are located within this psuedo file.

This psuedo file is created and maintained by the "PCDU" utility provided on the MS-1000 distribution disk.

NOTE: PCDU has it's own software technical section within this document. Please refer to this section for more detail on the program.

TurboDOS/PC Networking

TurboDOS/PC is utilized by MS-1000 to obtain access to TurboDOS file and print servers in a network. Once the PC-DOS has been downloaded into the slave processor, TurboDOS/PC is executed from the download image file and the slave processor can now begin access to TurboDOS drives and print servers. At this point the download image file can no longer be accessed by the slave processor, and the BIOS PC-DOS EXEC support code is enabled if running under PC-DOS version 3.xx. The TurboDOS/PC driver is setup using the MS-1000 installation utility, then copied into the PC-DOS image file for proper networking operations.

NOTE: *TurboDOS/PC is documented by Software 2000 in the Guide to* TurboDOS/PC 1.0x. The TurboDOS/PC driver options relative to the MS-1000 package are documented with the CFGMSS utility.

Cold Start Procedure

This is a detailed explanation of the entire cold start sequence of the MS-1000 software and how various user options will affect the procedure.

Files

The following files, programs, and utilities are involved with cold start procedure.

MS-SLAVE.CMD - BIOS emulation program file
MS-SLAVE.SYS - BIOS emulation system file

These files contain the BIOS emulation routines for the MS-1000 package. The very first step that begins MS-1000 operation is the loading of the BIOS emulator into the slave processor. Two configurations are offered to accomplish the loading of this code from a TurboDOS executing slave or initial slave OS loading (performed by the master processor at reset time).

These MS-1000 files are not on the MS-1000 distribution disk, yet are created by the installation utility "CFGMSS".

NOTE: CFGMSS is covered in both startup terms and detailed option information within this guide.

PCIMAGE.DSK - Download image file
PCDU.CMD - Maintainence utility

This is the default download image file. This is the same term that this name is refered to with the installation utility "CFGMSS". This file is not distributed on the distribution disk, yet created and maintained through the "PCDU" utility. PCDU is discussed in simple start-up terms and also in detail within this guide.

PCIMAGE.DSK is quite simply a psuedo file of the image of a PC-DOS compatible disk (9 sector, either single or double sided). PCIMAGE.DSK may contain up to 180K or 360K of file information, but more importantly, contains the PC-DOS operating system and boot sector, plus the components of TurboDOS/PC (program and driver). PCIMAGE.DSK could also contain PC-DOS resident drivers (*.sys files) and the PC-DOS file "CONFIG.SYS" for configuration requirements of PC-DOS. The slave processor design prohibits the use of device drivers that expect to operate hardware components directly, but hardware independent enhancement drivers (such as ANSI.SYS) can be utilized.

The location of PCIMAGE.DSK within your TurboDOS drive/user spectrum is important for the proper setup of MS-1000. In terms of installation, this area is refered to as the network drive and network user numbers.

IBMBIO.COM - DOS BIOS I/O interface
IBMDOS.COM - Disk operating system
COMMAND.COM - Command line interpreter

These files are the minimum required for loading of PC-DOS into the slave processor. These file are placed into the download image file by PCDU automatically during image file creation.

TURBOPC2.COM - TurboDOS/PC networking program
TURBOPC.DRV - TurboDOS/PC network driver module

These files are required for start-up of TurboDOS/PC in the slave processor once PC-DOS has been loaded and executed. These files must be present in the download image file and are placed there with the PCDU utility.

MS-AUTO.BAT - Automatically executed user batch file

This file is the final startup customization that one could perform for PC-DOS. This file is distributed in default form on the MS-1000 distribution disk. MS-AUTO.BAT must be located on your TurboDOS drive (the network drive), where the root directory user number has been assigned.

Start-up Procedure Step #1

The first step in loading MS-1000 software is the execution of the BIOS emulator in the slave processor. This is accomplished from either a program load under TurboDOS or slave OS load from the master after slave reset. Both configurations are offered for maximum flexibility in system configuration.

All operations beyond this point are common between the program load and system load version of MS-1000. Furthermore, the TurboDOS operating system is no longer a neccessity to the slave processor.

The BIOS emulator will initialize it's own drivers and components, then transfer control to the bootstrap routine of the BIOS.

NOTE: The BIOS initialization will validate the correct terminal type and serial number of the master processor. If either check proves corrupt, the appropriate message is displayed, followed by the halting of the slave processor.

Start-up Procedure Step #2

If enabled, the user logon routine will prompt the user for a valid "User id". The file name and user area location of the logon file may be configured with CFGMSS. The drive location from the download image file is also used for lookup of this file. The configuration of this file is compatible with your standard TurboDOS logon file, with a few notable differences in how the logon drive and user area are utilized.

If logon is performed under MS-1000, and either a drive reference or user number reference is present in the logon file line, these will be substituted for the drive and user area where the download image file is assumed to be located. This allows considerable flexibility in larger systems where different MS-1000 users are required to use different PC-DOS configurations (device drivers, TurboDOS/PC driver configurations, etc.).

If logon is not performed under MS-1000, the default settings for the drive and user number of the download image file are maintained. Logon is enable or disabled with CFGMSS.

Start-up Procedure Step #3

At this point, the first attempt to access the download image file is performed, and if not found, an error message is displayed and the slave processor halted. If found, a message displaying the fact that PC-DOS is downloading is displayed, along with the drive, user, and filename of the download image file.

The bootstrap is now entirely under the control of PC-DOS referenced into what it thinks is a PC-DOS compatible disk (the download image file). PC-DOS continues by loading it's components, first IBMBIO.COM, followed by IBMDOS.COM, and finishing up with COMMAND.COM. These are all located within the download image file, displayed previously by the BIOS emulator. The familiar PC-DOS sign-on message will appear next.

NOTE: Download is NOT complete at this point. The BIOS is programmed to feed automatic responses to PC-DOS to continue the start procedure. Simple return responses are sent for the date and time request by PC-DOS, followed by the command to load TurboDOS/PC. The download image file at this point is still the only device that PC-DOS understands.

Start-up Procedure Step #4

TurboDOS/PC is now loaded into the slave processor, by PC-DOS from the download image file. Once executing, TurboDOS/PC initializes itself and it's driver, which is configured to map the first sixteen disk devices (A through P) to remote disk devices referenced through your TurboDOS master processor.

NOTE: The download image file is no longer being utilized in the startup procedure. PC-DOS will now understand that up to sixteen remote disk devices are now available through your TurboDOS master. However, the startup procedure is still NOT complete at this time.

Start-up Procedure Step #5

And now we approach the end of BIOS Emulator's responsibility in the startup procedure. After TurboDOS/PC and driver are automatically loaded, the BIOS continues automatic responses to PC-DOS and switches to the proper drive name (A through P). This will be either the default network drive or altered downloading drive through logon routines. This will insure a ready to operate TurboDOS drive to continue processing on.

The last automatic response from the BIOS is performed to begin execution of the MS-1000 autoexec batch file "MS-AUTO.BAT". The file must be located on the drive under the user area which PC-DOS considers the root directory. The PC-DOS root directory user number is configured with CFGMSS.

MS-AUTO.BAT Procedure

MS-AUTO.BAT is now free to continue PC-DOS startup in whatever manner is neccessary to customize your MS-1000 system. Your slave processor is now, for all practical purposes, a PC-DOS executing machine linked to your TurboDOS master processor through the TurboDOS/PC networking components.

A default example for the MS-AUTO.BAT file is distributed on the MS-1000 distribution disk as follows:

```
echo off
prompt $p$g
turboprn
datetime
```

"Echo off" is a PC-DOS command which disables batch file character echoing during processing. "Prompt pg" is a PC-DOS command which customizes the command line prompt to display the current directory along with the current drive and prompt.

"Turboprn" will execute the TurboDOS/PC print spooling filter which MUST be installed for proper network routing of the print stream.

"Datetime" will execute an ICM supplied utility which syncronizes the current date and time maintained by the master processor to the newly loaded copy of PC-DOS. The user does not need to worry about setting the date and time every time the MS-1000 package is loaded. DATETIME.COM is located on your MS-1000 distribution disk.

Software Distribution

The MS-1000 software is currently available for the ICM CPS-16F slave processor product. The following standard ICM formatted disk media is available:

8 INCH, DOUBLE DENSITY, SINGLE-SIDED (1DT)

5-1/4 INCH, DOUBLE DENSITY, DOUBLE SIDED, 40 TRACK (2DT4)

5-1/4 INCH, DOUBLE DENSITY, DOUBLE SIDED, 80 TRACK (2DT8)

The files are separated into three catagories; 1) MS-1000 programs and files, 2) TurboDOS/PC programs and files, and 3) PC-DOS programs and files.

MS-1000 Programs and Files

CFGMSS.CMD	- Configuration utility
PCDU.CMD	- Download image file utility
DATETIME.COM	- Date and time syncronization program
ZDIR.COM	- Sorted directory listing program
MS-AUTO.BAT	- Default MS-AUTO batch file
MS-DRVU.DRV	- Default TurboDOS/PC driver module
MS-SLVU.CMD	- Default MS-1000 command program
MS-SLVU.SYS	- Default MS-1000 system file
MSSUSR.O	- 8086 protection module
MSSUSR.REL	- Z-80 protection module
PCDUBOOT.SYS	- Download image file boot system

TurboDOS/PC Programs and Files

CHANGE.COM	- Change disks program
MASTER.COM	- Attach to master program
PRINT.COM	- Print control program
PRINTER.COM	- Printer control program
REASSIGN.COM	- Device re-assignment program
RESET.COM	- Reset open files program
TURBOPC2.COM	- TurboDOS/PC networking program
CMDTOCOM.CMD	- TurboDOS translator program

PC-DOS Programs and Files

COMP.COM	- File comparator program
DEBUG.COM	- Debugger program
EDLIN.COM	- Editor (line oriented)
KEYBFR.COM	- Keyboard translators
KEYBGR.COM	
KEYBIT.COM	
KEYBSP.COM	
KEYBUK.COM	
MODE.COM	- PC mode program (other than physical)
MORE.COM	- Display pagination program
TREE.COM	- Sub-directory display program
ATTRIB.EXE	- Attribute display/set program
EXE2BIN.EXE	- File conversion program
FIND.EXE	- File location program
LINK.EXE	- Object linkage editor

(List Continued on Next Page)

JOIN.EXE	- Directory joining program
SHARE.EXE	- File sharing program
SORT.EXE	- Sorting filter
SUBST.EXE	- Drive substition program
COMMAND.COM	- Command line interpreter file
IBMBIO.COM	- BIOS I/O interface file
IBMDOS.COM	- PC-DOS system file
ANSI.SYS	- ANSI console driver file

MS-1000 INSTALLATION UTILITY

The MS-1000 installation utility "CFGMSS" was created to ease the complication neccessary when configuring the MS-1000 BIOS emulator and TurboDOS/PC driver for your own system environment. A good working knowledge of the startup procedure that takes place every time MS-1000 is loaded into the slave processor may be required to understand the installation options. The startup procedure is explained in the software technical section of this guide.

CFGMSS was designed to execute under the TurboDOS operating system (the default operating system that your slave processor is executing). Initial installation or re-installations of the BIOS emulator and TurboDOS/PC driver are performed by this utility. At a minimum, CFGMSS should be used, even if all the default options are correct for your installation requirements, to insure that the proper files are created for the BIOS emulator and TurboDOS/PC driver.

The following files must be present within the user area when you begin execution of CFGMSS:

MS-SLVU.CMD - default BIOS emulator (command version)

MS-SLVU.SYS - default BIOS emulator (system version)

MS-DRVU.DRV - default TurboDOS/PC driver

All files read or written by CFGMSS will be within your current drive/user area. Furthermore, CFGMSS will create or re-install the following files:

MS-SLAVE.CMD - configured BIOS emulator (command version)

MS-SLAVE.SYS - configured BIOS emulator (system version)

TURBOPC.DRV - configured TurboDOS/PC driver

CFGMSS requires no command line options when executed, for example:

```
A>CFGMSS <ret>

MS-SLAVE Configuration Utility (v1.0)

   A - New installation of MS-SLAVE command version
   B - New installation of MS-SLAVE system version
   C - Re-installation of MS-SLAVE command version
   D - Re-installation of MS-SLAVE system version
   E - New installation of TurboDOS/PC driver
   F - Re-installation of TurboDOS/PC driver
   X - Exit back to OS

Enter installation option (<RET>=A):
```

Typical throughout the operation of CFGMSS, are menus and prompt lines that inform you of the possible responses to options. Always shown on the prompt line is the default for merely pressing the "return" key. The return key has been assigned the most popular installation responses, as well as the "no change" response to the various options.

The main installation option menu can be grouped into two catagories; 1) configuration of the BIOS emulator "MS-SLAVE" (both command and system versions) and, 2) configuration of the TurboDOS/PC driver module "TURBOPC.DRV".

CFGMSS Installation Options

Options A and B are used for first time installation of the BIOS emulation package. These options read the default distribution files "MS-SLVU.CMD" and "MS-SLVU.SYS" respectively, and begin options for the BIOS emulator.

Options C and D are used for re-installation of the BIOS emulation package. These options read the files "MS-SLAVE.CMD" and "MS-SLAVE.SYS" respectively, and begin options for the BIOS emulator.

Options A and C will output the file "MS-SLAVE.CMD", while options B and D will output the file "MS-SLAVE.SYS". These files are ready for use in startup of the MS-1000 software.

Options E and F are used for first time installation and re-installation of the TurboDOS/PC driver module. The default configuration of this file is known as "MS-DRVU.DRV" on the distribution disk.

All installation options after they are selected, will display the input and output files that will be acted upon. A verification prompt is issued in case a mistake was made in selection. A no response to this prompt will return you to installation option menu, while a yes response will continue by reading in the input file. File customization for the option will immediately continue.

BIOS Emulator Options

Selected through installation options A through D, the BIOS emulator options are all the same sequence of events. A breif description of the option and how it affects configuration is displayed, along with the current setting of the option. As mentioned before, all options can be accepted with no change by a <ret> without input response.

The BIOS emulator options are catagorized in the following manner:

Download image file

Network drive name

Network user number

Logon routines

Logon file

Logon user number

Console channel number

Console baud rate and handshaking

The following text is a detailed description of each BIOS emulator option. A knowledge of file naming conventions and the target system configuration are assumed here, besides a good understanding of the startup procedure for download PC-DOS and TurboDOS/PC into the slave processor.

Download Image File (default = PCIMAGE.DSK)

This is the name of the download image file that will be referenced by the BIOS emulator for the purpose of downloading PC-DOS and TurboDOS/PC into the slave processor. This name may be any valid file specification (8 character name field and 3 char type field).

Network Drive Name (default = A)

This is the TurboDOS drive name where the user logon file is located. It is also the default TurboDOS drive name where the download image file is located, unless instructed otherwise by a drive descriptor within the logon file. The network drive name is logged into automatically towards the end of the startup procedure before the MS-AUTO.BAT execution begins. This drive name can be any valid TurboDOS drive A through P.

Network User Number (default = 0)

The network user number is the default user number where the download image file is located, unless instructed otherwise by the user descriptor within the logon file. The network user number may be any valid TurboDOS user 0 through 31.

NOTE: At a minimum, these last three options inform the BIOS emulator of where to find the download image file within your TurboDOS network. Although not a restriction, it is recommended that the user number here be your system area "user 0".

Logon Routines (default = Enabled)

This option will allow the user logon routines within the BIOS emulator to be enabled or disabled. If disabled, the two following options will not be revelent in the downloading procedure. If enabled, the two following options select the user logon file name and user area on the network drive where the file is located.

Logon File (default = USERID.SYS)

If user logon is enabled, the logon file specifies the name of the logon file in the system. This name may be any valid file specification (8 character name field and 3 char type field). The logon routines of the BIOS emulator are compatible with the file format of a normal TurboDOS logon file "USERID.SYS", and may be used in your system without special logon file creation. Note however that user number and drive specification located on each line of the logon file can affect the PC-DOS downloading operation.

Logon User Number (default = 31)

If user logon is enabled, the logon user number specifies the user area, on the network drive, where the logon file is located. The logon user number may be any valid TurboDOS user 0 through 31.

Console Channel Number (default = 1)

The console channel number is where the M/STER terminal is connected to the slave processor. This channel number is known to the BIOS emulator the same as TurboDOS, and may be assigned to either channel 0 or 1. ICM's TurboDOS operating system, by default, will use channel 1 of the slave processor.

Console Baud Rate and Handshaking (default = 9600, handshaking disabled)

The following two prompts set the M/STER terminal baud rate and handshaking options for the BIOS emulator. The baud rate code (0 through 15) is selected from the displayed menu, following by the handshaking option (Enabled or Disabled).

As a rule, the M/STER terminal may be increased to 19,200 baud without the need for hardware "DTR/CTS" handshaking, but will NOT operate at 38,400 baud without it. Furthermore, TurboDOS will NOT operate properly at 38,400 baud either, so it is recommended that the TurboDOS operating system be switched to 38,400 baud with handshaking and verified before configuration of the BIOS emulator for this data rate.

Finally, installation options for the BIOS emulator finish up with a complete list of the current option settings, followed by a prompt for verification. If a no response is issued, the option list will start over again from the beginning. If a yes response is issued, the output file is written and CFGMSS will return to the initial installation option menu.

TurboDOS/PC Driver Options

Selected though installation options E and F, the TurboDOS/PC driver options display a brief description of the option and how it affects configuration, along with the current setting of the option. All current settings are accepted with no change by a <ret> without input response.

The TurboDOS/PC driver options are catagorized in the following manner:

Root directory user number

Privileged status

Print mode

End of print character

The following text is a detailed description of each TurboDOS/PC driver option available under MS-1000.

NOTE: A knowledge of TurboDOS/PC and reference to the TurboDOS/PC guide will be helpful in driver configuration.

Root Directory (default = 0)

The root directory user number is the TurboDOS user area where PC-DOS will consider it's root directory begins. The root directory user number may be any valid TurboDOS user number 0 through 31. Although not a restriction, it is recommended that the selected user number be system area 0.

Privileged Status (default = Enabled)

The privileged user status will limit MS-1000 user's in the following manner. When set enable, sub-directories may be freely created or removed by the user. When set disabled, only existing sub-directories can be accessed by the user.

Print Mode (default = spooled to queue A on drive A)

The print mode will set the default mode of printing for an MS-1000 user. The print mode can always be altered later by use of PRINT command under TurboDOS/PC.

Two or three prompts are issued for this option depending upon the desired print mode. The first determines the print mode according to the provided menu list, followed by a request to set the printer (for direct print mode), or a request to set the queue (for spooled to queue mode). Printer or Queue requests are not performed for either the local print or spooled to file modes.

In all cases, the spooler drive is requested because the TurboDOS/PC driver maintains this option for use with the PRINT command during MS-1000 operation.

NOTE: All MS-1000 remote printing or spooling requires the installation of the "TURBOPRN.COM" driver during system startup operations. This is normally executed from the MS-AUTO.BAT file.

End of Print Character (default = 0, disabled)

The end of print character is that character that the TurboDOS/PC spooler will recognize within a printer output stream. When found, the spooler will close the current print file and queue for despooling, if specified. The end of print character is disabled when set to 0, or enabled when set to decimal representation of the desired ASCII character (i.e. SUB=26, ETX=3).

Finally, installation options for the TurboDOS/PC driver finish up with a complete list of the current option settings. A verification prompt is issued, and if a no response is given, the option list will start over again from the beginning. If a yes response is issued, the output file "TURBOPC.DRV" is written and CFGMSS will return to the initial installation option menu.

PC DISK UTILITY (PCDU)

PCDU

PCDU.CMD is an MS-SLAVE utility used for maintenance of the image file used in loading DOS into the slave processor. Files may be freely displayed, typed, copied, compared, renamed, or deleted in the DOS image file or on any TurboDOS device. Devices are considered to be TurboDOS devices if a drive name letter and colon delimiter precedes the file specification, else the DOS image disk is accessed. The only exception to this rule is the second argument of the "RENAME" command.

PCDU does NOT support the ability to cross over user area boundaries in TurboDOS. The current user area is always used for TurboDOS device file accesses. The operator may log into any user area before executing the program.

PCDU contains the file name considered to be the DOS image disk. This file name is "PCIMAGE.DSK" located in the default drive and user area when PCDU is executed. PCDU contains a command "Image" that will change the DOS image file name.

To enter the PCDU sub-system mode, execute the program as follows without command line arguments.

```
OA}PCDU <ret>
```

PCDU will load and sign-on as follows:

```
PC Image File Utility, 8086 v1.0

   DIRectory of files     TYPE file
   COPY  file(s)          DELete file(s)
   COMPARE file(s)        Help menu display
   REName file(s)         Image filename
   FORMAT image file      Quit program

   PC image file: d:PCIMAGE .DSK

PCDU}
```

The command line prompt "PCDU}" will signify that you are executing under the utility for maintenance of the DOS image disk. All PCDU commands require the file arguments to be typed in after the command. Typing the <ret> key begins the command on the command line. The help menu is displayed first when entering the PCDU sub-system. Portions of the commands shown in capital letters are the minimum required characters to specify a command. All commands requiring arguments must contain at least one space character between the command and each argument.

Whenever PCDU returns back to it's subsystem command line prompt, program file buffers have been flushed and the DOS image file has been closed. However, TurboDOS disk buffers may require additional time to be flushed to the disk.

File Specifications

Files within the DOS image file are referenced by file specifications only, with the format as follows:

filename.filetype

Where "filename" may be one to eight characters in length, and the filetype may be one to three characters in length. When an "*" character is encountered in the filename or filetype fields, the remainder of the field is filled with the wild card character (?).

Two command file specifications, DIRECTORY and COPY will fill the entire filename and filetype fields with wildcards if they are missing. This makes these commands perform easier.

Files located on TurboDOS devices are referenced as follows:

d:filename.filetype

Where "filename.filetype" follows the same rules described above for DOS image file references, and "d:" specifies the drive name letter of the TurboDOS device.

NOTE: The absence of the drive name letter and colon delimiter informs PCDU that the file is to be referenced within the DOS image disk. The only exception to this rule is the second argument to the "RENAME" command.

A few examples are in order here to point out methods for file operations across the DOS image file and TurboDOS boundaries.

COPY d:XXX.TYP YYY.TYP

These two arguments would instruct the copy command to transfer the file XXX.TYP on the TurboDOS drive "d" into the DOS image file YYY.TYP. If the destination file happens to be the same name and type as the source file, then normally specification of the destination file by drive name only CAN NOT be used, because references into the DOS image file must not use drive names. Two methods around this problem can be used as follows:

COPY d:XXX.TYP XXX.TYP

Shown above, the destination file name and type for the DOS image file may be completely specified.

```
COPY d.XXX.TYP *.*
```

Or an ambiguous reference for the destination file name and type can be used.

```
COPY d:XXX.TYP *
```

Or because missing fields of a destination filespec are assumed ambiguous, this command is also equivalent to the two previous commands.

```
COPY d:*.COM * ;n

COPY d:*.DRV * ;n
```

The above two commands could be used to copy all files with types "COM" and "DRV" on TurboDOS drive "d" into the DOS image file.

Command Options

In the following text explaining commands, the curly brackettes "{}" will enclose optional arguments in a command or file specification (filespec).

DIRECTORY {filespec} {;options}

The directory command will display the specified filenames for verification of their presence. Files are displayed in alphabetical order five wide across each line. A header line is displayed before the first file showing the requested drive name followed by it's file organization type, either TurboDOS or PC image file.

COPY source-file(s) destination-file(s) {;options}

The copy command allows a file or group of files to be transferred from one device to another. If the specified source-file contains any wild card characters (?), the operator is asked if individual files should be confirmed before they are copied. If the destination-file already exists, the operator is asked if this file should be deleted before the copy may proceed. Source files are then copied to destination files in alphabetical order.

COMPARE source-file destination-file {;options}

The compare command allows a file or group of files to be compared from one device to another. If the specified source-file contains any wild card characters (?), the operator is asked if individual files should be confirmed before they are compared. Source files are then compared to destination files in alphabetical order.

As files are compared the following indicators are displayed base on the results of the comparison. If the files are anything but equal, the terminal bell is sounded to indicate a difference.

==	Source-file is identical to the destination-file.
<>	Source-file is not the same as the destination-file.
=<	Source-file is identical but smaller in size than the destination-file.
=>	Source-file is identical but greater in size than the destination-file.

RENAME old-file(s) new-file(s) {;options}

The rename command allows a file or group of files to be renamed from one name to another. If the specified old-file contains any wild card characters (?), the operator is asked if individual files should be confirmed before they are renamed. Old files are then renamed to new files in alphabetical order.

FORMAT {;options}

The format command is used to create the DOS image file. This file is always created on the default drive and user area when PCDU was executed. Two sizes of image files may be created by this command; a 180k byte file that is equivalent to a PC single sided, 9-sector floppy disk or a 360k byte file that is equivalent to a PC double sided, 9-sector floppy disk.

The option "n" will specify that if the image file already exists under the default drive and user area, it is OK to delete this file before creating the new one. If this option is not included on the command line, and the image file does exist, the following prompt will be issued:

Image file already exists, OK to delete (y/n)?

The options "1" or "2" will specify the size of the image file; 1=180k and 2=360k. If neither option is specified on command line, then the format command will issue the following prompt:

Select image file size (1=180k,2=360k)?

After both options are satisfied, formatting will proceed by first deleting the old image file (if it existed). The boot system is written first, followed by the FAT table(s), then the initial directory area. The message "Formatting completed" is displayed after the image file creation is complete.

The format command will then transfer the components of DOS into the image file automatically in their logical order needed for proper DOS downloading from the BIOS emulator. These files must exist under the default drive and user area when PCDU was executed. The files are as follows:

IBMBIO.COM - BIOS interface drivers
IBMDOS.COM - Disk operating system
COMMAND.COM - Command interpreter

NOTE: Formatting requires a number of things to process correctly in order to produce a successful DOS image file ready for operation with the BIOS downloader. The following error messages may be displayed and the formatter aborted. Possible solutions to these errors are explained here.

Not enough memory to format

The formatter requires additional memory above and beyond normal PCDU operations that is dynamically allocated by the program. This message is displayed when memory is not available.

Cannot open boot system file
Cannot read boot system file

The boot system file "PCLUBOOT.SYS" must exist under the default drive and user area when PCDU was executed. These messages will are displayed if the boot system file does not exist or a read error occurs when loading the file.

Cannot make image file
Cannot write image file

These errors will occur if the disk or directory is full on the default drive.

TYPE file {;options}

The type command will type the specified file on the console device. The file must not be ambiguous or an error occurs.

DELETE file(s) {;options}

The delete command allows a file or group of files to be deleted. If the specified old-file contains any wild card characters (?), the operator is asked if individual files should be confirmed before they are deleted. Files are then deleted in alphabetical order.

HELP

This command will re-display the initial list of commands shown when the subsystem is entered.

IMAGE filename

This command is used to change the name of the DOS image file. The drive and user area of the file are fixed when PCDU is first executed and must not be specified as part of the "filename".

QUIT

This command will terminate the program and exit back to the operating system. All program and system related buffers are flushed and PC-DOS diskettes may be removed from the drives.

Logical Errors

Invalid command

PCDU cannot recognize the command as one of it's supported set of commands.

Not enough memory

This error can occur at program initialization or during program operation. If this error occurs at program initialization, PCDU did not have enough memory to pre-allocate needed record buffers for proper operation. PCDU will terminate and return back to the operating system. If this error occurs during program operation, PCDU did not have enough memory to read in the list of file(s) to perform a command. PCDU will abort the command and return back to the subsystem prompt.

Filename is ambiguous

This error occurs if a filespec with wild card characters is supplied to the TYPE command. Use only non-ambiguous filespecs when using this command.

File not found

This error occurs with all commands requiring filespecs if not one single file was located on the device.

First filename missing
Second filename missing

These errors occur with the COPY, COMPARE, and RENAME commands if two filespec arguments are not present. These commands require two filespecs to operate.

Filename missing

This error occurs with the TYPE and DELETE commands if the filespec argument is not present. These commands require one filespec to operate.

Filenames are identical

This error occurs with the COPY, COMPARE, and RENAME commands if the first filespec argument is identical to the second filespec argument.

Cannot open file
Cannot make file
Cannot write file

These errors occur with all commands operating on files. These errors are considered severe in nature and cause PCDU to return back to the subsystem prompt level.

Physical Errors

When PCDU is executed, it will assign the TurboDOS abort address to it's own internal routine. This will insure proper file cleanup if a physical error is encountered through the TurboDOS system devices. Errors encountered when accessing the PCDU image file "PCIMAGE.DSK" are also controlled with the following messages and options.

If opening the image file fails (usually because the file does not exist), the following message is displayed:

Image file ready error (Abort or Retry)?

An "R" may be typed to retry the operation again, or an "A" may be typed to abort the operation and return back to the subsystem level.

If records within the image file cannot be read or written, the following message is displayed:

(Read or Write) image file error, Sector: begsec-endsec
(Abort, Retry, or Ignore)?

An "R" may be typed to retry the operation again, an "I" may be type to ignore the error and process the sector(s) with the error(s), or an "A" may be typed to abort the operation and return back to the subsystem level.

Guide to
TurboDOS/PC 1.0
with MS-1000

July 1986

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ABOUT THIS GUIDE

Purpose

TurboDOS/PC 1.0 has been revised specifically for use with MS-1000 Software. We've designed this Guide to provide the information you need to use TurboDOS/PC. This document tells you what TurboDOS/PC does, how to load it into your computer, and how to use its various facilities. It describes the various TurboDOS/PC commands. It explains the use of the TurboDOS/PC program interface, and discusses various limitations. Finally, it gives details about how to implement the network drivers required to install TurboDOS/PC on a new hardware configuration.

Organization

This guide is organized into four sections. The first section explains some of the fundamentals: what TurboDOS/PC is, what it does, how to start it running, and how to use its basic facilities. The second section describes the various TurboDOS/PC commands in detail. Both are of interest to all users.

The third section is intended for assembly-language programmers writing application programs, and explains the TurboDOS/PC program interface in detail.

Assumptions

In writing this guide, we've assumed that you are thoroughly familiar with the use of the MS-DOS or PC-DOS operating system provided with your computer. The last two sections (program interface and driver implementation) also assume you are an experienced assembly-language programmer with in-depth familiarity with the TurboDOS operating system. There has been no attempt to duplicate material covered in the MS-DOS or TurboDOS manuals.

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TABLE OF CONTENTS

USER'S GUIDE

In this section, you will learn everything you need to know to start using TurboDOS/PC with the CPS-MS-1000 package: what it is, what it does, how it start's running, how to use its basic facilities, and what to do in case of errors.

TurboDOS/PC has been customized for the CPS-MS-1000 package by InterContinental Micro Systems for ease of use and configuration.

Overview of TurboDOS/PC

TurboDOS/PC is a software product that interfaces MS-DOS machines with a TurboDOS network. It runs on the MS-1000 slave processor that uses PC-DOS. TurboDOS/PC allows your MS-1000 to become a TurboDOS network client, and to access the resources of TurboDOS file and print servers in the network.

Your MS-1000 continues to operate normally under control of its native PC-DOS operating system with full access to its local peripheral devices. The only effect of the network connection provided by TurboDOS/PC is that the MS-1000 slave processor now has access to all remote disk and printers.

Remote Disks

The MS-1000 slave processor has no local disk drives that can be accessed. Once TurboDOS/PC has been loaded, you will be able to access up to sixteen remote disks A: through P:. These will refer to remote disk drives attached to one or more TurboDOS file servers. However, you can use them just as if they were local disk drives.

Remote Disks (continued)

All the usual file- and directory-oriented commands of PC-DOS (like COPY, DEL, REN, DIR, CHDIR, MKDIR, RMDIR, etc.) work exactly the same with remote disks as with local ones. PC-DOS application programs, overlays and data files may be copied to and executed from remote disks (except for packages that use copy-protection schemes to prevent this).

Remote Printing

Similarly, TurboDOS/PC allows you to route printed output either to the local printer attached to your MS-1000 slave or to remote printers attached to TurboDOS print servers. A new command named PRINT (part of TurboDOS/PC) lets you control where print output should be routed. The same command lets you specify whether you want your remote printing to be "direct" or "spooled".

In direct printing, your print output is sent directly to the selected remote printer and printed immediately. In spooled printing, however, your print output is first saved in a print file on a remote disk, then printed afterwards as a background activity. Spooled printing frees your slave to work on another task without having to wait for the printing to finish. It also makes it possible for many users to share one printer without interfering with one another.

Mostly Invisible

As you can see, there's not a great deal to learn about using TurboDOS/PC. For the most part, it is an invisible extension to the native PC-DOS operating system that comes with your slave. There are a few new commands to learn (like PRINT) but you probably won't need to use them very often. Mostly, you can ignore TurboDOS/PC and just enjoy the remote disks and printers at your disposal!

Hardware Required

TurboDOS/PC works with the InterContinental Micro Systems MS-1000 slave processor. The bus oriented network porting has already been integrated.

Getting Started

TurboDOS/PC is loaded automatically for you directly after PC-DOS boots up. The proper versions of TurboDOS/PC are listed below and located on your MS-1000 distribution disk.

Name	Description
TURBOPC2	TurboDOS/PC for PC-DOS versions 2.xx or 3.xx.
TURBOPRN	Additional program required for remote printing with all versions of PC-DOS.

Startup Errors

If an error occurs during the startup phase, TurboDOS/PC will display one of the following error messages after its copyright notice:

Already installed
You are trying to install TurboDOS/PC twice. Your second attempt is ignored.

<filename> not present
The network driver file <filename> is not present.

In each case, TurboDOS/PC is not installed.

Drives and Files

TurboDOS/PC expands the disk capacity of your MS-1000 by giving you access to all remote drives belonging to TurboDOS file servers attached to your network.

Drive Letters

In order to enable you to access the various disk drives attached to your TurboDOS servers, PC-DOS assigns a unique letter to each drive. MS-1000 maps your PC-DOS drives letters A: through P: to the corresponding drive letters A: through P: known by the MS-1000 slave's TurboDOS master processor.

Up to 16 remote drives may be accessible. The actual number of remote drives and the specific assignment of drive letters depends your particular network configuration.

TurboDOS/PC provides a REASSIGN command that lets you change the drive letter assignments around. For example:

```
A>REASSIGN A=D D=A
```

temporarily switches the letters assigned to drives A: and D:. (Using REASSIGN can get rather confusing, however, so we don't recommend it unless you have a compelling reason.)

Remote Drives vs. Local Drives

You can use remote drives to do just about anything that is allowed on local drives of a PC. All of the usual file- and directory-oriented PC-DOS commands work equally well on TurboDOS remote drives. However, there are a few differences:

1. Physical disk operations that bypass the PC-DOS file system are not allowed on remote drives. Don't try to use commands like CHKDSK, DISKCOMP, DISKCOPY or FORMAT on remote drives. If you do, you will get an error message like "invalid drive specification" (no harm will be done).

2. Files on remote drives are not "stamped" with the date and time of creation. If you use the DIR command to look at the directory of a remote drive, you will see that the date and time fields of the directory display will be blank.

3. Files on remote drives may be shared by other PC-DOS and TurboDOS computers connected to your network. This can be a great advantage because common programs and data may be accessed several users at the same time. On the other hand, you may wish to keep private files on your local drives to prevent others from accessing them.

Sub-Directories

Starting with version 2.00, PC-DOS allows you to segregate the files on a disk into several "sub-directories". This allows grouping of files by owner, application, or other convenient category. Each such sub-directory is identified by a "pathname". (See your PC-DOS manual for more details.)

TurboDOS has a similar mechanism whereby disk files may be segregated into 32 different sub-directories identified by "user numbers" from 0 to 31. In order to allow PC-DOS users to access remote drives belonging to TurboDOS file servers, TurboDOS/PC maintains a mapping between each PC-DOS sub-directory pathname and the corresponding TurboDOS user number.

One particular user number (commonly, zero) corresponds to the PC-DOS root directory. The remaining 31 user numbers may be mapped into any desired tree of PC-DOS sub-directories.

The usual PC-DOS commands MKDIR and RMDIR are used to create and delete sub-directories on remote drives. For example:

```
A>MKDIR D:FRANCIS
A>MKDIR D:FRANCIS\INVEST
A>MKDIR D:FRANCIS\GAMES
```

creates three new sub-directories on remote drive D:. Normally, each newly-created sub-directory is automatically assigned by TurboDOS/PC to the next available user number. You don't need to be concerned about user numbers unless you need to access the same files from a TurboDOS machine.

Sub-Directories (Continued)

However, it is possible for you to explicitly assign a sub-directory to a particular user number. To do this, you must prefix the sub-directory name in the MKDIR command by "nn#". A couple of examples should make this clear:

```
A>MKDIR D:FRANCIS\9#USERNINE
A>MKDIR D:20#TWENTY
```

Not more than one sub-directory may be assigned to a particular user number on a remote drive.

Remote Disk Changes

If any remote drives in your network are floppy disks or other removable media, you must take special care before removing or changing them. First, you should check to make sure that no other user is using the disk you want to change. Then use the CHANGE command to let the file-server know you want to change disks:

```
A>CHANGE
Enter drive(s) to be changed: DEF
Change drive(s) DEF
Enter <CR> when change complete
```

Wait until the CHANGE command tells you it's okay to change the disks (as above). Then remove and replace disks as required. Finally, press RETURN to advise you are done with the change. Remember, never remove a remote disk without first entering a CHANGE command.

Disk Errors

If you hear a "beep" and see a diagnostic message on your console such as:

```
Read Error, Drive D, Track 0, Sector 2
(Retry, Ignore, Abort)

Write Error, Drive F, Track 5, Sector 16
(Retry, Ignore, Abort)
```

it means that the file-server could not read or write the specified disk sector even after a number of retries. When you see such a message, you must choose one of three recovery options (Retry, Ignore, Abort) by keying the letter R, I, or A.

If you key R (retry), TurboDOS/PC will try the read or write operation several more times. If it is still unsuccessful, you will get another message.

If you key I (ignore), processing will continue as if the error had not occurred. This option is not recommended in most situations because it causes processing of invalid data and may lead to other errors.

If you key A (abort), TurboDOS/PC terminates the program you were running when the error occurred.

NOTE: If you use REASSIGN to re-assign drive letters, the drive letters reported in these error messages will be the original ones prior to re-assignment.

Disk Errors (Continued)

If you hear a "beep" and see this message on your console:

```
Not Ready Error, Drive C (Retry, Abort)
```

it means the file-server could not access the selected drive for one of the following reasons:

- there's no such drive on your network
- the drive isn't ready to operate
- the drive's door was left open
- no disk is mounted in the drive
- the disk hasn't been formatted
- the disk format is unrecognizable

Again, you must select the desired recovery option by keying R or A.

Printing

TurboDOS/PC allows you to route printed output either to the local printer attached to your MS-1000 slave or to remote printers attached to TurboDOS print servers on the network.

Your network may be equipped with several remote printers (up to 16 of them), all of which may be in use simultaneously. Each remote printer is assigned a letter (A, B, C, etc.) You can select which printer to use, and can change your selection at any time.

For remote printing, you also have the choice of two different methods: direct and spooled.

Local Printing

To route print output to the local printer attached to your slave, use this command:

```
A>PRINT LOCAL
Printing is to LOCAL
A>
```

Direct Printing

You can route print output directly to any remote printer on a character-by-character basis. This is the simplest method of printing, and is useful for very long print jobs (e.g. overnight) and for certain special situations such as single-sheet printing.

To select direct printing mode, you need to specify which remote printer you wish to use:

```
A>PRINT PRINTER=B
Printing is to PRINTER B
A>
```

Direct Printing (Continued)

Direct printing has some drawbacks, however. For one thing, when you use direct printing, your slave is tied up until the print job has finished. Printers are generally the slowest components of any computer system, and you will find they are are often a bottleneck limiting how much work you can get done.

Another drawback of direct printing is that it is very awkward to use in a multi-user environment. If two users attempt to print directly to the same printer at the same time, the result is a merged printout that is not likely to be of much use to either user. Thus, direct printing requires that users carefully coordinate among themselves to avoid such conflicts.

You can avoid both of these problems by using spooled printing.

Spooled Printing

When you select spooled printing, TurboDOS/PC automatically intercepts your print output and saves it in a print file on a remote disk. This process is called "spooling".

When the print job is done, TurboDOS/PC automatically causes the contents of the print file to be printed. This process is called "de-spooling", and is performed by a print server in the background independent of your slave. You can go ahead and run your next program without waiting for the printing to finish. When the printing is complete, the print file is deleted automatically.

In a multi-user environment, several users may be generating spooled print output at the same time without any interference. As their jobs finish, the print files are queued automatically for de-spooling on a first-come first-served basis.

Spooled Printing (Continued)

To select spooled printing mode, you need to specify the print queue on which you want your print job placed (more about print queues shortly). You may also specify the remote disk drive onto which you want the print file to be written:

```
A>PRINT DRIVE=C QUEUE=A
Printing is to SPOOLER on DRIVE C
            to QUEUE A
A>PRINT QUEUE=B
Printing is to SPOOLER on DRIVE C
            to QUEUE B
A>
```

If you don't specify the spool drive (second example above), it will remain the same as before.

Print Jobs

When a program generates its first character of print output, a new "print job" begins. If spooled printing is in effect, TurboDOS/PC automatically creates a new print file at this point. Subsequent print output is spooled to this print file until the print job ends, whereupon TurboDOS/PC closes the print file and queues it for de-spooling.

In most cases, the print job ends automatically at the conclusion of the program. However, the print job may also be ended by an explicit "signal end-of-print" request from the program, or by the presence of a reserved end-of-print character in the print output stream (if one is defined for your system).

Print Queues

TurboDOS/PC supports up to 16 print queues. A print queue is simply a list of print jobs awaiting de-spooled printing. Each queue has a letter (A, B, C, etc.). You can assign a particular remote printer to de-spool from a particular print queue. Jobs are always printed from a queue on a first-come first-served basis.

The simplest way to use these queues is to assign each remote printer to a different queue -- for example, printer A to queue A, printer B to queue B, and so on. However, queues may be used in more imaginitive ways.

Even if your network has only one remote printer, you may want to make use of several print queues to group together print jobs with similar forms requirements and/or priorities. For example, you could use queue A for jobs requiring wide paper, queue B for jobs to be printed on narrow paper, queue C for jobs to be printed on pre-printed invoice forms, queue D for computer-printed checks, and so forth. Whenever the printer is done printing all jobs from one queue, you can reassign the printer to a different queue after changing to the appropriate kind of paper.

If your network has multiple remote printers, you can assign two or more printers to the same print queue. In this case, the workload is automatically shared among the printers. This technique is fine if you don't care which printer is used to print which job.

Queue Assignment

To assign a particular printer to de-spool from a particular queue, use the command:

```
A>PRINTER A QUEUE=C
PRINTER A assigned to QUEUE C
A>
```

If the printer is currently printing, the new assignment takes effect at the end of the current print job.

To display the current queue assignment of a particular printer:

```
A>PRINTER A
PRINTER A assigned to QUEUE C
A>
```

To take a particular printer off-line at the end of the current print job:

```
A>PRINTER A OFFLINE
PRINTER A assigned to OFFLINE
A>
```

The purpose of taking a printer off-line is to prevent subsequent de-spooling to that printer. This is useful when you want to change paper or ribbons, or when you want to reserve the printer for direct printing.

Print Job Control

De-spooling is an automatic background activity which generally requires no human attention. If something goes wrong, however, you can exercise manual control. To temporarily suspend de-spooling to a particular remote printer (if the paper jams, for example):

```
OA}PRINTER A STOP
PRINTER A assigned to QUEUE C (Stopped)
OA}
```

To resume de-spooling from the point it was stopped:

```
OA}PRINTER A GO
PRINTER A assigned to QUEUE C
OA}
```

To stop de-spooling to a specified printer and restart the current print job from the beginning when de-spooling is resumed:

```
OA}PRINTER A BEGIN
PRINTER A assigned to QUEUE C (Stopped)
OA}
```

To terminate the current print job on a specified printer, and continue with the next queued job:

```
OA}PRINTER A TERMINATE
PRINTER A assigned to QUEUE C
OA}
```

The terminated print file is not deleted.

Spooler Errors

If you hear a "beep" and see the following diagnostic message on your console:

```
Spooler Error (Ignore, Abort)
```

it means that the disk to which you were spooling has run out of space in the middle of your print job. TurboDOS/PC has closed your print file (prematurely), but has not queued it for de-spooling.

When you see this message, you must choose one of the two recovery options (Ignore or Abort) by keying the letter I or A.

If you key I (ignore), your print routing is set to "off-line", and your program will continue with any further print output discarded. Remember to reset your print routing when the program is finished.

If you key A (abort), your program will be terminated.

COMMAND REFERENCE This section describes each TurboDOS/PC command in detail. For ease of reference, the commands are presented in alphabetical order.

Presentation This section uses the following notation:

- Keywords are shown in capital letters, and must be entered as shown. (You can use either upper- or lower-case.)
- Parameters are shown in lower-case, and are described in the following text.
- Items shown in braces {} are optional. If you want to include such an optional item, do not type the braces, but only the information inside.
- An ellipsis ... indicates that the preceding item may be repeated as many times as you like.
- Spaces and punctuation characters must be entered as shown (except for braces {} and elipses ...).

CHANGE Command

You must use CHANGE before removing a disk from any remote drive.

Syntax

```
CHANGE {drivelist} {;N}
```

Explanation

The command tail consists of a list of drive letters corresponding to the remote disks that you want to change, or an asterisk * if you want to change all remote disks. If you omit the drive list, CHANGE will prompt you for it. Before shutting down a file-server, it is a good idea to enter the command "CHANGE *".

If any of the drives you request are in use by another user, your request will be denied. Otherwise, you will be prompted to change the requested disk(s), and to enter RETURN when you are done. Until you have pressed RETURN, no other user will be allowed to access the disk(s) that you are changing.

Options

Option	Explanation
;N	Pause for RETURN is bypassed.

Examples

```
A>CHANGE CDE
Change drive(s) CDE
Enter <CR> when change complete [RETURN]
A>CHANGE * ;N
Change drive(s) ABCDEFGHIJKLMNOP
A>
```

Error Messages

```
Invalid drive(s) requested
Following drive(s) in use: d...
Unable to free drive(s): d...
```

MASTER Command

The MASTER command lets you temporarily attach your MS-1000 slave as a file-server console.

Syntax

```
MASTER
```

Explanation

If you need to run a program in the file-server (the TurboDOS BACKUP, BOOT, FORMAT or VERIFY commands, for example), you can use the MASTER command to attach your slave as a file-server console temporarily. To detach from the file-server (and resume normal MS-1000 operation), key in the abort character (normally CTRL-A, but may be patched at CS+4 to another character).

Do not attempt to run MASTER from more than one console at a time. If you do, console output from the master will be randomly distributed across two or more consoles, and be undecipherable. If this should occur by mistake, simply detach all but one of the consoles.

The MASTER command can be used only if the file-server's TurboDOS operating system is configured with a special remote console driver module CONREM. Refer to the TurboDOS Implementor's Guide for details.

Example

```
A>MASTER
Console attached to master processor
0A}FORMAT B:
        :
        :
0A}[CTRL-A]
Console detached from master processor
A>
```

Error Messages

Console already attached to master Remote console driver not present

PRINT Command

The PRINT command lets you control routing of your print output.

Syntax

```
PRINT {option}...
```

Explanation

The PRINT command may include one or more of the options described below. A PRINT command with no option arguments causes your current print routing to be displayed on the console. Each user controls his own print routing independently.

Options

Option	Explanation
DRIVE=d D=d	Drive "d" is used for spooling, where "d" is the drive letter of a remote disk drive.
FILE F	Print output is spooled to disk, but not automatically queued for printing.
LOCAL L	Print output is routed to the local printer attached to the MS-1000 slave processor.
OFF O	Print output is discarded.
PRINTER=p P=p	Print output is routed direct to printer "p" without spooling to disk, where "p" is a printer letter in the range A through P.
QUEUE=q Q=q	Print output is spooled to disk, and then automatically queued on queue "q" for printing, where "q" is a queue letter in the range A through P.

Examples

```
A>PRINT DRIVE=C QUEUE=A
Printing is to SPOOLER on DRIVE C
             to QUEUE A
A>PRINT P=B
Printing is to PRINTER B
A>PRINT L
Printing is to LOCAL
A>PRINT O
Printing is to OFFLINE
A>
```

Error Messages

```
Invalid request
```

WARNING: Some versions of PC-DOS included a background print utility called PRINT.COM. To resolve the conflict with the TurboDOS/PC command that has the same name, one of the two commands must be renamed.

PRINTER Command

The PRINTER command lets you control de-spooling on any selected printer.

Syntax

```
PRINTER p {option}...
```

Explanation

The "p" argument is a printer letter in the range A through P, and identifies the printer to be controlled. The PRINTER command may include one or more of the options described below. A PRINT command with no option arguments causes the current status of printer "p" to be displayed on the console. Any remote printer may be controlled from any MS-1000 slave processor.

Options

Option	Explanation
BEGIN B	Stop de-spooling to printer, and reposition current print job to start at the beginning again when de-spooling is resumed.
GO G	Resume de-spooling to printer after STOP or BEGIN.
OFFLINE O	Take printer offline at the end of current print job. No further de-spooled printing will be done, but printer is available for direct printing.
QUEUE=q Q=q	De-spool to printer from print queue "q", where "q" is a queue letter in the range A through P. If printer is currently printing from another queue, the new assignment takes effect at the end of the current print job.

Options (Continued)

Option	Explanation
STOP S	Stop de-spooling to printer, pending subsequent GO or TERMINATE.
TERMINATE T	Terminate the current print job, and continue with the next job in the queue. The terminated print file is not deleted.

Examples

```
A>PRINTER B QUEUE=A
Printer B Assigned to QUEUE A
A>PRINTER B STOP
Printer B Assigned to QUEUE A (Stopped)
A>
```

Error Messages

```
Invalid request
```

REASSIGN Command

The REASSIGN command lets you temporarily reassign the correspondence between logical drive letters and physical drives.

Syntax

```
REASSIGN  {x1=y1 x2=y2 ... xN=yN}
```

Explanation

The REASSIGN command may include one or more arguments of the form "x=y", where x and y are drive letters in the range A-Z. The first letter (x) represents a logical drive that will be mapped to the physical drive given by the second letter (y). An argument of the form "x=y=z" is equivalent to the pair "x=y y=z". A REASSIGN command with no arguments restores the original meaning to all drive letters (A=A, B=B, C=C, etc.).

The REASSIGN command is useful when an application has been designed to perform disk operations on specific drives and you want to redirect these operations to other drives. This command should be used only when necessary. It may not work properly with certain programs error messages.

The REASSIGN command should always be used instead of the ASSIGN command provided with PC-DOS. REASSIGN fixes some problems present in the original ASSIGN command. In addition, the REASSIGN command maps TurboDOS C-functions and T-functions.

Examples

```
A>REASSIGN A=D B=E D=A E=B
A>REASSIGN A=D=A B=E=B
A>REASSIGN
A>
```

Error Messages

Invalid drive specified

RESET Command

The RESET command closes all files that may have been left open by PC-DOS.

Syntax

```
RESET
```

Explanation

PC-DOS internal commands (the ones built into COMMAND.COM) have the habit of leaving files open. Sometimes this may make it difficult to change disks or shut down a file-server. In this situation, RESET may be used to close all files. If no files were open, RESET does nothing.

Example

```
A>RESET
A>
```

TURBOPC Command

The TURBOPC command installs TurboDOS/PC and allows you to access remote disk drives and do remote printing over the network.

Syntax

```
TURBOPC2 {filename}
```

Explanation

TurboDOS/PC is automatically loaded into your MS-1000 slave processor at startup time. There should never be a need to re-run this program during normal slave operations.

TURBOPC2 allows you to give the filename of a network driver file. If none is given, they expect to find the driver under the default filename "TURBOPC.DRV".

Example

```
A>TURBOPC2
A>
```

Error Messages

```
Already installed
Insufficient memory
<filename> not present
```

TURBOPRN Command

The TURBOPRN command installs the TurboDOS/PC "print filter" which is required if you want to use remote printing.

Syntax

```
TURBOPRN
```

Explanation

You should use the TURBOPRN command immediately after you install TurboDOS/PC if you plan to use remote printing. Its function is to intercept all print output requests to the MS-1000's ROM BIOS and to redirect them to TurboDOS/PC if you have selected a print routing other than "local". If you forget to install TURBOPRN, all printing will be local regardless of the print routing you select.

Example

```
A>TURBOPRN
A>
```

(Intentionally left blank.)

PROGRAMMER'S GUIDE This section is intended for the assembly-language programmer interested in writing PC applications to be used with TurboDOS/PC. It describes the TurboDOS/PC program interface, the implementation of sub-directories on remote disks, and certain limitations that may be important to programmers.

Program Interface For the most part, TurboDOS/PC is invisible to applications, and supports all PC-DOS operating system calls in a fully transparent fashion. However, it does provide the additional capability for application programs to

invoke most disk- and print-oriented TurboDOS C-functions and T-functions.

TurboDOS functions are invoked by executing an INT 0x21 instruction with register AX set to 0xFF00 (for C-functions) or 0xFF01 (for T-functions). The function number is passed in register CL and the function arguments are passed in other registers, following normal TurboDOS register conventions.

Disk-oriented TurboDOS functions apply only to remote drives, and return an error code (AL=0xFF) if an attempt is made to use them for local drives. Don't forget to set up current disk, current user number, and current DMA segment and offset; under TurboDOS/PC these values all default to zero.

In T-function 27 (Get/Set Print Mode), print mode 2 means "local" (instead of "console"). C-function 5 (List Output) and T-functions 28 (Signal End-of-Print) and 31 (Flush List Buffer) perform no operation if the current print mode is "local" or "offline".

The following tables list all C-functions and T-functions supported by TurboDOS/PC. For more detail, see TurboDOS Programmer's Guide.

C-Function Summary The following C-functions are supported by TurboDOS/PC. Call via INT 0x21 with register AX set to 0xFF00.

CL=	C-Function Name	Arguments Passed	Values Returned
5	List Output	DL = char	-
14	Select Disk	DL = drive (0=A)	-
15	Open File	DS:DX = &FCB	AL = (-1 if err)
16	Close File	DS:DX = &FCB	AL = (-1 if err)
17	Search for First	DS:DX = &FCB	AL = (-1 if err)
18	Search for Next	-	AL = (-1 if err)
19	Delete File	DS:DX = &FCB	AL = (-1 if err)
20	Read Sequential	DS:DX = &FCB	AL = (NZ if err)
21	Write Sequential	DS:DX = &FCB	AL = (NZ if err)
22	Make File	DS:DX = &FCB	AL = (-1 if err)
23	Rename File	DS:DX = &FCB	AL = (-1 if err)
25	Return Current Disk	-	AL = drive (0=A)
26	Set DMA Address	DS:DX = &DMA	-
30	Set File Attributes	DS:DX = &FCB	AL = (-1 if err)
32	Get/Set User Number	DL = -1	AL = user number
		DL = user number	-
33	Read Random	DS:DX = &FCB	AL = (NZ if err)
34	Write Random	DS:DX = &FCB	AL = (NZ if err)
35	Compute File Size	DS:DX = &FCB	AL = (-1 if err)
36	Set Random Record	DS:DX = &FCB	-
42	Lock Record	DS:DX = &FCB	AL = (NZ if err)
43	Unlock Record	DS:DX = &FCB	AL = (NZ if err)
51	Set DMA Base	DX = DMA base para	-
52	Get DMA Address	-	ES:BX = DMA addr

T-Function Summary The following T-functions are supported by TurboDOS/PC. Call via INT 0x21 with register AX set to 0xFF01.

CL=	T-Function Name	Arguments Passed	Values Returned
0	Reset O/S	-	-
9	Set Date and Time	BX = Julian date DH = hours DL = minutes CH = seconds	-
10	Get Date and Time	-	BX = Julian Date DH = hours DL = minutes CH = seconds CL = tick count
11	Rebuild Disk Map	DL = drive (A=0)	AL = 0/-1
19	Get Alloc Info	DL = drive (0=A)	AL = block size CL = dir blocks DX = free blocks BX = tot. blocks
20	Get Physical Info	DL = drive (0=A)	AL = sector size CX = res. tracks DX = tot. tracks BX = sectors/trk
21	Get/Set Drv Status	DL = drive (0=A) DH = 0 (set R/W) DH = 1 (set R/O) DH = -1 (get)	AL = 0/-1 BL = -1 if ready Bh = -1 if R/O
23	Set Buffer Params	DH = # of buffers DL = buffer size	-

24	Get Buffer Params	-	AL = mem. size
			BH = # buffers
			BL = buffer size

25	Lock/Unlock Drive	DL = drive (0=A) DH = 0 (unlock) DH = -1 (lock)	AL = 0/-1
26	Flush/Free Buffers	DL = drive (0=A) DH = subfunctions	-

CL=	T-Function Name	Arguments Passed	Values Returned
27	Get/Set Print Mode	DL = print mode DH = printer/queue CH = spool drive	AL = spool drive BH = prntr/queue BL = print mode
28	Signal End-of-Print	-	-
29	Get/Set Despool Mod	DL = despool mode DH = queue assgnmt CH = printer	AL = 0/-1
30	Queue a Print File	DS:DX = &FCB BH = print queue BL = user#/delete	AL = 0/-1
31	Flush List Buffer	-	-
33	Remote Console I/O	DL = 0/char DH = -1 to attach	AL = 0/1/-1
41	User-Defined Fcn	CH = net routing BX & DX userdef	AL,BX-DX userdef
42	Reorg Disk Dir	DL = drive (0=A)	AL = 0/-1

Implementation of Sub-Directories

Starting with version 2.00, PC-DOS supports UNIX-type sub-directories. When the user creates a new sub-directory by means of the MKDIR command or the corresponding PC-DOS function call, PC-DOS creates three new directory entries:

1. An entry in the parent directory under the name of the new sub-directory and pointing to the new sub-directory.

2. An entry in the new sub-directory under the name "." pointing to the new sub-directory itself.

3. An entry in the new sub-directory under the name ".." pointing to the parent directory.

When the user creates a new sub-directory on a remote disk, TurboDOS/PC emulates the action of PC-DOS by creating three new directory entries as above. These entries appear in the TurboDOS disk directory as empty read-only files flagged with a special attribute (f2) to indicate that they represent PC-DOS sub-directories. The spec1 byte (offset 13) of the directory entry specifies the user number to which the entry "points".

Known Limitations

The following limitations of TurboDOS/PC should be carefully noted by programmers and implementors:

1. TurboDOS/PC has been tested extensively on the IBM Personal Computer under DOS versions 1.10, 2.00, 2.11, and 3.00 as supplied by IBM. It should work properly with any PC-DOS version 1.xx, 2.xx, or 3.0x (except possibly for very early 1.0x versions that were plagued with problems).

2. TurboDOS/PC interfaces with the TurboDOS network stricly on a request-only basis. It provides no capability for the PC to be a network file- or print-server.

3. Remote files are not date/time stamped. Applicable PC-DOS functions return file date/time fields zero-filled. When used on a remote drive, the DIR command displays the date/time fields as blank.

4. PC-DOS versions 2.00 and beyond allow console I/O to be redirected to a file. If console I/O is redirected to a remote disk file, however, only UNIX-style (handle-oriented) I/O functions are redirected properly by TurboDOS/PC; CP/M-style console I/O functions (1-12) are not redirected. Consequently, redirection to a remote file works properly for all internal PC-DOS commands, but may not work for some external commands and transient programs that use CP/M-style console I/O.

5. TurboDOS/PC interfaces with TurboDOS version 1.40 and later. It does not work with earlier versions of TurboDOS because the format of network messages changed starting with version 1.40.

Known Limitations (Continued)

6. TurboDOS/PC allows a maximum of 20 file handles and 32 remote files to be open concurrently in each PC. If 32 remote files are open, a request to open or create an additional remote file causes the least recently used remote file not attached to an active file handle to be closed automatically. Program termination causes all remote files to be closed automatically.

7. The PC-DOS file attributes "hidden" and "system" are not supported for remote files. The other PC-DOS file attributes ("read-only", "volume-id", "directory", and "archive") are all supported.

8. It is not possible to move a remote file to a different sub-directory using PC-DOS function 86.

9. PC-DOS makes use of "wildcard" directory searches much more often than TurboDOS. Such searches must be performed linearly and cannot be optimized by hashing. Consequently, TurboDOS/PC tends to perform poorly with remote disks that have very large directory areas. In the case of a large fixed disk, it may be advantageous to use multiple partitions rather than one large directory area.

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**** INTRODUCTION ****

The Intercontinental Micro Systems Corp. (ICM) CPS-16F single board slave processor is an 8086(tm) based computer complying with the IEEE 696.1/D2 S-100 Bus specification. This computer incorporates all features necessary for a complete stand alone system, each to be dedicated to a user in a distributed processor system utilizing operating systems such as TurboDOS (tm) and CP/NET (tm). In addition, with TurboDOS/PC the CPS-16F can run many of the popular monochrome PCDOS (tm) programs using a PC character compatible video terminal.

The CPS-16F processors together with an S-100 Bus master (host) like the ICM CPZ-4800X or CPZ-186 SBCP constitute a high performance, high throughput network which can be integrated into most S-100 bus mainframes. The master/slave communications take place over the S-100 Bus via slave/host bidirectional memory transfers under control of the host processor. This memory mapping technique thoroughly enhances data throughput and reduces overhead hardware resulting in a high performance, low cost slave processor, making distributed processing comparable to mainframe performance at a fraction of the cost.

FEATURES

* IEEE 696.1/D2 S-100 Bus compliance.
* NEC uPD70116C-10 10 Mhz (CPS-16F) operation.
* Faster execution of 8086 Instruction Set.
* Added instruction set including high-speed Multiplication/ Division Operations.
* 8080 Emulation Mode.
* Compatible with CPZ-4800X or CPZ-186 SBCP, any Z80 based CPU with extended address compatibility or 16-bit based CPU's complying with IEEE 696.1/D2 Bus specification.
* Two synchronous or asynchronous serial I/O ports.
* Two parallel I/O ports; eight data bits and two handshake lines per port.
* Monochrome PCDOS, TurboDOS and CP/NET compatible.
* 1 Megabytes of onboard dynamic RAM.
* 8- or 16-bit S-100 data transfer capability.
* Master/Slave memory-to-memory transfers under DMA control at 571 Kbytes/sec transfer rate when used with CPZ-4800X SBCP.
* Master confiscation of slave memory for diagnostic purposes.
* Software selectable baud rates.
* Usable as an intelligent I/O processor in single user systems.
* Usable as a 1 Megabyte RAM in either single-user or multi-user systems.

PERFORMANCE SPECIFICATIONS

PROCESSOR
Clock Rate
CPS-16F.....10 MHz
Type
CPS-16F..... NEC uPD70116C-10

Bus Interface.....IEEE 696.1/D2 S-100
Status, control, data and address. Slave I/O port address switch selectable for address range from 00h to FFh. Slave memory address switch selectable for address range from 010000h to 1FFFFFh at 64K boundaries.

I/O CHANNELS:
Serial I/O channels (two ports)
CPS-16F (asynchronous).....up to 800 Kbaud
CPS-16FS (synchronous).....up to 800 Kbaud

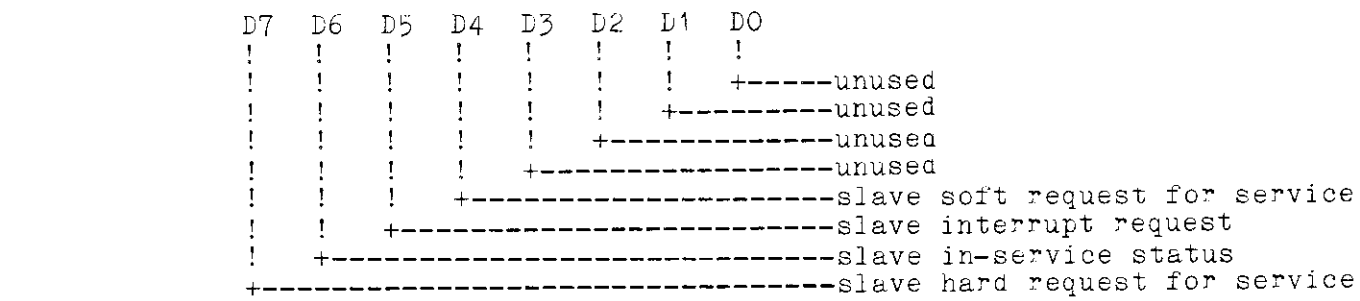
I/O Interface.....through personality boards such as Dumb terminal, RS232 modem, and RS422 interface boards.

Parallel I/O channels (two ports)
Data rate.....up to 300 Kbytes/sec.
Interface signals ..... eight data lines plus two handshaking lines per port.
I/O interface.....through personality boards such as Centronics Printer, Priam and ST506 intelligent hard disk interface boards.

1 MEGABYTE DYNAMIC RAM:
Type ..... 256K x 1
Wait states.....none required
Direct memory transfers.....to/from CPZ-4800X SBC?
Data transfer rate (non-DMA).....190 Kbytes/sec
Data transfer rate (DMA).....571 Kbytes/sec

Memory address.....switch selectable in 64 Kbyte boundaries for a total of sixteen 64 Kbyte pages.

STATUS PORT BIT ASSIGNMENTS (as read by master):



COMMAND PORT DATA BIT ASSIGNMENTS (as executed by master):

D7	D6	D5	D4	D3	D2	D1	D0	
0	0	0	0	0	0	0	0	mstr clr slv req./reset latches
0	0	0	0	0	0	0	1	master confiscate slave's memory
0	0	0	0	0	0	1	0	unused (reserved)
0	0	0	0	0	0	1	1	master release slave to run
1	0	0	0	0	0	0	0	master clear slave reset latch
0	1	0	0	0	0	0	0	master request to slave
0	0	1	0	0	0	0	0	master interrupt to slave

COMMAND PORT ADDRESS BIT ASSIGNMENTS (as executed by slave):

A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0		
1	0	0	0	0	0	0	0	0	0	0	400H	(00) PIT Chan 0 Counter
1	0	0	0	0	0	0	0	0	1	0	402H	(02) PIT Chan 1 Counter
1	0	0	0	0	0	0	0	1	0	0	404H	(04) PIT Chan 2 Counter
1	0	0	0	0	0	0	0	1	1	0	406H	(06) PIT Mode Register
1	0	0	0	0	0	0	1	0	0	0	408H	(08) SCC Port B Cmd/Status
1	0	0	0	0	0	0	1	0	1	0	40AH	(0A) SCC Port B Data
1	0	0	0	0	0	0	1	1	0	0	40CH	(0C) SCC Port A Cmd/Status
1	0	0	0	0	0	0	1	1	1	0	40EH	(0E) SCC Port A Data
1	0	0	0	0	0	1	0	0	0	0	410H	(10) INT Command Words
1	0	0	0	0	0	1	0	0	1	0	412H	(12) INT Vectors
1	0	0	0	0	0	1	1	0	0	0	418H	(18) CIO Port A Data
1	0	0	0	0	0	1	1	0	1	0	41AH	(1A) CIO Port B Data
1	0	0	0	0	0	1	1	1	0	0	41CH	(1C) CIO Port C Data
1	0	0	0	0	0	1	1	1	1	0	41EH	(1E) CIO Control Register
1	0	0	0	1	1	0	0	0	0	0	460H	(60) Request Service (Hard)
1	0	0	1	0	1	0	0	0	0	0	4A0H	(A0) Software Interrrupt
1	0	1	0	0	1	0	0	0	0	0	520H	(120) Request Service (Soft)

NOTE: If jumper JA is removed, the I/O ports are denoted in ( ) and are the same as the CPS-16X.
If jumper JA is jumpered, the I/O ports start at 400H and can run monochrome PC programs with proper software installed or TurboDOS compatible programs with new slave circuit drivers.

**** FUNCTIONAL DESCRIPTION ****

The CPS-16F is functionally partitioned into the following major groups:

- --CPU/1 Megabyte Dynamic RAM Logic
  - --1 Megabytes of Dynamic Ram
  - --CPU/S-100 Address Multiplexer
  - --Dynamic RAM Controller with Refresh
- --Slave Processor Control Logic
  - --Slave Processor Chip Select/Command Decoder
  - --Slave Request Logic
    - --Hard Request Logic
    - --Soft Request Logic
    - --Interrupt Request Logic
- --Clock Generator
  - --10 MHz Clock
  - --Baud Rate Clocks
- --Reset Generator
- --Input/Output Structure
  - --Serial I/O Port Control
  - --Parallel I/O Port Control
- --S-100 Bus Interface
  - --Status/Control Signals Receivers
  - --Data Receivers/Data Transmitters

Each group is described below to give the user a clear understanding of the hardware and software setup option. Prior to describing each group, a "thumbnail sketch" of the overall function of the CPS-16F is first described.

(1) Master/slave Action at Reset Time

After power-up reset, master reset or manual slave reset the 8086 CPU is immediately tri-stated before it can fetch and execute any instruction codes. At this time the slave HARD-REQUEST (Bit 7) and IN-SERVICE STATUS (Bit 6) are set which indicates theslave's 1 Megabytes of RAM is addressable through the S-100 Bus address lines A0-A20. Address lines A0-A15 address the 256 Kbyte RAM and A16-A20 select the page in which a 64 Kbyte section lies in the master's address range. In this SERVICE state the master is controlling when refresh of the DRAM is to occur through the S-100 sM1* status signal. The master commences to poll slave request flags via I/O port status read commands and upon determining that a slave requires service, can then "map" the slave memory into its address space. The master may then down-load the slave's operating system into the slave's memory and at the completion of this transfer, the master issues an I/O port RESET SLAVE command (80H) to the slave followed by a RELEASE SLAVE TO RUN command (03H) which causes the slave's tri-state condition to be released. The slave then commences to execute program instructions deposited by the master beginning at the 8086's hardware address FFFF0H resulting in execution of the slave's operating system. Thus, a "cold-boot" operation is executed.

(2) Master/slave Action during File Transfers

This operation is quite similar to the action described above. When a slave requires the transfer of files to or from the master, a SOFT-REQUEST flag (BIT 4) is raised. This means that a flag is raised but without the slave's CPU going into tri-state immediately as in paragraph (1) above. The master, upon determining that slave service is requested, will then issue a CONFISCATE SLAVE'S MEMORY command (01H). The CPU will tri-state itself and set the IN-SERVICE STATUS (BIT 6) to indicate the slave's memory is relinquished to the master as previously described. The slave's program execution is suspended for the duration of the master's data transfer process. Files are transferred as required and at the completion, the master issues a RELEASE command (03H) so that the slave resumes where it left off.

The hardware is partitioned into two major groups: (1) the slave kernel and (2) the I/O structure. The I/O simply consists of the serial I/O and parallel I/O controllers and associated logic. The slave kernel consists of the slave CPU, 1 Megabyte of slave memory, slave CPU address/S-100 Bus address multiplexer and the logic associated in asserting the slave CPU tri-state condition.

CPU/1 Megabyte Dynamic RAM Logic

The CPS-16F is a 8086 based CPU with an operational speed of 10 Mhz. It has 1 Megabytes of memory implemented in such a manner that memory is accessed by either the slave CPU or by the master CPU via the S-100 Bus address and control lines. Control logic is provided to issue a service request flag, switch memory control from the slave to the master and back, refresh the slave memory appropriately, switch the address lines from the slave to the S-100 Bus and back and provide RAS/CAS control to the memory.

The memory consists of thirty-two256 Kbyte-by-one-bit Dynamic RAM devices. The CPS-16F uses 256 row refresh architechture DRAM's with a maximum access time of 150 ns to provide reliable, non-wait state memory operation. It is configured for early-write mode to simplify internal buffering requirements. Address signals are sourced from either the slave CPU or the master CPU via the S-100 Bus address lines. Data signals are transmitted in the slave's internal data bus or to/from the host processor via buffers connected to the S-100 Data Bus lines.

An address translator PROM translates the S-100 address to the the CPU useable range.
Example 1 assumes the use of a master with 64K of memory (CPZ-4800X) and CPS-16F Slaves whose S-100 base address is set at 10000H. S-100 Bus address 10000H is translated to 8086 CPU address 00000H, 20000H to 10000H, 30000H to 20000H and so on. However while S-100 E0000H translates to 8086 D0000H, S-100 F0000H translates to 8086 F0000H which means the master does not have access to the slaves 2nd bank from the 8086's top of memory. Example 2 assumes the use of a master with 1 Megabytes of memory (CPZ-186) and CPS-16F Slaves whose S-100 base address is set at 100000H. S-100 Bus address 100000H is translated to 8086 CPU address 000000H, 110000H to 10000H, 120000H to 20000H and so on.

CPU/S-100 Address Multiplexer

Four Octal buffers are provided to switch address lines A0 through A15 to the slave memory from either the slave CPU or the master CPU via the S-100 Bus address lines. The 8086 operating in the maximum mode uses a series of 3 pulses to indicate bus request/grant/return. External logic latches the appropriate state. After the grant pulse the 8086 CPU tri-states the internal bus and the SERVICE signal switches the S-100 Bus address signals through to the memory. The return pulse turns the SERVICE signal off thus returning address throughput from the 8086 CPU to the memory.

Dynamic RAM Controller

The TMS 4500A is a monolithic DRAM system controller which provides address multiplexing, timing, control and refresh/access arbitration functions to simplify the interface of dynamic RAM's to microprocessor systems. The controller contains a 16-bit multiplexer for DRAM type addressing and provides the RAS/CAS timing strobes for data read/write operations. An 8-bit refresh counter generates the 256-row addresses required for refresh. There are two modes of controller operation. One is when the slave CPU commands the controller and the other is when the S-100 Bus is in command. When in non-SERVICE mode the controller receives read/write commands from the slave 8086 CPU. An internal refresh timer issues RAS refresh strobes every 8 microseconds to ensure data retention. Refresh/access arbitration logic will ensure that if a memory access is in progress and refresh is required it will finish the access then insert refresh. If on the other hand, refresh is in progress and memory access is required the controller will issue appropriate wait states to the CPU until refresh is completed then finish the memory access. When in the SERVICE mode the controller receives read/write commands from the S-100 Bus interface and refresh is determined by external command. The S-100 Bus must do the refresh/access arbitration by ensuring a memory access does not occur during a S-100 M1 cycle because the status signal sM1* triggers the controller to issue a refresh strobe.

Extended Address Select Logic

When the slave enters the SERVICE mode, a comparator is enabled which compares the master's extended address lines A16(m) through A20(m) against a five position jumper referred to as the EXTENDED ADDRESS SELECT jumper. If the master executes a memory transfer to the bus, the acknowledged slave whose comparator is enabled will cause a memory cycle to occur in the slave.

I/O Port Address Select Logic

The I/O Port Address Select Logic consists of the I/O Port Address Decoder and the Host Processor Status/Command Decoder/Logic.

I/O Port Address Decoder

The I/O Port Address Decoder consists of an eight bit comparator which compares the master's least significant address bits A0(m) through A7(m) against an eight position jumper referred to as the I/O PORT SELECT jumper. If the master executes an I/O cycle transfer to the bus, the slave whose address decoder compares, will respond to either a master's command or to the master's request for the slave's status.

Host Processor Status/Command Decoder/Logic

The master may issue one of eight commands to the slave, these commands are listed as follows:

** Clear Slave Request (00H)
The slave may issue two types of requests to the master by setting internal latches. These are: (1) SOFT-REQUEST and (2) INTERRUPT REQUEST. The master is required to acknowledge the requests which is done through an I/O command, CLEAR SLAVE REQUEST that resets both latches.

** Confiscate Slave's Memory (01H)
The master may asynchronously issue a memory confiscation command and request the slave's central processor to tri-state itself. The slave will respond by setting the "request" status bit 7. The master should then poll the "service" status bit 6 until it is set. This indicates that the slave's CPU has successfully been tri-stated and that the input source to the slave Dynamic RAM Controller has been transferred from the slave to the master. This completes the transfer of control over the slave's RAM from the slave processor to the master's processor. The master may transfer the control back to the slave by issuing a "Release Slave to Run" command (03H).

The master may maintain control indefinitely thereby treating the slave as a 64Kbyte RAM appearing in the master's extended address space.

** Clear Reset Latch (02H)
This master command clears the slave's reset latch and is normally issued only after the Reset Slave (80H) command. This command does not clear the INTERRUPT REQUEST or SOFT-REQUEST latches.

** Release Slave to Run (03H)
The master may issue a release command to the slave following successful confiscation of the slave's memory. This command causes the RAM control to pass from the master back to the slave processor where it resumes execution prior to being tri-stated (see "CONFISCATE SLAVE'S MEMORY" command above).

** Reset Slave (80H)
The master may reset a selected slave by issuing a RESET SLAVE command which sets the reset latch. This command causes the slave processor and other slave logic to be reset. The reset state is maintained until the master issues a "Clear Slave Request" command or the master "slave clear" line is asserted on the S-100 Bus.

** Request Slave Service (40H)
A request/acknowledge handshake is implemented in the master-to-slave direction. This is done by the master issuing a Request Slave Service command. The command causes an interrupt to the slave's processor via the slave's 8259A Interrupt Controller, IR input 3. The slave may then execute interrupt code and issue an acknowledge command by asserting the SOFTREQ status signal. The cycle is completed by the master issuing a "Clear Slave Request" command. The main function of this interrupt is to act as a watchdog timer to determine if a slave is functional when the slave has not requested service to the master for a period of one second. If functional, the slave will set the SOFT-REQUEST flag which

** Interrupt Slave (20H)
The master has access to a second interrupt input in the slave's interrupt structure. This command utilizes the 8259A Interrupt Controller's IR input 2.

Slave Processor Control Logic

The slave control logic consists of two subdivisions. These are: (1) the Chip Select/Command Decoder and (2) the Slave Request Logic.

** Slave Processor Chip Select/Command Decoder
This logic decodes slave commands consisting of the following control functions:

** CSSCC
CSSCC is the chip select signal for the slave processor's 2-channel Serial Communications Controller (SCC).

** CSCIO
CSCIO is the chip select signal for the slave processor's Counter/ Timer and Parallel I/O Unit (CIO).

** CSPIT
CSPIT is the chip select signal for the slave processor's 3-channel programmable Interval Timer (PIT).

** CSINT
CSINT is the chip select signal for the slave processor's Eight-channel Programmable Interrupt Controller.

** CSSER
CSSER is the strobe signal utilized to assert one of the following functions:
- SOFT-REQUEST (I/O port address = 80H)
- HARD-REQUEST (I/O port address = 40H)
- SLAVE INTERRUPT REQUEST (I/O port address=20H)

** Slave Request Logic

- SOFT-REQUEST
Soft-request is a signal asserted by the slave which may be read by the master. The slave asserts this signal when it requires service by the master but does not relinquish control to the master until the master initiates a slave memory confiscation process.

- HARD-REQUEST
Hard-request is a signal asserted by the slave processor which causes the slave processor to tri-state itself thereby suspending program execution. Note the difference between a soft and a hard request: the soft request does not cause immediate suspension of slave processor execution whereby the hard request does.

-SLAVE INTERRUPT REQUEST
The Slave Interrupt Request asserts a signal on the status port which may be polled by the master or asserts a signal via an Open collector driver which may be optionally connected to one of eight S-100 Bus vectored interrupt lines (VIO-VI7).

Slave Clock Generator

The CPS-16F utilizes the Intel 8284A Clock Generator and Driver device and a 30 MHz crystal to generate the 10 MHz 33% duty cycle MOS clock that the 8086 CPU requires. A 5 MHz 50% duty cycle TTL clock is also generated for use by peripherals.

Reset Generator

The slave's reset line is asserted to clear the slave's processor and internal logic. One of three reset sources cause the slave reset line to be asserted. These are:

- Master Prime
The master may issue a reset signal by asserting the I/O command "Reset Slave" (see HOST PROCESSOR STATUS/ COMMAND DECODER/LOGIC section).

- Slave Clear
The master may issue a reset signal by asserting the bus reset signal "Slave Clear" (S-100 Bus pin 54).

- Slave Reset
The user may exercise a manual reset by providing a closure to ground on the slave reset input. A connector input located at the top of the slave circuit board is provided (J1). The input is debounced by a one-shot.

Input/Output Structure

The I/O structure consists of two serial I/O ports with associated baud rate generator and two parallel I/O ports.

Serial I/O Port Control

The Serial I/O Port Control consists of the Serial I/O Controller and the Baud Rate Clock Generator.

Serial I/O Controller

The Serial Communications Controller (SCC) is a programmable dual channel device which provides formatting for serial data communications. The channels can handle either asynchronous (Z8531) or synchronous (Z8530) data transfers to/from serial peripheral devices. The SCC operates either under programmed I/O or Interrupt Control. All lines necessary to handle asynchronous, synchronous, synchronous bit oriented protocols and other serial protocols are available to the user at interface connectors J2 & J3. In addition, +/- 16 volt DC and +5 volt DC power are available at these connectors.

The SCC may be interfaced to peripheral devices requiring differing protocols. This interface is tailored to the exact device requirements by use of a Personality Module. The interface is implemented through two 16-pin Ansley connectors. Refer to the "Personality Board Users Guide" for a description of the Serial Personality Modules currently available.

To program the SCC, the system software issues commands to initiate the mode of operation via data bits 0-7 . Fifteen write registers exist for that purpose. In addition, Eight read registers allow the programmer to read the status of each channel.

Baud Rate Clock Generator

The Baud Rate Clock Generator consists of a clock generator and a 8253 Programmable Interval Timer (PIT). The PIT is a device which, under software control, can generate variable clock periods which are a multiple of the base input clock 2.4576 MHz. The device has other modes of operation; however, only the modes applicable to the CPS-16F operation will be described here.

The 8253 consists of three channels, each with a signal input and a clock output. Channel 0 is tied to SCC channel A transmit and receiver clock inputs, channel 1 to SCC channel B transmit/receiver clock inputs, and channel 2 is used a real time interrupt output to the Interrupt Controller.

Channels 0 and 1 are connected to the SCC inputs via jumper options PJA and PJB. These signals are also tied to the serial interface connectors. If clock signals are originated by the interfacing devices, the jumpers are cut appropriately. The channel A jumper provides for separate transmit and receive clock inputs from the interface (connector J2) or may serve as baud rate generator outputs to the interface. This arrangement is intended to provide a clock to synchronous MODEM'S via "external" clock in accordance with the EIA RS-232C standards. The modem can then return a transmit/receive clock to the serial controller. In summary, means are provided to implement serial interfaces accommodating asynchronous, synchronous, HDLC and a great number of currently defined communications protocols.

For channels 0 and 1, the 8253 generates a square wave whose period is defined by a count programmed into the respective channel's counter. The square wave will remain at a logical ZERO state for one half the count, and at logical ONE for the remaining half of the count. The counter decrements for each clock period that is received.

The 8253 is programmed by the CPU specifying the mode, loading sequence and counter contents via data bits 8-15. The Baud rates that can be derived from the 2.4576 Megahertz clock are listed as follows:

Baud Rate	Theoretical Frequency (16 x clock)
600	9.6 kiloHertz
1200	19.2 kiloHertz
1800	28.8 kiloHertz
2000	32.0 kiloHertz
2400	38.4 kiloHertz
3600	57.6 kiloHertz
4800	76.8 kiloHertz
7200	115.2 kiloHertz
9600	153.6 kiloHertz
19200	307.2 kiloHertz

Parallel I/O Port Control Interface

The parallel I/O Port Control Interface consists of the Counter/Timer and Parallel I/O Unit (CIO). The CIO is a programmable three-port LSI component, which interfaces peripheral devices to the 8086 microprocessor. The CIO provides data transfer to and from peripheral devices under programmed I/O or interrupt control. Handshaking data transfer control lines are provided to the interface in addition to the two eight-bit data ports. The CPU reset line and the peripheral clock are also connected to this interface. The CIO is flexible and may be connected to peripheral devices requiring differing protocols.

The interface is tailored to the exact device requirements by use of a "Personality Module". The Personality Module is a small external circuit board which connects to the CPS-16F to provide the hardware drivers and receivers, logic and other circuitry as required. Refer to Appendix A for a description of the parallel Personality modules currently available.

To program the CIO, the system software issues commands to initialize the mode of operation. Initialization is provided by loading the mode registers via data bits 8-15.

Interrupt Controller

The Interrupt Controller consists of the 8259A Eight-channel Priority Interrupt Controller. The interrupt channels are assigned as follows:

Interrupt 0: Serial Communications Controller
Interrupt 1: Real Time Clock
Interrupt 2: Interrupt 1 from Master
Interrupt 3: Interrupt 2 from Master
Interrupt 4: Parallel Controller
Interrupt 5: Reserved
Interrupt 6: Parallel Port (pin 23) Interrupt
Interrupt 7: Reserved

To program the INT, the system software issues commands to initialize the mode of operation. Initialization is provided by loading the mode registers via data bits 0-7. Note: All channels should be programmed for edge-triggered mode.

S-100 BUS INTERFACE

The CPS-16F S-100-BUS interface consists of 68 lines. These are grouped into sets used to transmit data, control & power. The groups are:

Group	No. of lines
Address Bus	22
Data Bus	16
Status Bus	5
Control Input Bus	3
Control Ouput	2
Vectored Interrupt Bus	8
Utility Bus	3
System Power	9

Devices connected on the bus are classified as either bus masters or bus slaves and as either permanent or temporary masters. The CPS-16F is a bus slave. It cannot take control of the bus. It can only request service by the master and once acknowledged, will be the only slave on the bus being serviced until the master releases the slave through an I/O command. File transfer to/from the slave are accomplished via memory-to-memory transfer from/to the master. Software may be configured to execute the transfers under DMA control in which case the transfer rate is approximately 571 Kbyte/second.

Each of the S-100 Bus signals utilized by the CPS-16F are described on the following pages. A summary of the S-100 Bus signals is included in Appendix B.

ADDRESS BUS

The address bus consists of 22 lines designated as A0 through A21. The address lines A0 through A15 address one of 64 Kbytes of the slave memory whereby address lines A16 through A20 map the slave memory onto the master's address space. All address lines are sampled during master memory cycles. Address lines A0 through A7 are used by the slave during master I/O cycles to transfer I/O commands from the master and status inputs to the master.

DATA BUS

The data bus can operate as two 8-bit data ports one for input and one for output or as a 16-bit bi-directional data port with appropriate controls. When executing 8-bit data transfers, input data is received via 8 lines designated as DI0 through DI7 and output data is transmitted via 8 lines designated as DO0 through DO7. Data transfers from the master to slave are accepted during master memory & I/O output cycles when the slave is addressed appropriately.

For 16-bit data transfers, the master will exert signal sXTRQ* true during pSYNC and the CPS-16F Slave will respond with the signal SIXTN* to indicate 16-bit transfer capability. The two 8-bit data ports are ganged together to form one bi-directional 16-bit data path such that DI0 corresponds to DI0 (16-bit) and DO7 corresponds to D15 respectively.

STATUS BUS

The status bus consists of 5 master output lines which define the current master processor bus cycle. The status lines used by the slave are:

STATUS	FUNCTION
sMEMR	Master memory read cycle
sM1	Master Opcode fetch cycle
sINP	Master input cycle
sOUT	Master output cycle
sXTRQ	Master 16-bit data request

-sMEMR

sMEMR is used by the slave to generate memory read cycles when the master confiscates the slave's memory & executes a read cycle.

-sM1

sM1 is used by the slave to detect master OPcode fetch cycles in order to subsequently generate refresh cycles in the slave memory. This operation takes place only during the time that the master has confiscated the slave's memory.

-sINP

sINP is used in the slave to extract the slave's status:

Hard-Request	(Bit 7)
In-Service	(Bit 6)
Interrupt Request	(Bit 5)
Soft-Request	(Bit 4)

-sOUT

sOUT is used in the slave to execute one of the eight commands to the slave. See "Host Processor Status/Command Decoder//Logic".

-sXTRQ

sXTRQ is used in the slave to assert the SIXTN signal acknowledging it is capable of a 16-bit memory data transfer.

CONTROL INPUT BUS

The control input bus consists of 3 master output lines which define the master's current processor cycle. These consist of:

Signal	Function
pDBIN	Master read cycle
pWR*	Master write cycle
pSYNC	Master processor start cycle

-pDBIN
pDBIN is used with sMEMR to place data onto the S-100 data bus during memory read cycles.

-pWR*
pWR* is used with sOUT to write input commands/data from the master to the slave. It is also a component of the memory write signal MWRT.

-pSYNC
pSYNC is used with sM1 to initiate memory refresh cycles when the slave's memory is confiscated by the master.

CONTROL OUTPUT BUS

The control output bus consists of 2 master input lines which allows the slave to synchronize operations of the bus master to its own internal requirements. These are:

SIGNAL	FUNCTION
RDY	Slave ready to complete transaction
SIXTN	8/16-bit datatransfer acknowledge

-RDY
RDY is the ready signal. This signal is normally not used but can be configured if necessary to add a wait state for use with extremely fast Bus Masters. Connection of this signal is optional. See "Solder/Trace Cut Options - PJD".

-SIXTN
SIXTN is a signal used by the master to determine if the slave is to execute an 8- or 16-bit data transfer during a master read or write cycle.

VECTORED INTERRUPT BUS

The slave may generate an interrupt to the master via the vectored interrupt bus. The interrupt pulse is generated by the slaves processor's execution of an output write cycle to port 80H. See "Slave Processor Control Logic". The user may connect the interrupt pulse generator to one of the eight vectored interrupt lines (VI0 - VI7) through a jumper option. See "Solder/Trace Cut Options - PJF".

UTILITY BUS

The utility bus signals utilized by the slave consist of:

Φ (Clock)	Master system clock
MWRITE	Master memory write strobe
SLAVE CLR	Master slave clear

-Φ (Clock)

Φ is used in the slave to synchronize the master's read slave's-memory cycle and the refresh pulse generator during the master's confiscation of the slave's memory.

-MWRITE

MWRITE is used by the master to generate memory write cycles during the master's confiscation of the slave's memory.

-SLAVE CLR

SLAVE CLR is used in the slave to generate a reset signal to internal logic and to the slave CPU when the master asserts the SLAVE CLR signal.

SYSTEM POWER

The system power utilized by the slave consists of:

+8 VDC	(2 lines)
+16 VDC	(1 line)
-16 VDC	(1 line)
Ground	(5 lines)

The +8 VDC is input to a +5 VDC regulator to generate the slaves +5 volt power. The +/- 16 VDC lines are routed to the serial I/O connectors where they may be utilized to generate regulated power for such applications as RS232 receivers. The +/- 16 VDC lines are routed via fuse links (thin trace areas) on the PCB which "burn open" in the event of a short circuit on the personality board connected to the serial I/O connectors. The ground lines are connected to the PCB ground plane.

**** OPERATING INSTRUCTIONS ****

Instructions are given herein to configure the CPS-16F from both the hardware and software standpoint.

Hardware Setup Instructions

The hardware is configured via jumper options and solder/trace cut areas. The solder/trace cut areas are referred to as PJX, where X is the area designator. The PJX options are located on the "solder" side of the board. Three jumper areas are provided on the "component" side. These are implemented by header jumpers.

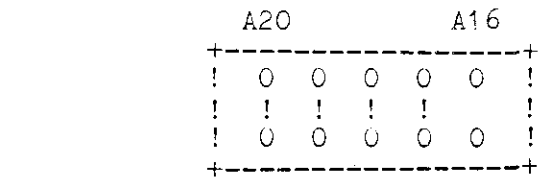
Jumper Options

Refer to figure 1 to locate the header jumper areas. These are designated as the EXT ADDR SEL, I/O PORT and JA jumpers.

EXTENDED ADDRESS SELECT (EXT ADDR SEL)

Logic is provided to map the slave's memory within the master's 2 megabyte memory address space by comparing the master's extended address lines [A16 (M) through A20 (M)] against a corresponding five position jumper. Successful comparison results in master/slave memory transfers provided that the slave's service request was previously acknowledged by the master via a similar process for a master/slave I/O transfer. The extended address comparison jumper is designated as EXT ADDR SEL on the board's silk screen. The jumper setting designates the page within the master's 2 megabyte address space that the slave's memory will reside in during the master's confiscation of the slave's memory.

EXT ADDR SEL



For CPZ-4800X: A16=open
For CPZ-186: A20=open

EXAMPLE:

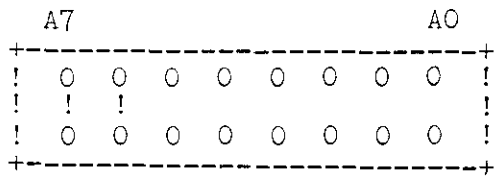
To map the beginning of the 1 Megabyte slave memory into the first 64 Kbyte page above the master's 64Kbyte on-board address space (010000H to 04FFFFH), install jumpers in positions corresponding to A17 through A20 and leave A16 position open. To map it at the 1 Megabyte address boundary, install jumpers in positions corresponding to A16 through A19 and leave A20 open.

Note:
1. A jumper installed corresponds to a logic 0 setting and the absence of a jumper corresponds to a logic 1 setting.
2. All slaves under the control of a common TurboDOS master must be set to reside in the same1 Megabytespace; ie: all EXT ADDR SEL jumper settings must be the same for each slave. Factory settings are provided for all slaves with EXT ADDR SEL set at 10H. TurboDOS software is configured for that setting.
3. Any other S-100 Bus device installed in the bus that is memory mapped may not reside within the address space assigned to the slave(s).

I/O PORT SELECT (I/O PORT SEL)

The master transfers commands to the slaves and receives status from the slaves through I/O Bus transfers. Logic is provided to map the slave within the master's 256 byte I/O address space by comparing the master's address lines [A0 (M) through A7 (M)] against a corresponding eight position jumper. Successful comparison results in a master/slave I/O transfer. It is through I/O status and command transfers that the master determines if a slave requires service and if a slave is to be confiscated for subsequent file transfers to/from the slave's memory.

I/O PORT SEL



EXAMPLE:

To map the slave into the I/O address space 3FH, install a jumper in position A7 and A6 and none in the remaining positions.

Note: 1. A jumper installed corresponds to a logic 0 setting and the absence of a jumper corresponds to a logic 1 setting.

2. Slaves under the control of a common master must be set to reside in individual I/O locations. ie: All I/O PORT SEL jumper settings are mutually exclusive. Factory settings are provided for all slaves with I/O PORT SEL set at 3FH. The customer must provide jumpers to map each slave at exclusive locations. The TurboDOS operating system is then configured as follows:

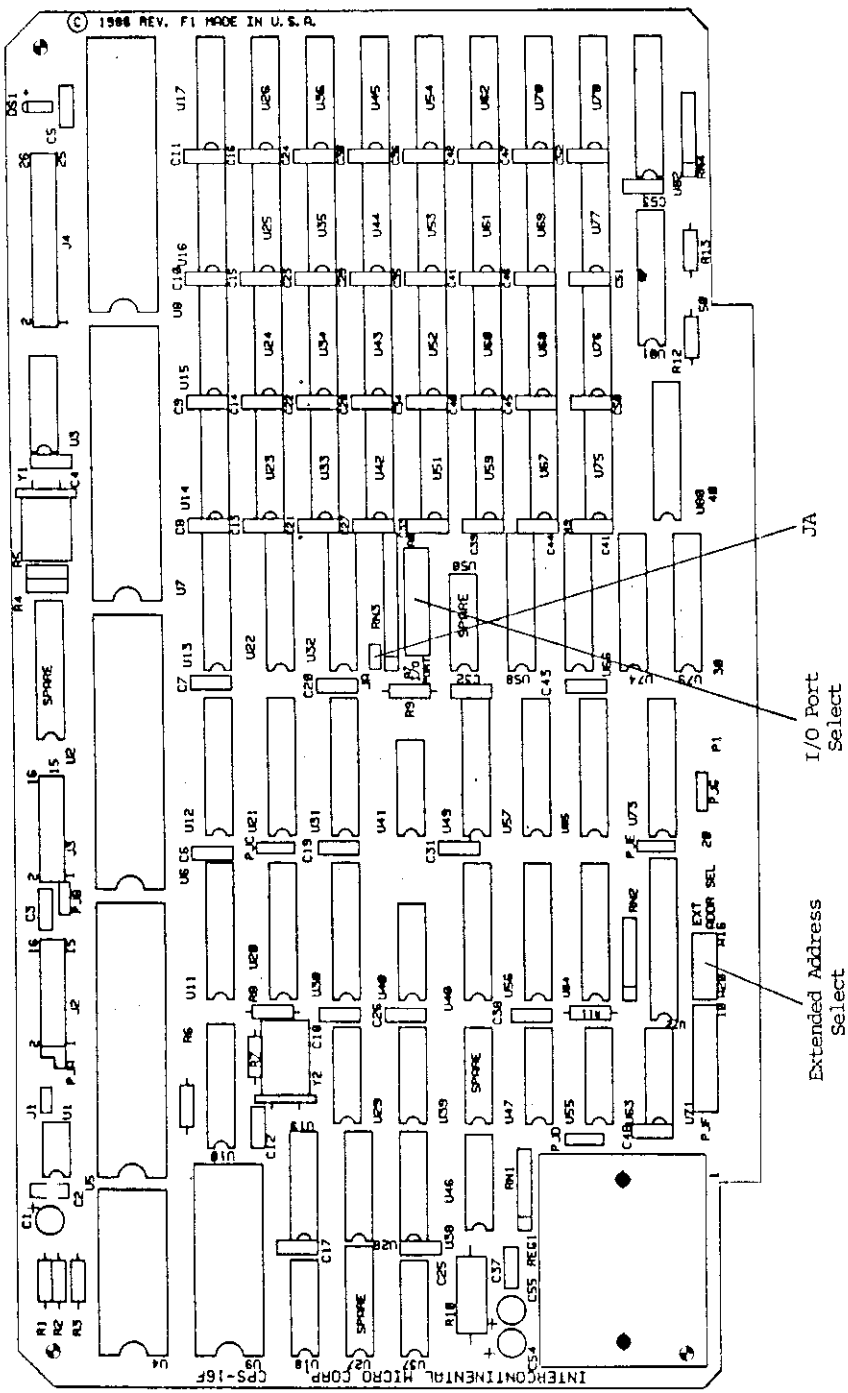
DEFAULT I/O PORT SETTING:

Slave Number:	1	2	3	4	5	6	7	8
I/O address :	3FH	3EH	3DH	3CH	3BH	3AH	39H	38H

Slave Number:	9	10	11	12	13	14	15	16
I/O address :	37H	36H	35H	34H	33H	32H	31H	30H

JA - MODE SELECT (CPS-16F OR CPS-16X SLLECT)

If JA is not jumpered but left open, the Slave internal I/O peripherals appear at addresses 000H through 120H which converts the board into a CPS-16X. All Slave circuit drivers that equate to these addresses will operate correctly. If JA is jumpered with a shunt or wire-wrap, the Slave internal I/O peripherals appear at addresses 400H through 520H which allows PCDOS programs to run with a modified driver installed.



- FIGURE 1 -
JUMPER OPTIONS

SOLDER/TRACE CUT OPTIONS

Refer to figure 2 to locate the solder/trace cut areas. These are listed as follows:

PJA - SCC Port A Clock Source Select
PJB - SCC Port B Clock Source Select
PJC - I/O Early/Normal Write Select
PJD - Master 0/1 Wait State Select
PJE - 256/1 Megabyte Memory Enable Select
PJF - Connect Slave Interrupt Request VI Lines
PJG - Two Megabyte Memory Boundary Select

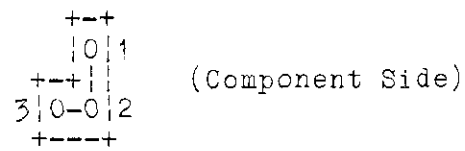
PJA

The CPS-16F comes configured so that the SCC ports receive their baud clocks from an on-board programmable timer. The board could be reconfigured to source the clocks from the SCC serial port connectors. Such is the case when synchronous modems connect to the serial ports. The modem provides a clock to the SCC. Furthermore, the modem may receive the clock from the on-board timer, condition the clock and return it to the input of the SCC. The transmit and receive clocks may be sourced separately on Port A. All combinations are possible through this jumper.

To source SCC PORT A clock inputs from the SCC connector J2 only, cut the trace from PJA-2 to PJA-3 on the component side. The source can now be connected through the personality board on either J2-2 or J2-3.

If the SCC PORT A clock inputs are to be sourced separately from the SCC connector, cut the trace from PJA-1 to PJA-2. The receive clock (SCC-12) is now input on J2-3 and the transmit clock (SCC-14) is input on J2-2.

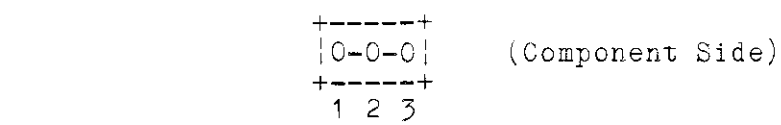
[PJA] area



PJB

To source SCC Port B input from the SCC connector only, cut the trace from PJB-1 to PJB-2. J3-03 (Receive Clock) is tied to SCC-28 and PJB-1. J3-02 (Transmit Clock) is tied to SCC-26 and to PJB-2. These two signals can be separated by cutting the trace from PJB-2 to PJB-3.

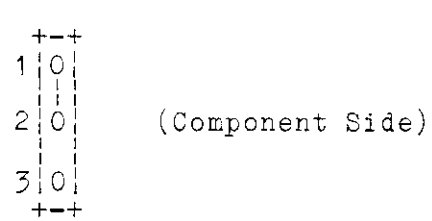
[PJB] area



PJC

The CPS-16F uses the normal I/O write command rather than the early write command in order to guarantee data-to-write setup time. If peripherals are used that don't require this setup time then to use the early write signal cut the trace from PJC-1 to PJC-2 and add a jumper from PJC-1 to PJC-3.

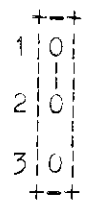
[PJC] area



PJD

When the host processor confiscates the CPS-16F's memory, data transfers normally do not require wait states. This is the case if the host processor is the CPZ-186. If the S-100 Bus memory read command is shorter than 250 ns or the write command is shorter than 150 ns then a single wait state may be required as is the case with the CPZ-48006. This wait state request occurs during pSYNC and is output through the RDY signal pin 72. This signal does not affect the CPZ-186. If your master does not require a wait state during pSYNC then cut the trace from PJD-1 to PJD-2 and jumper from PJD-2 to PJD-3.

[PJD] area



(Component Side)

PJE

The CPS-16F memory controller normally uses Address bit 19 to control the bank select input when using 1 Megabyte of memory. If 256 Kbytes of memory are to be used then cut the trace from PJE-2 to PJE-3 and jumper from PJE-1 to PJE-2. Replace the 256K x 1 DRAM's with thirty-two 64K x 1 DRAM's.

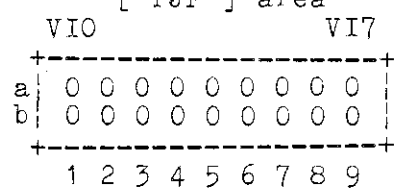
[PJE] area

(Component Side)

PJF

The CPS-16F may assert an interrupt to the host (Slave Interrupt Request). The interrupt may be connected to one of 8 VI lines of the S-100 bus. This is accomplished by connecting a strap on the PJP jumper area. TurboDOS does not utilize this feature.

[PJF] area

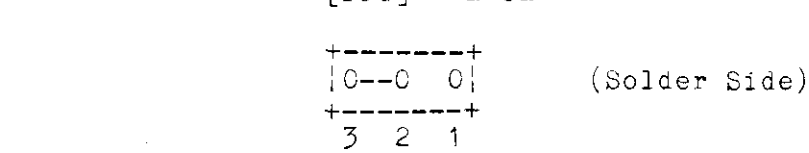


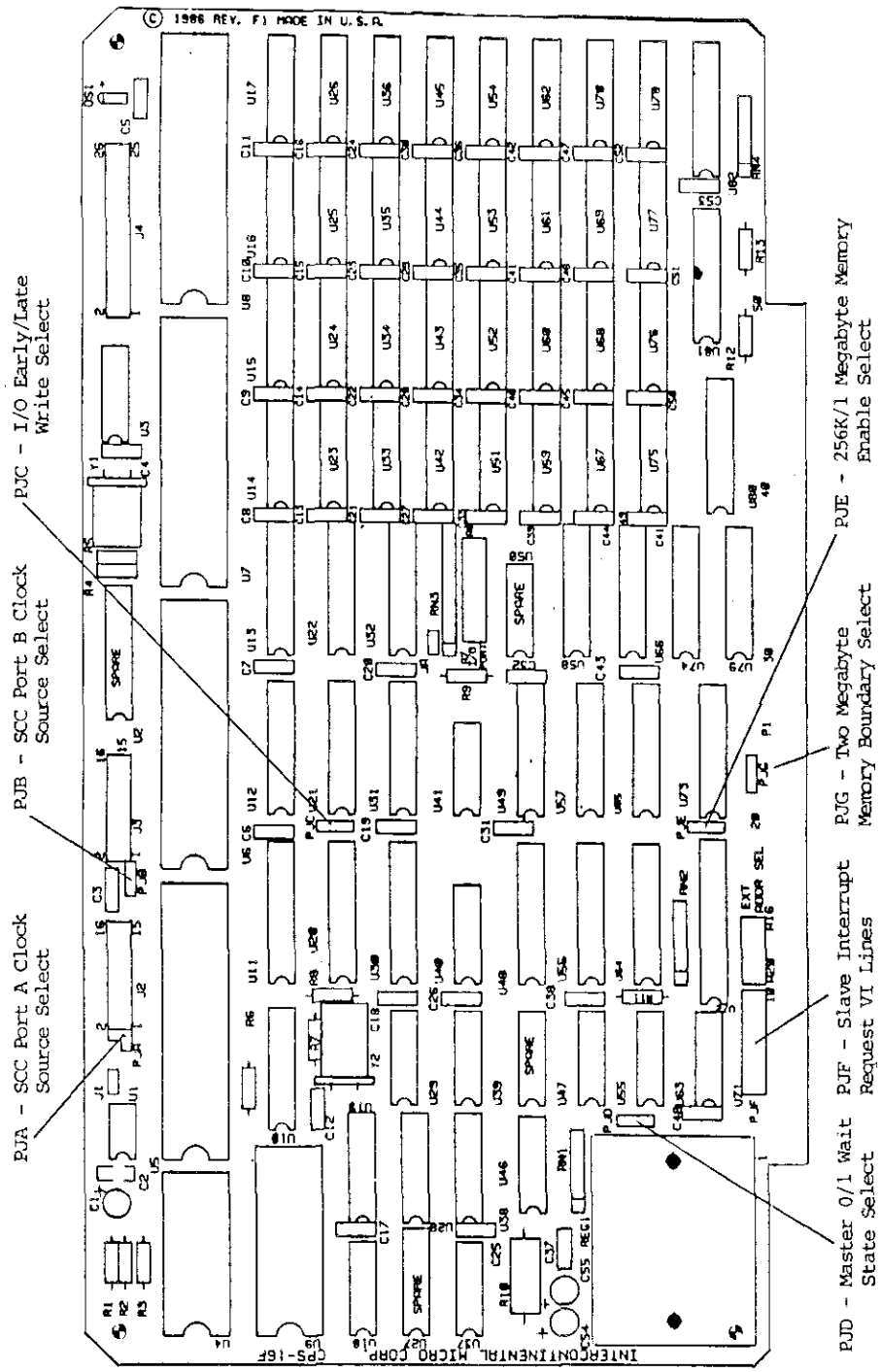
(Front View)

As an example, to connect Slave Interrupt Request to VI1, connect a jumper from a2-to-b2.

PJG

Logic is provided to map the slave's memory within the master's 0-2 Megabyte address range or 2-4 Megabyte address range. The CPS-16F comes normally configured for the 0-2 Megabyte address range. To map the slave's memory in the 2-4 Megabyte range cut the trace from PJG-2 to PJG-3 and jumper from PJG-1 to PJG-2. The slave will then only respond to memory requests when address bit A21 is a logic 1.





- FIGURE 2 -
SOLDER/TRACE CUT OPTIONS

**** SOFTWARE DESCRIPTIONS ****

The CPS-16F slave processor board was designed primarily for the execution of PC-DOS software under a software product known as MS-SLAVE. The nucleous of the MS-SLAVE product is a IBM style BIOS designed to execute with the CPS-16F, thus allowing PC-DOS and the TurboDOS/PC networking product to be loaded and executed in the CPS-16F.

The BIOS software is designed to make the CPS-16F appear compatible with an IBM PC and the monochrome display adaptor. All PC-DOS software that is not copy protected and will execute in an IBM PC with the monochrome display adaptor should execute properly in the CPS-16F. The MS-SLAVE product information and documentation contains the information required to install the product for the CPS-16F.

The CPS-16F can be made hardware compatible with previous revisions of the CPS-16X through jumper option area "JA". For installation of the CPS-16F without upgrading TurboDOS drivers, jumper JA should be left open (or a no connect).

The CPS-16F contains a slightly different clock rate as the input to the counter/timer circuit on the board (8254). This will cause the older real-time-clock driver (RTCCPS) to run 25% faster. Because this real-time-clock driver primarily performs the timing for process delays and dispatching, this may not cause any problems with the software that is currently executing on the product.

Beginning with the release of TurboDOS version 1.43, all drivers for the CPS 16-bit slave with be compatible with any revision level of the board. However, TurboDOS version 1.43 must be the host operating system for the MS-SLAVE product and the CPS-16F. Along with TurboDOS/PC version 1.08 and PC-DOS version 3.10, the CPS-16F will be fully compatible with the PC-DOS file sharing and record locking conventions, thus allowing true multi-user software to execute in the InterContinental Micro bus network environment.

PERSONALITY BOARD INTERCONNECTION INSTRUCTIONS

The CPS-16F has four connectors at the top of the board numbered J1 through J4. These are listed below: (See Appendix Connector Tables)

J1 - Slave reset connector
J2 - SCC Port A Connector
J3 - SCC Port B Connector
J4 - CIO Connector

J2,J3 & J4 are typically connected to peripheral devices through personality boards which are small printed circuit boards customizing the above listed devices to a variety of peripherals. The slave may be reset by providing a switch closure across J1. J1 may be left open without adverse effect as this input is pulled-up.

Most S-100 Bus chassis provide a jumper plate at the rear of the chassis to which peripheral connectors are installed. Typically, the connectors are of the ITT CANNON DB25 type. The personality boards provided by ICM are boards with DB25 connectors at one end and header plugs at the other. The DB25 connector end is to be installed in the cutouts provided on the connector plate. Flat ribbon cable then connects the CPS-16F connector to the personality board.

At a minimum, a SCC Port B (RPB-100) personality board must be installed. The instructions follow:

1. - Select a DB25 connector cutout at the rear of the chassis for the RPB-100 personality board.
2. - Insert and hold the RPB-100 personality board in the cutout.
3. - Install #6 nuts, washers and bolts passing the bolts through the personality board's DB25 connector.
4. - Install the flat ribbon cable provided at the personality board and at the CPS-16F connector J3.
5. - Install a cable from the chassis connector to the peripheral.

Refer to the "Personality Board User's Guide" for a complete description of the Personality Boards available and for instructions on interfacing these boards.

**** SLAVE I/O ASSIGNMENTS ****

Master Side

Slave I/O Base Address ..... 0 - FF hex (Master R/W)
Slave Status ..... Slave I/O Base (Master Read)

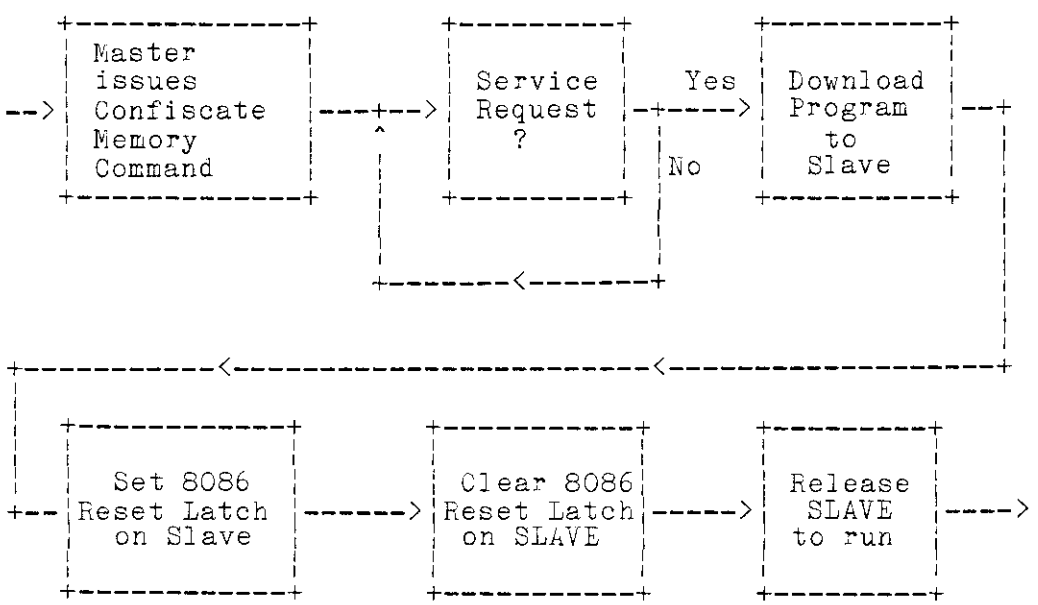
Slave Status Bits .. (master read)

bit	7	6	5	4	3	2	1	0
	REQUEST	SERVICE	SLV INT REQ	SOFT REQUEST	UNDEF	UNDEF	UNDEF	UNDEF

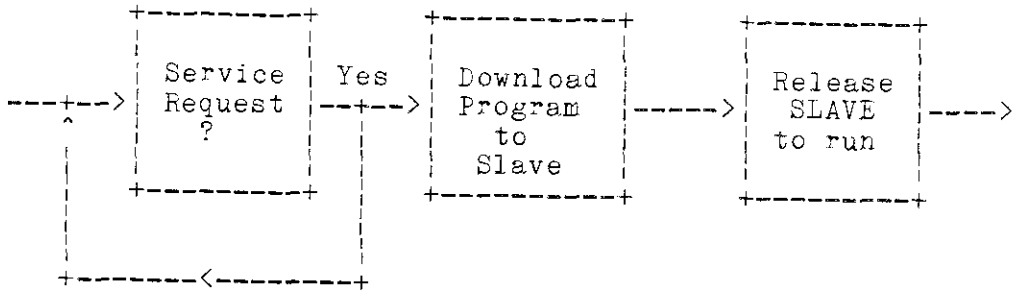
Slave Command Bits .. (master write) .. Slave I/O Base Address

bit	7	6	5	4	3	2	1	0	
	0	0	0	0	0	0	0	0	... Clear Slave Request/Reset
	0	0	0	0	0	0	0	1	... Master Confiscate of Slave
	0	0	0	0	0	0	1	0	... Clear Reset Latch only
	0	0	0	0	0	0	1	1	... Release Slave to Run
	1	0	0	0	0	0	0	0	... Reset SLAVE 8086 CPU chip
	0	1	0	0	0	0	0	0	... Master Request to Slave
	0	0	1	0	0	0	0	0	... Master Intrp to Slave

Below is a flowchart of how a MASTER might confiscate a SLAVE for program down loading.



Below is an example of using the SLAVE for normal MASTER/SLAVE transactions.



Slave Side

All SLAVES have the following internal I/O ports defined.

PIT chan 0	400 hex (read/write)
PIT chan 1	402 hex (read/write)
PIT chan 2	404 hex (read/write)
PIT mode reg	406 hex (read/write)
SCC chan B cmd*/stat	408 hex (read/write)
SCC chan B data	40A hex (read/write)
SCC chan A cmd*/stat	40C hex (read/write)
SCC chan A data	40E hex (read/write)
INT command	410 hex (read/write)
INT vectors	412 hex (read/write)
CIO port A	418 hex (read/write)
CIO port B	41A hex (read/write)
CIO port C	41C hex (read/write)
CIO control	41E hex (read/write)
REQUEST SERVICE (Hard)	460 hex (write only)
REQUEST SERVICE (Soft)	520 hex (write only)
SOFTWARE INTERRUPT	4A0 hex (write only)

NOTE: The Slave internal I/O ports can not be read or written by the Master CPU. To emulate the older CPS-16X ports simply open jumper JA which subtracts 400 hex from each port address.

The slave executes a hard service request to the master by outputting to port 460 hex. The byte sent to port 460 hex has no meaning. Just the function of writing to Port 460 hex causes the Request to happen.

*** APPENDIX ***

J1

	SIGNAL	FUNCTION
J1-1	SRESET*	Slave Reset
J1-2	Ground	Ground

J2

	SIGNAL	FUNCTION
J2-1	ADSR*	Port A Data Set Ready
J2-2	ATXC*	Port A transmit clock
J2-3	ARXC*	Port A receive clock
J2-4	ATXD	Port A transmit data
J2-5	ARXD	Port A receive data
J2-6	ARTS*	Port A request-to-send
J2-7	ACTS*	Port A clear-to-send
J2-8	ADCD*	Port A data carrier detect
J2-9	ADTR*	Port A data terminal ready
J2-10	ARNG*	Port A ring indicator (not connected)
J2-11	ABRCLK	Port A baud rate clock
J2-12	GND	Ground
J2-13	+16 VDC	+16 VDC power
J2-14	-16 VDC	-16 VDC power
J2-15	+5 VDC	+5 VDC power
J2-16	GND	Ground

J3

	SIGNAL	FUNCTION
J3-1	BDSR*	Port B Data Set Ready
J3-2	BTXC*	Port B transmit clock
J3-3	BRXC*	Port B receive clock
J3-4	BTXD	Port B transmit data
J3-5	BRXD	Port B receive data
J3-6	BRTS*	Port B request-to-send
J3-7	BCTS*	Port B clear-to-send
J3-8	BDCD*	Port B data carrier detect
J3-9	BDTR*	Port B data terminal ready
J3-10	BRNG*	Port B ring indicator (not connected)
J3-11	BBRCLK	Port B baud rate clock
J3-12	GND	Port B Ground
J3-13	+16 VDC	Port B +16 VDC power
J3-14	-16 VDC	Port B -16 VDC power
J3-15	+5 VDC	Port B +5 VDC power
J3-16	GND	Port B Ground

J4

	SIGNAL	FUNCTION
J4-1	RDYA	Port A Ready
J4-2	STBA*	Port A Strobe
J4-3	RDYB	Port B Ready
J4-4	STBB*	Port B Strobe
J4-5	D0A	Port A DATA BIT 0
J4-6	D1A	Port A DATA BIT 1
J4-7	D2A	Port A DATA BIT 2
J4-8	D3A	Port A DATA BIT 3
J4-9	D4A	Port A DATA BIT 4
J4-10	D5A	Port A DATA BIT 5
J4-11	D6A	Port A DATA BIT 6
J4-12	D7A	Port A DATA BIT 7
J4-13	D0B	Port B DATA BIT 0
J4-14	D1B	Port B DATA BIT 1
J4-15	D2B	Port B DATA BIT 2
J4-16	D3B	Port B DATA BIT 3
J4-17	D4B	Port B DATA BIT 4
J4-18	D5B	Port B DATA BIT 5
J4-19	D6B	Port B DATA BIT 6
J4-20	D7B	Port B DATA BIT 7
J4-21	RESET*	RESET OUTPUT
J4-22	GND	GROUND
J4-23	INT3*	INTERRUPT
J4-24	GND	GROUND
J4-25	PCLK	CLOCK OUTPUT

**** WARRANTY ****

All products sold hereunder are under warranty on a return to factory basis against defects in workmanship and material for a period of one (1) year from the date of delivery.

Conditions of this warranty are as follows: Purchaser must 1) obtain a return material authorization (RMA) number and shipping instructions, 2) product must be shipped prepaid, 3) written description of the failure must be included with the defective product. All transportation charges inside the continental U.S. will be paid by Intercontinental Micro Systems (ICM) Corp. For products returned from all other locations, transportation must be prepaid. Should ICM determine that the products are not defective, the purchaser must pay all return transportation charges. All repairs will be provided at repair rates being charged at the time by ICM. Under the above product warranty, ICM may, at its option, either repair or replace any component which fails during the warranty period providing the purchaser has reported same in a prompt manner. All replaced products or parts shall become property of ICM.

All above warranties are contingent upon proper use of the product. These warranties will not apply 1) if any repair, parts replacement, or adjustments are necessary due to accident , unusual physical, electrical or electromagnetic stress, neglect, misuse, failure of electric power, air conditioning, humidity control, transportation, failure of rotating media not furnished by ICM, operation with media not meeting or not maintained in accordance with ICM specifications or causes other than ordinary use, 2) if the product has been modified by purchaser, 3) where ICM's serial numbers or warranty date decals have been removed or altered, 4) if the product has been dismantled by purchaser without the supervision of or prior written approval of ICM.

EXCEPT FOR THE EXPRESS WARRANTIES CONTAINED HEREIN, ICM DISCLAIMS ALL WARRANTIES ON THE PRODUCTS FURNISHED HEREUNDER, INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS; and the stated express warranties are in lieu of all obligations or liabilities on the part of ICM arising out of or in connection with the performance of the products. ICM is not liable for any indirect or consequential damages.

After the warranty period, the products will be repaired for a service charge plus parts, provided that it is returned prepaid to ICM after retaining a return material authorization (RMA) number.

INTRODUCTION

The M/STER preliminary User's Guide offers simplified instruction on how to set up, operate and connect the new terminal to the computer.

The M/STER User's Guide

Intercontinental Micro Systems makes no representatives or warranties with respect to this guide. Further, we reserve the right to make changes in the specifications of this product at any time without notice and without obligation of Intercontinental Micro Systems to notify any person of such revision or changes.

> **FCC WARNING:** This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

Intercontinental Micro Systems 4015 Leaverton Court, Anaheim, CA 92807-1692
(714) 630-0964 Telex: 821375-SUPPORT UD

TABLE OF CONTENTS

General Information

The information contained within the User's Guide, generally pertains to the functions of all emulations performed by the M/STER. However, some functions outlined, pertain only to specific emulation modes and are noted as such.

Each function for each terminal emulation and the corresponding command is listed on page 12.

Throughout this guide, commands are listed to perform different functions with the terminal. When the commands are listed individually such as ESC H the keys must be depressed sequentially. When they are blocked together such as CTRL G, they must be depressed simultaneously for the function to be performed.

Optional Features

Options available on the M/STER include:

Current Loop.
1500 additional characters non-volatile function key memory.
International character/keycap sets.
Amber screen (no cost option).

CONNECTING THE TERMINAL TO COMPUTER

To connect your terminal directly to a computer system use the pin connector labeled main port A (see back of terminal, Figure 2). Use either RS232C connector cable or current loop. The maximum distance between the terminal and computer can only be 50 feet away if an RS232C interface is used. A current loop interface allows the terminal to be up to 1,000 feet away from the computer. (Current loop is optional on the M/STER.)

Figure 2. Rear of Terminal

For an RS232C installation, use a shielded, twisted-pair cable with a connector which has been configured to match the pin connector assignments listed in Table 1. Table 2 lists the pin assignments of the RS232C Main Port (A) connector for the current loop. For a current loop installation, configure the cable connector as described in Table 3.

Table 1. RS232C/Main Port (A) Pin Connector Assignments
Computer Interface
(Reference EIA Standard RS232C for Signal Definitions)

Pin Number	Signal Name
1	Frame Ground
2	Transmit Data
3	Receive Data
4	Request to Send
5	Clear to Send
6	Data Set Ready
7	Signal Ground
8	Data Carrier Detect
20	Data Terminal Ready

Table 2. RS232C/Main Port (A) Pin Connector Assignments, Current Loop

Pin Number	Signal Name
9	20 mA source (+12v, no load)
10	Detected current loop data
12	Current Loop +, Receive
13	Current Loop -, Transmit
14	20 mA source (+12V, no load)
24	Current Loop -, Receive
25	Current Loop +, Transmit

Table 3. Configuration of Comp. Interface Conn. For Current Loop

Transmission	Current Source	Cable Connector Jumpers	Pin Connection
Full duplex transmit	Active	9 to 25	7- 13+
	Passive		13- 25+
Full duplex receive	Active	14 to 12 3 to 10	7- 24+
	Passive	3 to 10	12+ 24
Half duplex	Active	3 to 10 9 to 25 12 to 13	7- 24+
	Passive	3 to 10 12 to 13	24- 15+

The M/STER has an auxiliary port which can be used as a printer port or a secondary host port. If defined as a printer port it can be used with most RS232C compatible serial printers. The printer interface is a 25-pin connector labeled auxiliary port (B) (see back of terminal). Table 4 defines the auxiliary port (B) connections.

Table 4. Auxiliary Port (B) Pin Connector Assignments

Pin Number	Signal Name
1	Frame Ground
2	Receive Data
3	Transmit Data
4	Request to Send
5	Clear to Send
6	Data Set Ready
7	Signal Ground
8	Data Carrier Detect
20	Printer Ready

Installation of Terminal

The installation procedures are as follows:

1. Connect the AC power cord to a grounded AC outlet.
2. The power switch (on top, right front of terminal base) should always be turned off when installing or connecting your terminal to your computer or printer.
3. Connect the coiled keyboard cord to the terminal at the connector called keyboard at the left rear of the terminal.
4. Connect the communications cable for the host computer to the terminal at the Main port A connector (see Figure 1). Table 1 lists the pinout descriptions.
5. Connect the cable from the printer (if one is being used) to the terminal at Port B connector (see Figure 1). Table 4 lists the pinout descriptions.

Turning on the Terminal

1. The ON/OFF switch is located on the bottom right hand front of the terminal.
2. Listen for a beep (usually within one second). This indicates that power is on.
3. Watch for the cursor to appear in the upper left hand corner of the screen (usually within 10-15 seconds).
4. Contract adjustment for desired brightness is controlled in set up mode. When the terminal is powered on, the set up parameters will be the ones most recently stored in non-volatile memory. To place the terminal in page set up, depress SHIFT SET-UP. For line set up depress CTRL SET-UP.

Main/Auxiliary Port Selection

A unique feature of the MSTER is the flexibility it offers with its main (A) and auxiliary 2.5(B) ports. Either port can be used as a host or modem port and either can be used as a printer port. These selections can be made while the terminal is in set-up mode.

25 Data Lines

When M/STER, TVI 25L or WY50 25L is selected in Set Up Mode, 25 data lines are displayed automatically. When the 25th line is programmed with a message, the display reverts to 24 data lines. Both the 24 and 25 line pages are scrollable if auto scroll is enabled in Set Up Mode.

Line/Page Set Up

In the M/STER, both line and page set up modes are available.

Page set up is entered by simultaneously depressing the **two Shift keys and the Alt key**. (Note: Current display data is lost when entering this mode.)

Line set up is entered by simultaneously depressing the **two Shift keys and the Control key.** Using this set up mode preserves the display data.

Attributes

The M/STER comes standard with character (or hidden) attributes. In its native mode, the M/STER defaults to character attribute in set up. This allows the display of visual attributes on a character by character basis and is compatible with the IBM monitor. In the WY50 and TVI 925 emulation modes, attributes can also be selected to display on a field basis, both embedded and non-embedded. The embedded mode requires a character location to be used on the display when starting or ending an attribute. The non-embedded mode does not require a character location when selecting or ending attributes.

Display Pages

When using embedded attributes (see preceding paragraph) two pages of display memory are available. The second page can be accessed by sending or entering the appropriate escape sequence at which point the 24 or 25 lines display the data on the second page. If non-embedded or character attributes are selected, one display of 24 or 25 data lines is available.

Note: To be compatible with the IBM monitor, using keyboard scan codes to enter data (M/STER native mode) character attributes must be selected.

Character Set

The full 256 IBM style character set is included in the M/STER. This set includes all North American letters and symbols, international letters and symbols, and line and block graphic characters. These characters are accessed by entering graphic mode or sending the corresponding 8 bit character to the M/STER. Standard line graphics are also available in WY50 or TVI 925 compatible modes. In all modes, the 8 bit graphics characters from the PC font are accessible by sending a character with the 8th bit set.

Cursor Addressing

The cursor addressing scheme is referenced in Appendix "A" of this manual, except when addressing the 25th data line. This requires the host to send an ASCII 8 (38 HEX) as the row code. The escape, lead-in and column codes remain the same.

M/STER Set Up Parameters and Selections

Next Item ↓	Next Value →	Save	S
Prior Item ↑	Prior Value ←	Exit	E
		Restore	R
		Default	D
		Function Default	F

Main	Terminal	Aux	Printer
Baud Rate	19,200	Baud Rate	1200
Data Bits	8	Data Bits	7
Stop Bits	2	Stop Bits	2
Parity	None	Parity	None
Handshake	DTR	Handshake	DTR
Communications	Full Duplex	Auto Newline	Off
Emulation	M/STER	Return	CR
Columns	80	Auto Scroll	On
Cursor Type	Underline	Refresh	60
Cursor Blink	Blink	Line Term	US
Video	Normal	Block Term	CR
Brightness	12	Edit Keys	Off
Screen Saver	On	Status Line	Off
Keyclick	Off	Func Key Line	Off
Bell Volume	2	Protect Att	Half Intensity
Bell Tone	2	Attributes	Character
Func Key Delay	0	Font	2

Notes:

1. | SHIFT | SHIFT | ALT | will give you the above page menu.

   | SHIFT | SHIFT | CTRL | will give you single line set up.

   Selections are made in line set up just as they are in page set up.

2. If the "S" key is depressed while in set up mode, all parameters are stored in non-volatile memory.

3. If the "D" key is depressed while in set up mode, all parameters default to the factory settings (those listed above), but are not saved in non-volatile memory until the "S" command is executed.

4. If the "R" key is depressed while in set up mode, the parameters most recently saved in non-volatile memory will be restored.

5. If the "F" key is depressed while in set up mode, all screen attributes, cursor and function key default values will be loaded for the current emulation and all information previously programmed and stored will be erased.

Main/Auxiliary Port Selection

A unique feature of the M/STER is the flexibility it offers with its main (A) and auxiliary (B) ports. Either port can be used as a host or modem port and either can be used as a printer port. These selections can be made while the terminal is in set up mode.

Special Escape Sequences

(In M/STER or TVI 925 compatible mode)

ESC ~	Enables auto newline. When a character is written in column 80, the cursor automatically is positioned at the beginning of a new line.
ESC 0	Disables auto newline. When a character is written in column 80, the cursor is not positioned at the beginning of a new line.
ESC [	Transmit keyboard status. Two bytes of data are sent to the host. The first byte is formed by the following status conditions:

Bit #	Bit = 1 Condition
Bit 0	Caps Lock on
Bit 1	X (always 0)
Bit 2	X
Bit 3	X
Bit 4	Alt key held down
Bit 5	Control key held down
Bit 6	Num Lock on
Bit 7	Shift key held down

The second byte is always a 61 hex (a).

ESC } Set full duplex communications

ESC { Set half duplex communications

ESC O Turn off video display

ESC N Turn on video display

ESC px Select printer termination character. This character is sent to the printer at the end of a page print operation, where x = termination character sent.

**ESC CTRL ** Resets terminal as though just powered on.

ESC CTRL ^ Set conversation mode.

ESC CTRL _ Set local mode. No further data is transmitted and received data is ignored while in this mode.

ESC L Print all unprotected data betwen home and cursor position. Protected data is sent to the printer port as spaces.

ESC F Fill screen display with all H characters.

ESC Z Turn on insert mode. This causes all entered data to be inserted at the cursor location with all following data moved right. Data moved past column 80 or 132 is lost.

ESC r Turn off insert mode.

ESC o Set margin bell. This causes a bell tone whenever the cursor is advanced past this column.

ESC n Turns off margin bell.

ESC]	Program answerback. Subsequent 32 characters are programmed into the answerback message unless terminated sooner with a CR. This message is stored in non-volatile memory until changed, and is transmitted to the host upon receipt of a CTRL E (ENQ) character.
ESC m	Auto newline is set to off and main port handshake is set to both. The emulation is forced to M/STER mode.
ESC c	The emulation is forced to TVI 925 25L and ASCII characters.
ESC 8	Auto linefeed on.
ESC 9	Auto linefeed off.

M/STER FEATURE CHANGES

Programmable Cursor and Function Keys

The IBM AT-style keyboard only offers 10 function keys. These correspond to function keys 1 through 10 in both the WY50 and TVI 925 emulations. If function keys 11 through 16 are required, use ALT 1 through 6. This sequence will correspond with WY50 and TVI 925 keys F11 through F16.

Note: The function keys on the M/STER are programmable only in WY50 and TVI 925 emulation modes.

Monitor Mode

This mode allows the characters 0 through 1F hex to be displayed instead of being interpreted. For example, when monitor mode is on, a carriage return is displayed as a note symbol instead of causing the cursor to go to the beginning of the line. A special control character, ^B (02 hex) is provided to allow single control characters to be written. Using the example above, ^B Return would display the note symbol also. This 2 character sequence is more efficient for writing single control characters than the 5 character sequence which turns on and off monitor mode.

Monitor mode is also useful for debugging programs to view the character stream coming to the terminal. You can turn this mode on from the keyboard by pressing Control 1. Monitor mode can be turned off by pressing Control 2. This allows you to view the actual escape sequences being sent to the screen to debug software.

Screen Features

All screen features are accessable via the appropriate escape sequence (ESC ` x in Wy50 mode or ESC . x in TVI 925 and M/STER modes). These selections are shown on page 11 and 12 in Section I of this User's Guide. ESC . x in 925 and M/STER modes sets screen and cursor attributes the same as the WY50 mode with two exceptions:

M/STER		WY50
Esc . 1	=	Esc ` 5
Esc . 6	=	Esc ` 3

Visual Attributes

The escape sequence to display attributes is **Escape G x** , where **x** is one of the following characters representing the desired attribute.

Attribute	"x" (std. intensity)	"x" (half intensity)
Normal	0	@
Blank	1	A
Blink	2	B
Blink & Blank	3	C
Reverse	4	D
Blank & Reverse	5	E
Blink & Reverse	6	F
Blink, Blank & Reverse	7	G
Underline	8	H
Blank & Underline	9	I
Blink & Underline	:	J
Blink, Blank & Underline	;	K
Reverse & Underline	<	L
Blank, Reverse & Underline	=	M
Blink, Reverse & Underline	>	N
Blink, Blank, Reverse & Underline	?	O

Table A - Keyboard Commands

Wyse 50 and TVI 925 Mode Function and Arrow Keys		
Function	**Code**	**Keystrokes**
Cursor up (no scroll)	CTRL K	↑
Cursor up (with scroll)	ESC j	Shift/CTRL/ ↑
Cursor down (no scroll)	CTRL J	↓
Cursor down (with scroll)	CTRL V	Shift/CTRL/ ↓
Cursor left	CTRL H	←
Cursor right	CTRL L	→
Function F1-F10	SOH @-I, CR	F1-F10
Shifted F1-F10	SOH, '-i, CR	Shifted F1-F10
Local Functions		**Keystrokes**
Toggle between 925 25L and M/STER modes		Shift/Sys Req
400 mS Break		CTRL/ALT/DEL
Page set up		Both Shift/ALT
Line set up		Both Shift/CTRL
Caps locked		Caps lock
Caps unlocked		Caps lock
Toggle scrolling		Scroll
Firmware Version		CTRL/Shift/Scroll
Monitor mode on		CTRL/I/1
Monitor mode off		CTRL/@/2
Toggle keyclick		Shift/+ (numeric pad)
Enable extension print		CTRL/PRTSC/*
Disable extension print		Shift/CTRL/PRTSC/*
Local or Duplex Edit Function	**Edit Char. ***	**Keystrokes**
Backtab	ESC I	Shift/|←/→|
Insert character	ESC Q	Shift CTRL/ins/0
Delete character	ESC W	Shift/CTRL/./del
Delete line	ESC R	CTRL/./del
Home cursor	CTRL ^	9/Home
Print page	ESC P	Shift/PRTSC/*
Page up	ESC J	9/PgUp (num lock off)
Page down	ESC K	3/PgDn (num lock off)
End	ESC Y	1/End (num lock off)

* Sequence sent to host when in WY50 or TVI925 modes and duplex edit selected.

Table B - Scan Code Chart

Switch	Designation	Down/Up	Switch	Designation	Down/Up	Switch	Designation	Down/Up
1	F1	3B BB	29	I	17 97	57	Not Used	
2	F2	3C BC	30	O	18 98	58	F7	41 C1
3	Esc	01 81	31	P	19 99	59	F8	42 C2
4	! 1	02 82	32	{ [	1A 9A	60	| \	2B AB
5	@ 2	03 83	33	}]	1B 9B	61	↑	2A AA
6	# 3	04 84	34	~ `	29 A9	62	Z	2C AC
7	$ 4	05 85	35	? Home	47 C7	63	X	2D AD
8	% 5	06 86	36	8 ↑	48 C8	64	C	2E AE
9	^ 6	07 87	37	9 Pg Up	49 C9	65	V	2F AF
10	& 7	08 88	38	_	4A CA	66	B	30 B0
11	* 8	09 89	39	FS	3F BF	67	N	31 B1
12	(9	0A 8A	40	F8	40 C0	68	M	32 B2
13	) 0	0B 8B	41	Ctrl	1D 9D	69	< ,	33 B3
14	_ -	0C 8C	42	A	1E 9E	70	> .	34 B4
15	+ =	0D 8D	43	S	1F 9F	71	? /	35 B5
16	←	0E 8E	44	D	20 A0	72	↑	36 B6
17	Num Lock	45 C5	45	F	21 A1	73	PrtSc *	37 B7
18	Scroll Lock Break	46 C6	46	G	22 A2	74	1 End	4F CF
19	F3	3D BD	47	H	23 A3	75	2 ↓	50 D0
20	F4	3E BE	48	J	24 A4	76	3 Pg Dn	51 D1
21	⇤ ⇥	0F 8F	49	K	25 A5	77	+	4E CE
22	Q	10 90	50	L	26 A6	78	F9	43 C3
23	W	11 91	51	: ;	27 A7	79	F10	44 C4
24	E	12 92	52	" '	28 A8	80	Alt	38 B8
25	R	13 93	53	↵	1C 9C	81	Spacebar	39 B9
26	T	14 94	54	4 ←	4B CB	82	Caps Lock	3A BA
27	Y	15 95	55	5	4C CC	83	0 Ins	52 D2
28	U	16 96	56	6 →	4D CD	84	Del	53 D3

Table C - Command Codes

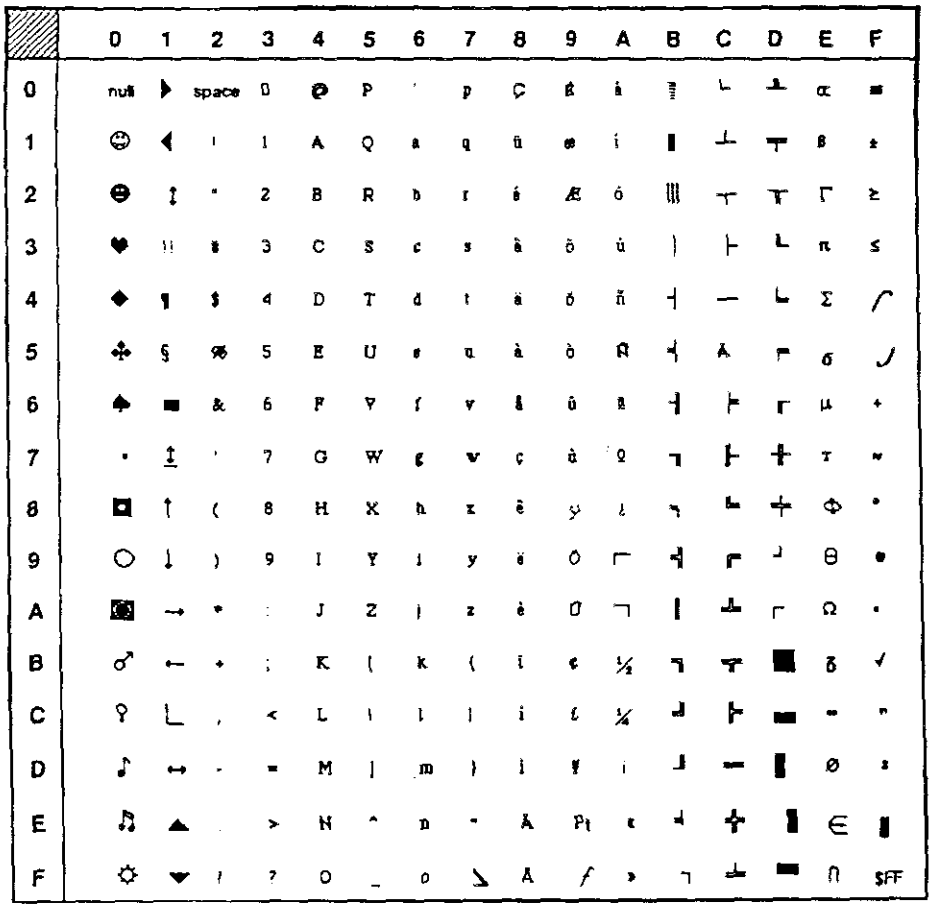
Function	Wy 50	TVI 925	Function	Wy 50	TVI 925
Send Term. I.D.	Esc sp	Esc M	Activate Segment 0	Esc]	
Wrt. Unprot. Attribute	Esc I		Set Screen Features	Esc '	Esc .
Unlock Keyboard	Esc "	Esc "	Address 80/132 Columns	Esc a	Esc ^
Lock Keyboard	Esc #	Esc #	Read 80/132 Columns	Esc b	Esc DEL
Set Prot. Mode	Esc &	Esc &	Tab	Esc i	Esc i
Prot. mode Off	Esc '	Esc '	Up Cursor w/Scroll	Esc)	Esc]
Wrt. Prot. Off (Std.)	Esc (	Esc (	Local Edit	Esc k	Esc k
Wrt Prot. On (H.I.)	Esc)	Esc)	Duplex Edit/Lower Case	Esc l	Esc l
Clear All Nulls	Esc *	Esc *	Insert Mode On	Esc q	Esc Z
Clear All Space	Esc +		Insert Mode Off	Esc r	Esc r
Clear All Prot. Spaces	Esc ,	Esc ,	Send mess All	Esc s	Esc s
Address Cursor P.R.C.	Esc -	Esc -	Era Line Null	Esc t	Esc t
Clear Unprot. Code	Esc .		Set Screen Format	Esc x	Esc V
Read Cursor P.R.C.	Esc /	Esc /	Era Page Nulls	Esc y	Esc y
Clear All Tabs	Esc 0	Esc 3	Prog. Function Keys	Esc z	Esc z
Set Tab	Esc 1	Esc 1	Home	Esc {	
Clear Tab	Esc 2	Esc 2	Keyclick On	Esc >	Esc >
Send line Unprot.	Esc 4	Esc 4	Keyclick Off	Esc <	Esc <
Send Page Unprot.	Esc 5	Esc 5	Reverse Screen		Esc b
Send Line All	Esc 6	Esc 6	Normal Screen		Esc d
Send Page All	Esc 7	Esc 7	Blank Screen		Esc O
Write ETX	Esc 8		Normal Screen		Esc N
Write STX	Esc 9		Extension Print On		Esc @
Clear Unprot. Null	Esc :	Esc :	Extension Print Off		Esc A
Clear Unprot. Space	Esc ;	Esc +/;	Transparent Print On		Esc `
Address Row, Column	Esc =	Esc =	Transparent Print Off		Esc a
Read Row, Column	Esc ?	Esc ?	Display User Line	Esc g	Esc g
Print Unprot.	Esc @	Esc L	Disable User Line	Esc h	Esc h
Set Message Attrib.	Esc A		Select Termination Seq.	Esc 3	Esc x
Set Block Mode	Esc B	Esc B	Select Print Term. Char.	Esc o	Esc p
Set Conv. Mode	Esc C	Esc CTL^	Address Row	Esc m	
Set Local Mode		Esc CTL_	Address Column	Esc n	
Set Half Duplex	Esc D	Esc {	Prog. Function Keys	Esc |	Esc |
Set Full Duplex	Esc D	Esc }	Load Func. w/Default	Esc _	Esc _
Insert line	Esc E	Esc E	Clear All Function Keys	Esc \	
Load Message line	Esc F		Graphic Mode On		Esc %
Set Attributes	Esc G	Esc G	Graphic Mode Off		Esc $
Set Graphics	Esc H		Load 26th line	Esc f	Esc f
Back Tab	Esc I	Esc I	Default Set Up Parameters		Esc m
Page Back	Esc J	Esc J	Fill Screen with H's		Esc F
Page Forward	Esc K	Esc K	Set Margin Bell		Esc o
Print Unformatted	Esc L/p		Reset Margin Bell		Esc n
Send Character	Esc M		Program Answerback		Esc]
Set No Scroll	Esc N	Esc H	Set Auto Linefeed		Esc 8
Reset No Scroll	Esc O	Esc H	Reset Auto Linefeed		Esc 9
Print All	Esc P	Esc P	Auto newline On		Esc ~
Insert Character	Esc Q	Esc Q	Auto Newline Off		Esc 0
Delete Line	Esc R	Esc R	Set Scan Code Mode		Esc m
Send mess. Unprot.	Esc S	Esc S	Set Ascii Mode		Esc c
Era Line Space	Esc T	Esc T	Transmit Keyboard Status		Esc]
Monitor Mode On	Esc U	Esc U	Print Unprotected		Esc L
Set Prot. Column	Esc V				
Delete Character	Esc W	Esc W			
Monitor Mode Off	Esc X/u	Esc X/u			
Era Pages Spaces	Esc Y	Esc Y			

Function	Control Seq.	
	WY50	TVI 925
Bell	Ctrl G	Ctrl G
Backspace	Ctrl H	Ctrl H
Tab	Ctrl I	Ctrl I
Linefeed w/Scroll	Ctrl J	Ctrl J
Up Cursor No Scroll	Ctrl K	Ctrl K
Right Cursor	Ctrl L	Ctrl L
Return	Ctrl M	Ctrl M
Lock Keyboard	Ctrl O	
Unlock Keyboard	Ctrl N	
Cursor Down No Scroll	Ctrl V	Ctrl V
Clear Unprot. Space	Ctrl Z	Ctrl Z
Escape Lead In	Ctrl [	Ctrl [
Home	Ctrl ^	Ctrl ^
New Line	Ctrl _	Ctrl _
Enable Bi-Dir Aux		Ctrl R
Disable Bi-Dir Aux		Ctrl T
Enable Xon/Xoff		Ctrl O
Disable Xon/Xoff		Ctrl N
Monitor Mode Enable	Ctrl 1/!	Ctrl 1/!
Monitor Mode Disable	Ctrl 2/@	Ctrl 2/@
Enable Trans. Print	Ctrl X	
Disable Trans. Print	Ctrl T	
Extension Print On	Ctrl R	
Extension Print Off	Ctrl T	
Down Arrow Key	Ctrl J	Ctrl V
Shift Down Arrow	Ctrl V	Ctrl J

Graphic Characters

The graphic characters shown in Table D are displayed when graphic mode is entered in M/STER mode.

Table D - Displayable Characters



APPENDIX A: Cursor Address Coordinates

Row/ Col.	ASCII Code	Row/ Col.	ASCII Code	Row/ Col.	ASCII Code
1	Space	33	@	65	`
2	!	34	A	66	a
3	"	35	B	67	b
4		36	C	68	c
5	$	37	D	69	d
6	%	38	E	70	e
7	&	39	F	71	f
8	'	40	G	72	g
9	(	41	H	73	h
10	)	42	I	74	i
11	*	43	J	75	j
12	+	44	K	76	k
13	,	45	L	77	l
14	-	46	M	78	m
15	.	47	N	79	n
16	/	48	O	80	o
17	0	49	P	81	p
18	1	50	Q	82	q
19	2	51	R	83	r
20	3	52	S	84	s
21	4	52	T	85	t
22	5	53	U	86	u
23	6	54	V	87	v
24	7	55	W	88	w
25	8	56	X	89	x
26	9	57	Y	90	y
27	:	58	Z	91	z
28	;	59	[	92	{
29	<	61	/	93	|
30	=	62	]	94	}
31	>	63	^	95	~
32	?	64	—	96	DEL/RUB

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Appendix A

PERSONALITY BOARDS

PERSONALITY BOARD - RS-232/MODEM
Part Number - RPB-200

Function: The RS232/MODEM Personality board provides RS232 drivers and receivers, terminations and jumper options to interface any simple RS-232 device such as CRT terminals, serial printers, modems or any other serial device not requiring an extensive handshake protocol. This may be used with the CPZ48006 SBCP, CPZ-186 SBCP, CPS-B8A SBSP or the CPS-16F SBSP.

PERSONALITY BOARD - RS-422 SERIAL COMMUNICATIONS
Part Number FTT-100

Function: The FFT100 personality board provides RS422 differential line drivers and receivers. These balanced drivers and receivers can provide serial communications for distances of up to 4000 feet at a communications rate of 100/Kbit/second. This assumes that 24 AWG twisted pair cable is used. Higher rates may be attained for shorter cable lengths. If the CPU's SIO controller is used in synchronous communications mode at its maximum rate of 800 Kbits/second, the maximum cable length recommended is 325 feet. Drivers and receivers are provided for all signals of the SIO to support full handshake protocols. The FTT-100 in combination with the lond Distance Serial Personality Board (LDS-100), provides a means of connecting terminals, printers and other RS-232 serial devices remotely located from the CPU mainframe. CPU-to-CPU communications may also be set-up over long distances by using the FTT-100 at both CPU's. In this case, the interconnecting cable is cross-connected to tie receiver-to-transmitter and transmitter-to-receiver devices. No cross connection is required between the FTT-100 and the LDS-100.Jumper options are provided to minimize the number of cable lines required if no handshaking signals are required as in the case of simple RS-232 Terminals where only transmit and receive signals are required. Ground is also provided but is not used in most cases. This module may be used with the CPZ48006 SBCP, CPZ-186 SBCP, CPS-B8A SBSP or the CPS-16F SBSP.

PERSONALITY BOARD - LONG DISTANCE SERIAL COMMUNICATIONS
Part Number - LDS-100

Function: The LDS-100 personality board provides RS422 differential line drivers and receivers. This SHORT HAUL MODEM can provide serial communications for distances of up to 4000 feet at a communications rate of 100Kbits/second. This assumes that 24 AWG twisted pair cable is used. Drivers and receivers are provided to support full handshake protocols. The LDS100 in combination with the RS-422 Serial Communications Personality Board (FTT-100), provides a means of connecting terminals, printers and other RS-232 serial devices remotely located from the CPU mainframe. Jumper options are provided to minimize the number of cable lines connected if no handshaking signals are required as in the case of simple RS-232 Terminals where only transmit and receive signals are used. Ground is also provided but is not used in most cases. AC power must be provided to the board. The board may be strapped for either 115VAC\60HZ or 230VAC\50HZ operation.

PERSONALITY BOARD - CENTRONICS PRINTER
Part Number - CPI-100

Function: The Centronics Printer Personality Board provides line drivers, receivers, terminators, jumper options and data strobe generator logic to interface to any printer compatible with the Centronics parallel interface. This module may be used with the CPZ4800 SBCP, CPZ-186SBCP, CPS-88A SBSP or the SPS-16F SBSP

PERSONALITY BOARD - PRIAM INTELLIGENT HARD DISK
Part Number - PRI-100

Function: PRIAM provides two intelligent hard disk interface controllers referred to as the "SMART" and the "SMART-E". These are preprogrammed microprocessor based controllers. They may be used for the entire line of PRIAM Winchester disk drives which range in capacity from 10 megabytes to 157 megabytes and comes in either fourteen inch packaging. Up to four drives in any combination of drive sizes may be interconnected. The controllers support a variety of read sector, write sector and format commands. Data transfers may be either programmed I/O or DMA.

The SMART-E has all the features that the SMART has in addition to error detection and correction, logical sector addressing, sector interleaving, parity generation and testing, direct data transfers and a 2 Kbyte data buffer (SMART has 1 Kbyte buffer). The interface performs the entire function of detailed disc control while presenting to the host a basic and cost effective interface. The PRI-100 Personality Board connects the parallel port of the CPZ-48006 SBCP or the CPS-MX SBCP to the SMART or SMART-E controllers. Thus, a very powerful disc subsystem may be directly connected to the ICM line of processors via the PRI100. A jumper option is provided on the PRI-100 to configure it for either the SMART or the SMART-E controller. The controllers mount along the drive sides alleviating the need for additional S-100 Bus slot. An adapter, PRI-100-1 is provided allowing direct connection of the PRI-100 to the smart controllers.

PERSONALITY BOARD - SMALL COMPUTER SYSTEM INTERFACE
Part Number - SAS-200

Function: The Small Computer System Interface (SCSI) defines a Local I/O Bus which can be operated at data rates up to 1.5 megabytes per second. This bus provides I/O device independence so that disk drives, tape drives, printers and various other peripherals may be interface d on the same I/O bus without modification to the host CPU's hardware or software. The SAS-200 personality board converts the parallel port of the CPZ-48006 SBCP, CPZ-186 SBCP, CPS-B8A SBSP or the CPS-16F SBSP to a SCSI I/O bus. Software is provided to emit bus timing in conformance with the SCSI specification. The system integrator may interface SCSI controllers such as the OMTI Data Technology Corporation, Zebec and Sysgen line of controllers. Each have powerful attributes such as connecting hard disks with floppies, hard disks with tape streamers and connecting to high performance SMD hard disk drives. The SAS-200 personality board is accompanied by an adapter board (SAS-200-1). This adapter board converts the SAS-200 DB25 connector interface to a 50 pin header connector interface with a pin assignment in exact conformance with the SCSI Bus specification. The integrator may connect directly to the SAS-200 with a DB25-to-SCSI Interface cable or may connect via the SAS-200-1 with a 50 pin flat ribbon cable.

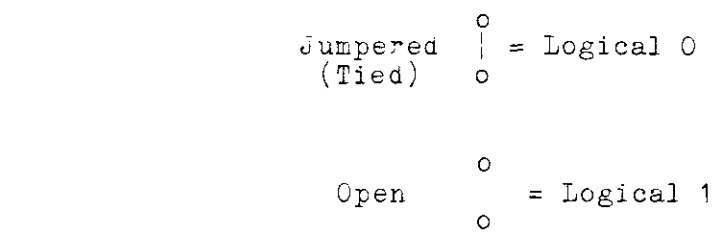
PERSONALITY BOARD - CLOCK/CALENDAR
Part Number - CCB-100

Function: The CCB-100 provides a highly accurate real time clock which may be set by the CPZ-4800 SBCP, CPZ-186 SBCP, CPS-B8A SBSP, or the CPS-16F SBSP under software control. The time of year, month, day, hour, minute and second is maintained and may be read back by the CPU. A Ni-Cad battery is used to provide backup power to the time control chip. In this manner the real time clock is continuously maintained even during extensive down time. This feature is quite useful for point of sales systems, inventory systems and other applications where continous clock monitoring is required. This board is also very useful in operating systems which feature date and time stamping such as TurboDOS. In a TurboDOS based system, this board may be connected to the file-servers' parallel port or may be connected to any one application processors' parallel port.

Appendix B

HEXADECIMAL CHART

Hexadecimal Notation	Decimal Notation
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
A	1010
B	1011
C	1100
D	1101
E	1110
F	1111



Appendix C

PIN ASSIGNMENT TABLE

The DB-25 Female Connector on the RPB-200 Personality Board

Signal	Pin #
Chassis Ground	1
Receive Data from Terminal	2
Transmit Data to Terminal	3
Signal Ground	7
Data Terminal Ready from Terminal	20

The DB-25 Female Connector on the Video Terminal

Signal	Pin #
Chassis Ground	1
Transmit Data to Terminal	2
Receive Data from Terminal	3
Signal Ground	7
Data Terminal Ready from Terminal	20

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ICM wants to provide you with the best possible documentation. To do this, we've provided a Customer Comment card. Please take a moment to complete and drop it in the mail. Thank You!

Date_____

Was the User's Guide easy to understand and use? Yes [] No []

Why?_____

If you found any errors in this User's Guide please indicate

Section_____ Page Number_____ Section_____ Page Number_____

What suggestions do you have for improving this User's Guide?

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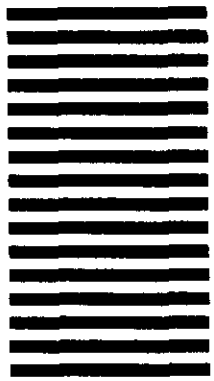

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