USERS MANUAL FOR

INTERTEC'S

SUPERBRAIN™ II

VIDEO COMPUTER SYSTEM

IMPORTANT NOTICE

This version of the SuperBrain Users Manual is intended for use with the SuperBrain II Jr, SuperBrain II QD, or SuperBrain II SD Video Computer Systems.

Document No. 6831010
June, 1982

This equipment complies with the requirements in Part 15 of FCC Rules for a Class A computing device. Operation of this equipment in a residential area may cause unacceptable interference to radio and TV reception requiring the operator to take whatever steps are necessary to correct the interference.

SUPERBRAIN II
USERS MANUAL REVISION RECORD

REV	DATE	APPROVAL	SHEETS/SECTIONS EFFECTED

TABLE OF CONTENTS

WILL THE MICROCOMPUTER YOU BUY TODAY STILL BE THE BEST MICROCOMPUTER BUY TOMORROW?

Probably the best test in determining how to spend your microcomputer dollar wisely is to consider the overall versatility of your terminal purchase over the next three to five years. In the fast-paced, ever-changing world of data communications, new features to increase operator and machine efficiency are introduced into the marketplace daily. We at Intertec are acutely aware of this rapid infusion of new ideas into the small systems business. As a result, we have designed the SuperBrain II in such a manner as to virtually eliminate the possibility of obsolescence.

Many competitive alternatives to the SuperBrain II available today provide only limited capability for high level programming and system expansion. Indeed, most low-cost microcomputer systems presently available quickly become outdated because of the inability to expand the system. Intertec, however, realizes that increased demands for more efficient utilization of programming makes system expansion capability mandatory. That means a lot. Because the more you use your SuperBrain II, the more you'll discover its adaptability to virtually any small system requirement. Extensive use of "software-oriented" design concepts instead of conventional "hardware" designs assure you of compatibility with almost any application for which you intend to use the SuperBrain II.

Once you read our operator's manual and try out some of the features described herein, we are confident that you too will agree with our "top performance — bottom dollar" approach to manufacturing. The SuperBrain II offers you many more extremely flexible features at a lower cost than any other microcomputer we know of on the market today. The use of newly developed technologies, efficient manufacturing processes and consumer-oriented marketing programs enables us to be the first and only major manufacturer to offer such an incredible breakthrough in the microcomputer marketplace.

Browse through our operator's manual and sit down in front of a SuperBrain II for a few hours. Then, let us know what you think about our new system. There is a customer comment card enclosed in this manual for your convenience.

Thank you for selecting the SuperBrain II as your choice for a microcomputer system. We hope you will be selecting it many more times in the future.

*** IMPORTANT ***

Do not attempt to write or save programs on your system diskette. It has been 'write protected' by placing a small adhesive aluminum strip over the notch on the right hand side of the diskette. Such attempts will result in a 'WRITE' or 'BAD SECTOR' error.

Before using your SuperBrain II, please copy the System Diskette onto a new blank diskette. If you do not have such a diskette, contact your local dealer. He should be able to supply you with one. If you have any questions concerning this procedure, please contact your dealer before proceeding. Failure to do so may result in permanent damage to your System Diskette.

BEFORE APPLYING POWER TO THE MACHINE INSURE THAT NO DISKETTES ARE INSERTED INTO THE MACHINE. NEVER TURN THE MACHINE ON OR OFF WITH DISKETTES INSERTED IN IT. FAILURE TO OBSERVE THIS PRECAUTION WILL MOST DEFINITELY RESULT IN DAMAGE TO THE DISKETTES.

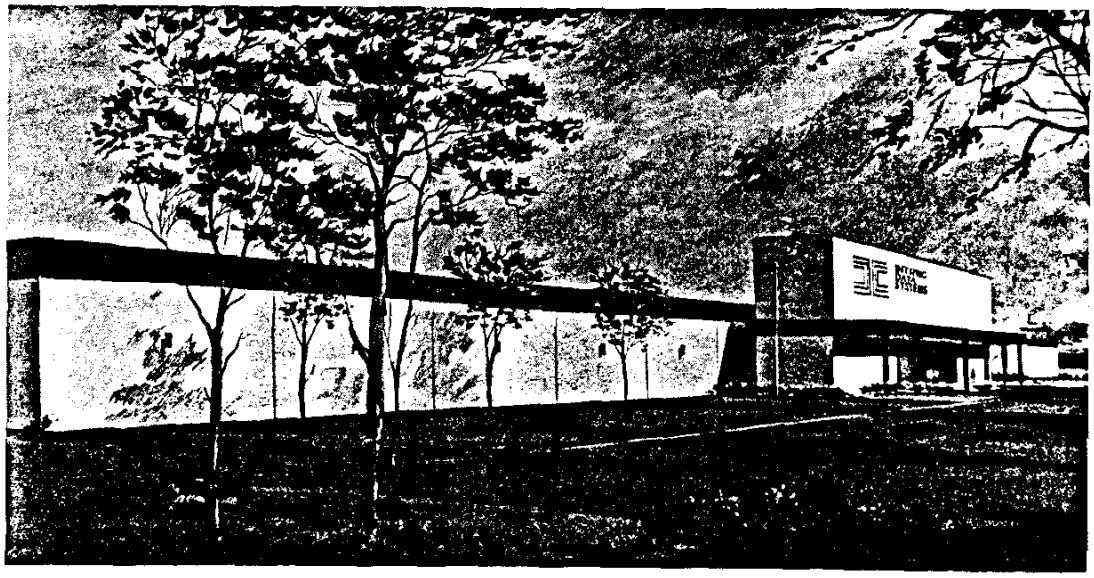
CONGRATULATIONS ON YOUR PURCHASE OF INTERTEC'S SUPERBRAIN II VIDEO COMPUTER SYSTEM

Your new SuperBrain II Video Computer was manufactured at Intertec's new 120,000 square foot plant in Columbia, South Carolina, under stringent quality control procedures to insure trouble-free operation for many years. **If you should encounter difficulties with the use or operation of your terminal, contact the dealer from whom the unit was purchased for instructions regarding the proper servicing techniques.** If service cannot be made available through your dealer, contact Intertec's Customer Services Department at (803) 798-9100.

As with all Intertec products, we would appreciate any comments you may have regarding your evaluation and application of this equipment. For your convenience, we have enclosed a customer comment card at the end of this manual. Please address your comments to:

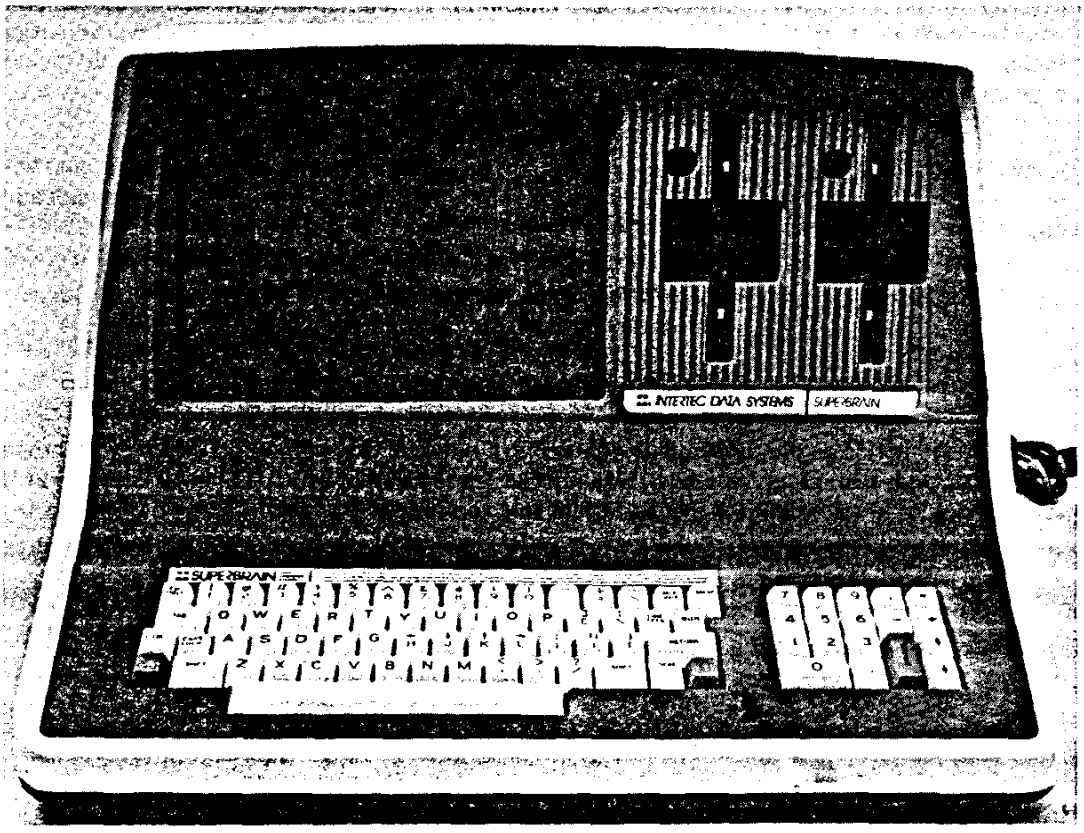
Product Services Manager
Intertec Data Systems Corporation
2300 Broad River Road
Columbia, South Carolina 29210

The SuperBrain II is distributed worldwide through a network of dealer/OEM vendors and through Intertec's own marketing facilities. Contact us at (803) 798-9100 (TWX — 810-666-2115) regarding your requirement for this and other Intertec products.



INTERTEC DATA SYSTEMS®
Corporate Headquarters: 2300 Broad River Road, Columbia, South Carolina 29210 • 803/798-9100 • TWX: 810-666-2115

Intertec's new one hundred and twenty thousand square foot corporate and manufacturing facility in Columbia, South Carolina



THE SUPERBRAIN II VIDEO COMPUTER SYSTEM

INTRODUCTION

The Superbrain II Video Computer System represents the latest technological advances in the microprocessor industry. The universal adaptability of the SuperBrain CP/M* Disk Operating System satisfies the general purpose requirement for a low cost, high performance microcomputer system.

From the standpoint of human engineering, the SuperBrain II has been designed to minimize operator fatigue through the use of a typewriter-oriented keyboard and a remarkably clear display. The SuperBrain II displays a total of 1,920 characters arranged in 24 lines with 80 characters per line. The video display characters can be varied between a primary and secondary character set. Blinking, half-intensity, underlining, and reverse video are user selectable display options. The video display is crisp and sharp due to Intertec's own specially designed video driver circuitry. And, the high quality, non-glare etched CRT face plate featured on every SuperBrain II assures ease of viewing and uniformity of brightness throughout the entire screen.

The SuperBrain II's unique internal design assures users of exceptional performance for just a fraction of what they would expect to pay for such "big system" capabilities. The SuperBrain II utilizes a single board "microprocessor" design which combines all processor, RAM, ROM, disk controller, and communications electronics on the same printed circuit board. This type of design engineering enables the SuperBrain II to deliver superior, competitive performance.

Standard features of every SuperBrain II include: two mini-floppy disk drives with up to 1.5 megabytes **formatted** disk storage, 64K of dynamic RAM memory, recognized CP/M* Disk Operating System featuring its own text editor, an assembler for assembly language programming, a program debugger and a disk formatter. Also standard are dual universal RS232 communication ports for serial data transmission between a host computer network via modem or an auxiliary serial printer. A number of transmission rates up to 9600 baud are available and selectable under program control.

Other standard features of the SuperBrain II include: special operator convenience keys, dual "restart" keys to insure simplified user operation, a full numeric keypad complement (whose values can be user reassigned by software), and a high quality typewriter compatible keyboard. Additionally, a real time clock is incorporated for time/date display and is user accessible.

For reliability, the SuperBrain II has been designed around five (5) basic modules packaged in an aesthetically pleasing desk-top unit. These major components are: the Keyboard/CPU module, the power supply module, the CRT assembly, the transition board, and the disk drives themselves. Failure of any component within the terminal may be corrected by simply replacing only the defective module. Individual modules are fastened to the chassis in such a manner to facilitate easy removal and reinstallation.

Terminal down-time can be greatly minimized by simply "swapping-out" one of the modules and having component level repair performed at one of Intertec's Service Centers. Spare modules may be purchased from an Intertec marketing office to support those customers who maintain their own "in-house" repair facilities.

The SuperBrain II cover assembly is exclusively manufactured "in-house" by Intertec. A high-impact structural-foam material is covered with a special "felt-like" paint to enhance the overall appearance. Since the cover assembly is injected-molded, there is virtually no possibility of cracks and disfigurations in the cover itself. By manufacturing and finishing the cover assembly in-house, Intertec is able to specify only high quality material on the external and internal cover components of your SuperBrain II to insure unparalleled durability over the years to come.

*CPM is a registered trademark of Digital Research

A wide variety of programming tools and options are either planned or available for the SuperBrain II. Software development tools available from Intertec include Basic (standard) and Fortran (optional) programming languages. A wide variety of applications packages (general ledger, accounts receivable, payroll, inventory, word processing, etc.) are available to operate under SuperBrain II CP/M Disk Operating System from leading software vendors in the industry. Disk storage capability is expandable by interfacing the SuperBrain II to a rigid disk which increases on-line storage to 10 megabytes or more.

The high performance ratio of the SuperBrain II has rarely been equalled in this industry. By employing innovative design techniques, the SuperBrain II is not only able to offer a competitive price advantage but boasts many features found only in systems costing three to five times as much. The SuperBrain II twin Z80A microprocessors insure extremely fast program execution even when faced with the most difficult programming tasks. Additionally, each unit must pass a grueling 48 hour burn-in before it is shipped to the customer. By combining advanced microprocessor technology with in-house manufacturing capability and stringent quality control requirements, your SuperBrain II should provide unparalleled reliability in any application into which it is placed.

SYSTEM SPECIFICATIONS

FEATURE	DESCRIPTION
CPU	
Microprocessors	Twin Z80A's with 4MHZ Clock Frequency. One Z80A (the host processor) performs all processor and screen related functions. The second Z80A is "down-loaded" by the host to execute disk I/O.
Word Size	8 bits
Execution Time	1.0 microsecond register to register
Machine Instructions	158
Interrupt Mode	All interrupts are vectored
FLOPPY DISK	
Storage Capacity (Formatted)	SuperBrain II Jr — 328 KB SuperBrain II QD — 680 KB SuperBrain II SD — 1.5 MB
Data Transfer Rate	250K bits/second
Average Access Time	250 milliseconds. 6 milliseconds track-to-track.
Media	5¼-inch mini-disk
Disk Rotation	300 RPM
INTERNAL MEMORY	
Dynamic RAM	64K bytes dynamic RAM
Static RAM	2048 bytes of static RAM is provided in addition to the main processor RAM. 1K x 8 of this RAM storage is used as a disk buffer. The remaining RAM is used for attribute storage.
FIRMWARE	2K x 8 bytes standard. Allows "bootstrapping" of system at power-on.
DAY/DATE CLOCK	Provides continuous time display. Maintains time and date information during power-off and compensates for variances in month/year lengths.
CRT	
Display Size	12 inch, specially focused, P4 phosphor, non-glare screen.
Display Format	24 lines x 80 characters per line

SYSTEM SPECIFICATIONS (continued)

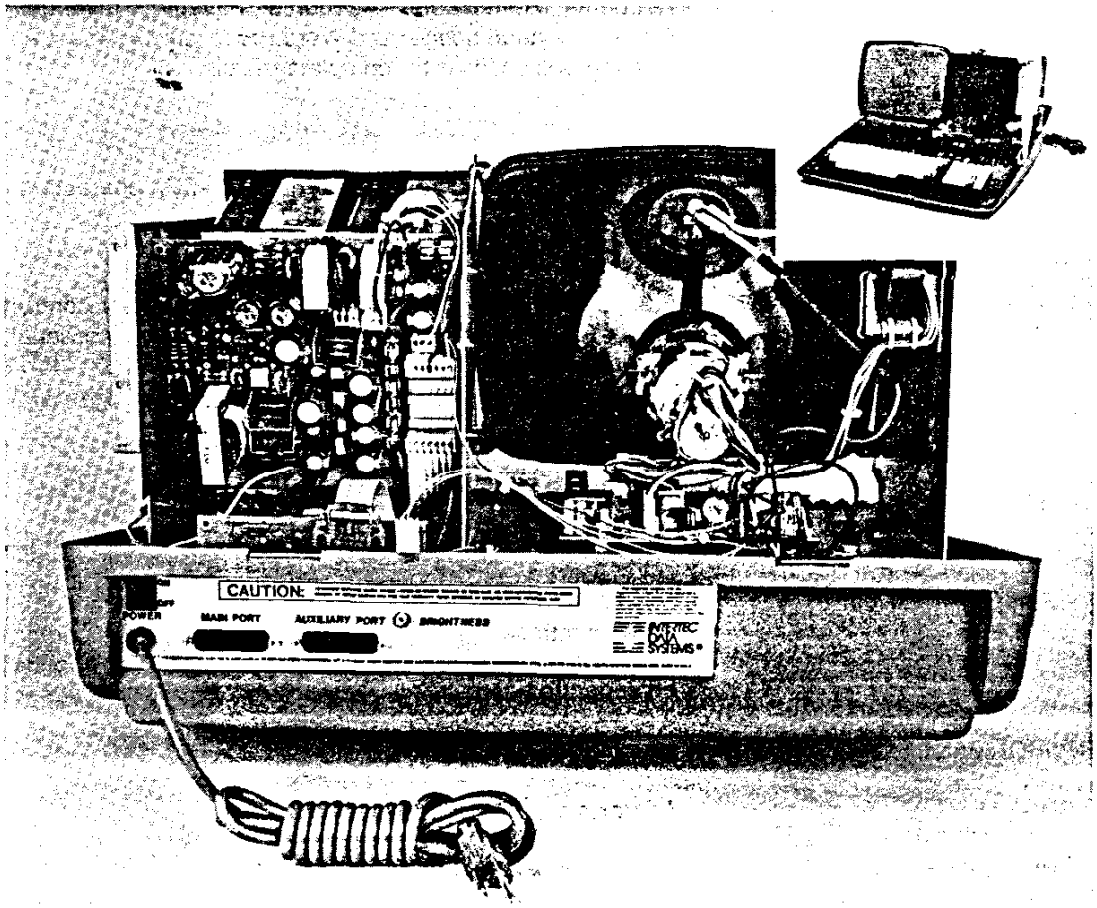
FEATURE	DESCRIPTION
Character Font	5 x 7 character matrix (with descenders) on a 7 x 10 character field. All displayed characters are derived from character sets stored on interchangeable EPROMS.
Display Presentation	Light characters on a dark background. Blinking, half-intensity, underlining, reverse video attributes standard; optional on-line secondary Character/Graphic set.
Bandwidth	20 MHZ
Cursor	Reversed image (block cursor)
COMMUNICATIONS	
Screen Data Transfer	Memory-mapped at 38 kilobaud.
Auxiliary Interface	Simplified RS-232 asynchronous. Parallel interface available. Baud rates are software selectable from 50 to 9600 baud.
Main Interface	Universal RS-232 asynchronous. Synchronous interface switch selectable. Baud rates are software selectable from 50 to 9600 baud.
Transparent Mode	Enables display of all incoming and outgoing control codes.
Parity	Choice of even, odd, none
Transmission Mode	Half or Full Duplex. One, one and one-half, or two stop bits.
Addressable Cursor	Direct positioning by either discrete or absolute addressing.
SYSTEM UTILITIES	
Disk Operating System	CP/M 2.2
DOS Software	An 8080 disk assembler, debugger, text editor and file handling utilities.
BASIC	Sequential and random disk access. Full string manipulation, interpreter.
OPTIONAL SOFTWARE	
Languages	FORTRAN; ANSI standard with relocatable, random and sequential disk access. Additionally, any user furnished CP/M compatible software package that can reside in 52K of memory.

SYSTEM SPECIFICATIONS (continued)

FEATURE	DESCRIPTION
Application Packages	Extensive software development tools are available including software for the following applications: Payroll, Accounts Receivable, Accounts Payable, Inventory Control, General Ledger and Word Processing. Contact an Intertec Sales Office for complete details.
KEYBOARD	
Alphanumeric Character Set	Generates all 128 upper and lower case ASCII characters.
Special Features	N-key Rollover, type ahead, and key repeat
Numeric Pad	0-9, decimal point, comma, minus and four cursor control keys. Reprogrammable to other values for individual applications.
Cursor Control	Up, down, forward, backward
INTERNAL CONSTRUCTION	
Cabinetry	Structural foam
Component Layout	Five board modular design. All processor related functions, RAM, controllers and keyboard are on a single printed circuit board. All video, chaining, and power related circuits on separate boards.
ENVIRONMENT	
Weight	Approximately 45 pounds
Physical Dimensions	14-5/8" (H) x 21-3/8" (W) x 23-1/8" (D)
Environment	Operating 0° to 50° Storage: C ' to 85° C; 10 to 95% relative humidity — non condensing.
Power Requirements	115 VAC, 60 HZ, 1 AMP (optional 230 VAC/50HZ model available)

INTERNAL CONSTRUCTION

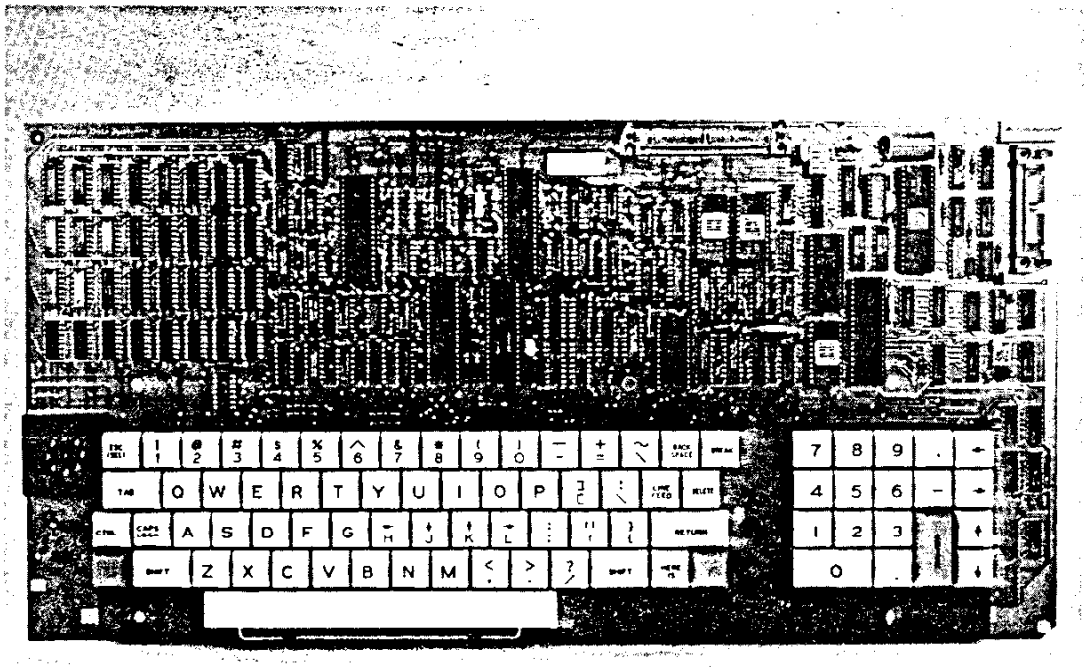
Perhaps the most remarkable feature of the SuperBrain II is its modular construction using only five major subassemblies which are clearly defined in their respective functions so as to facilitate ease of construction and repair. These five subassemblies are shown and described below.



KEYBOARD/CPU MODULE

The control section of the SuperBrain II Video Computer is based upon the widely acclaimed Z80A microprocessor. The result is far fewer components and the ability to perform a number of functions not possible with any other approach. The Keyboard/CPU module contains the SuperBrain II twin Z80A microprocessors. One Z80A (the host processor) performs all processor and screen related functions while the second Z80A can be "downloaded" to execute disk I/O handling routines. The result is extremely fast execution time for programs.

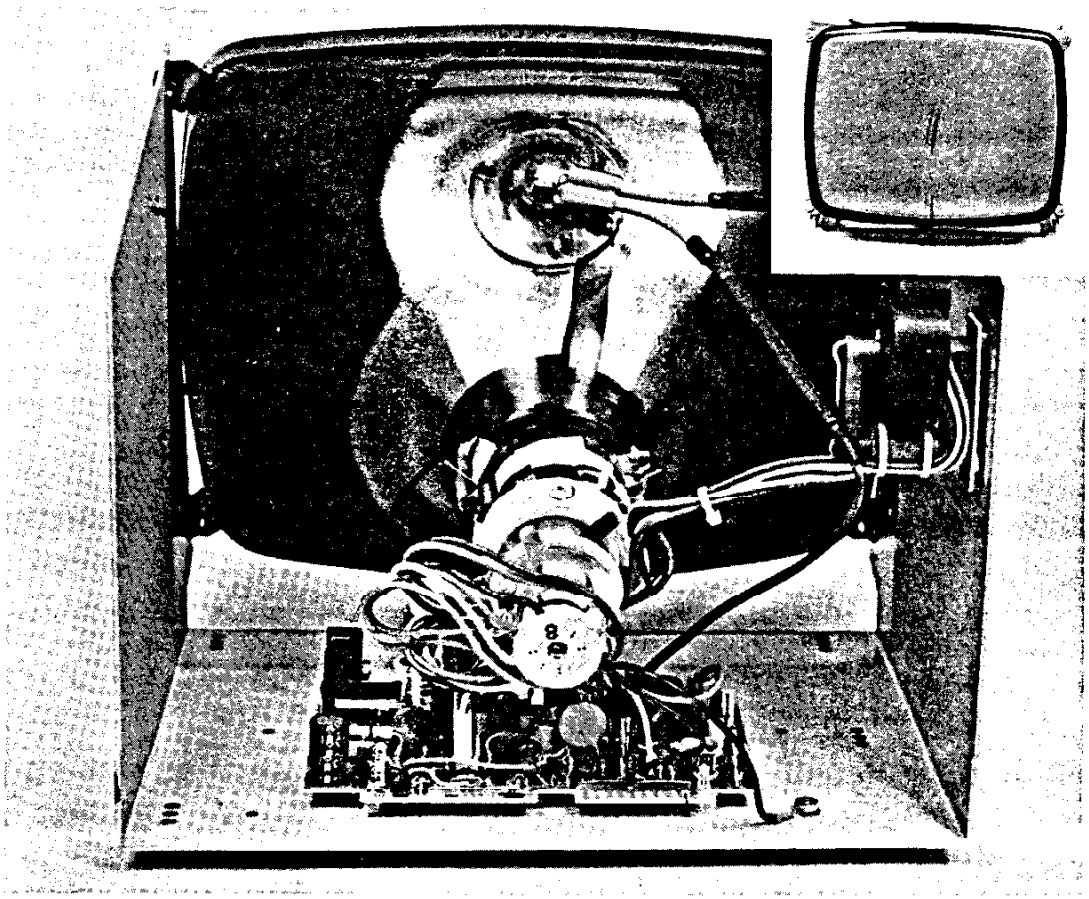
In addition to containing the SuperBrain II's microprocessor circuitry, the Keyboard/CPU module contains 64K of dynamic RAM. Also found on this module is: the character and keyboard encoder circuitry, the "bootstrap" EPROM, the disk controller and all communications electronics. Power is supplied to this module via a single 7 pin ribbon cable connected to the SuperBrain II's main power supply module. Connection of this module to the disk drive modules is via a separate ribbon cable. Separate connectors also exist for the CRT display signals and serial I/O ports.



CRT DISPLAY MODULE

The CRT Display Module consists of a 12 inch, high resolution, cathode ray tube mounted in a rigid aluminum chassis. The faceplate of the CRT is etched in order to reduce glare on the surface of the screen and provide uniform brightness throughout the entire screen area. The CRT display presentation is arranged in 24 lines of 80 characters per line for a total display capacity of 1,920 characters.

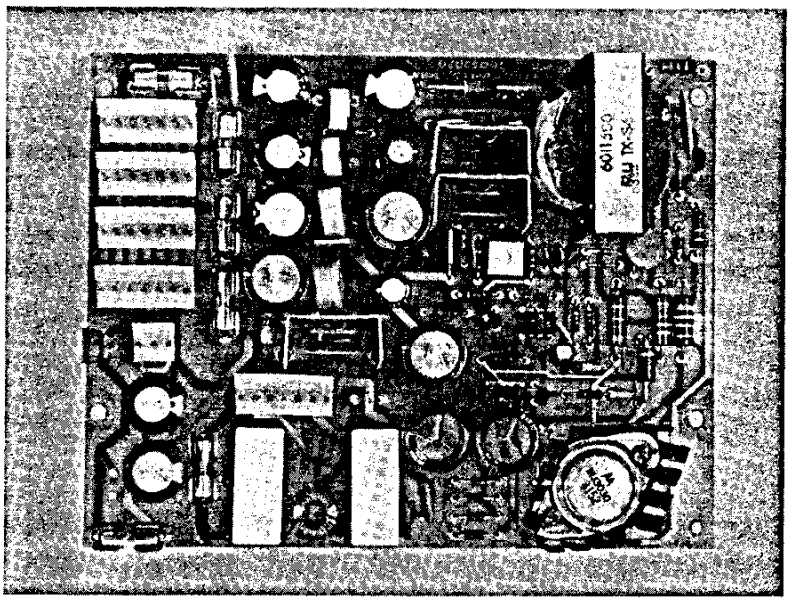
The CRT video driver circuitry is mounted in the base of the CRT chassis to facilitate ease of removal and subsequent repair. In this manner, either the CRT itself or the video circuitry can be easily exchanged without disrupting any of the other major modules within the terminal.



This module is easily removed for service or replacement. A single edge connector is provided for connection to SuperBrain II's Keyboard/CPU Module.

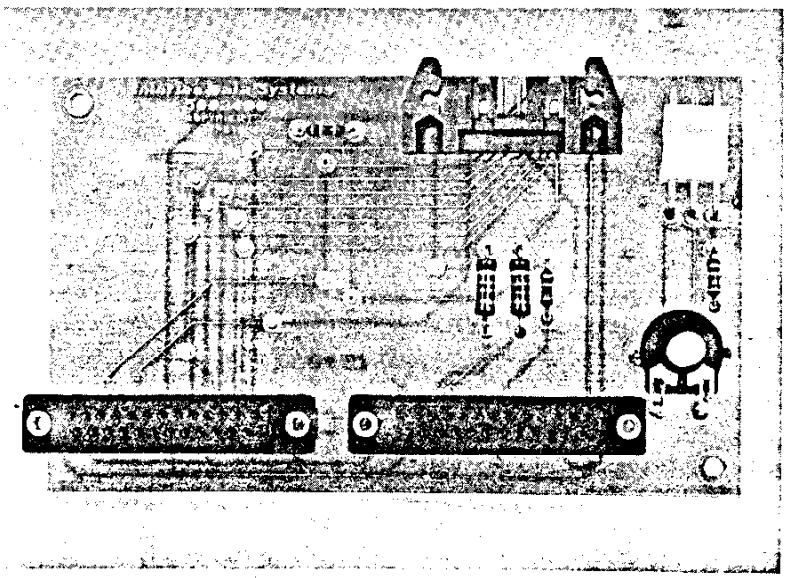
MAIN POWER SUPPLY MODULE

The SuperBrain II's power supply is of a "solid-state, switching" design and employs a voltage regulator to provide many years of trouble-free service. This design reduces heat dissipation and allows for efficient cooling of the entire terminal with a specially designed whisper fan to reduce environment noise. The entire power supply can be easily removed by unscrewing the screws holding it to the disk drive back plate. This module supplies the five voltages required to power the Keyboard/CPU module, the Video Module, and disk drive.



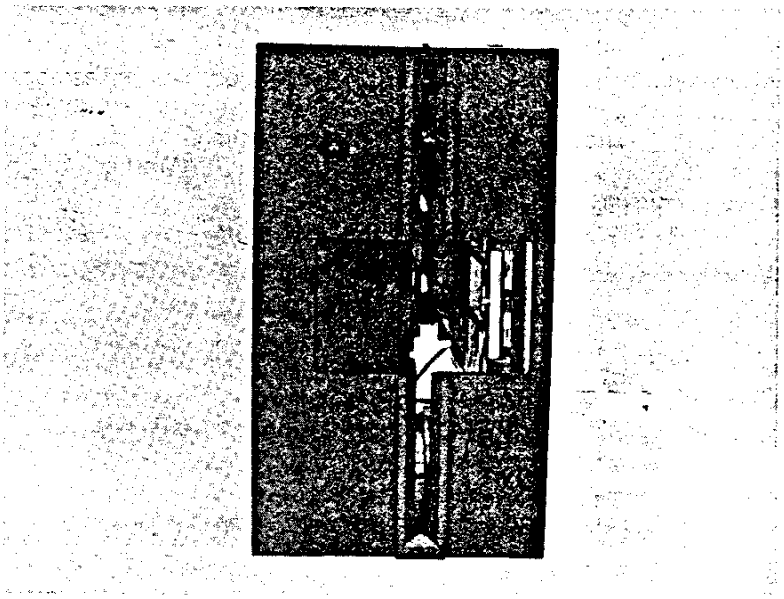
TRANSITION BOARD

This board contains the RS-232 serial I/O connectors and video brightness control. It connects to *the video module and the keyboard/CPU module.*

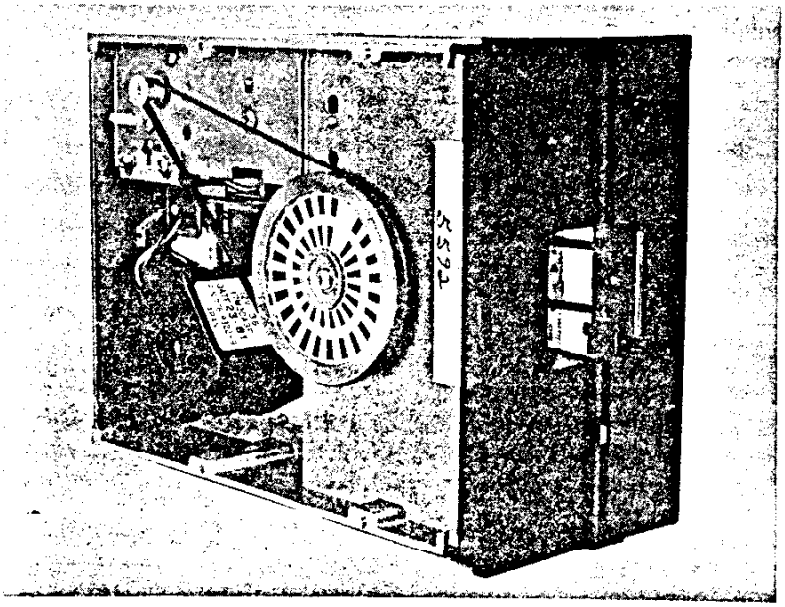


DISK DRIVE MODULES

The SuperBrain II has a specially designed double-density disk drive subassembly. Each SuperBrain II contains two of these type drives which are mounted conveniently just to the right of the CRT display module on a rugged aluminum mounting bracket so that they are flush mounted with the front "bezel" of the unit. Power to these drives is derived from the Power Supply Module located just behind the drive assemblies themselves. Data to and from these drives is routed via a single 34 pin ribbon cable connecting the drives to the Keyboard/CPU module.



Front View of SuperBrain II Drive Assembly



Side View of SuperBrain II Drive Assembly

THEORY OF OPERATION

The SuperBrain II contains two Z80 microprocessors. uP1 is the main processor which executes all user programs from the 64K RAM main memory, while transparently managing the CRT Display processes. All user I/O is also connected to uP1. This I/O includes the Serial Ports, Interface Controller, Keyboard Encoder, Time/Date Clock, and the External Bus. uP2 performs all floppy disk control functions from instructions contained in the 2K Bootloader EPROM. Part of this same EPROM contains the Cold Bootloader for uP1, and is executed when a System Reset is performed. The Floppy Disk Control section also contains a 1K x 8 RAM buffer used for temporary storage of disk read/write data. This buffer can be accessed by either uP1 or uP2, therefore, a protocol exists to prevent microprocessor contention for this buffer.

The 64 kilobyte main memory consists of thirty-two 16K x 1 bit dynamic RAMS. These are divided in four banks (0-3) with each bank containing 16 kilobytes of storage. The RAS-CAS timing sequence necessary for memory access is created by the memory timing generator.

The CRT-VIDEO CONTROLLER circuitry is divided into three main areas: The CRT controller which generates all the timing signals for data display; the character generator circuitry which produces the character font; and the attribute generation circuitry which provides the special video capabilities of blinking, underlining, half-intensity, and reverse video in addition to normal video display.

The capability exists to install an alternate character set EPROM as an option. This would allow the CRT controller to access either character set during normal operation.

The CRT controller generates all the timing necessary to display 24 rows of characters with 80 characters per row. Thus the screen can display a total of 1,920 characters. These characters are stored in the CRT refresh buffer which is the upper 2,048 bytes (2K) of main memory.

Because the CRT buffer is not a separate buffer and the processor must also use the same bus to access memory, this bus must be timeshared between the two. This is accomplished by the CRT controller performing a direct memory access (DMA) cycle which is done at the last scan line of each character row. Each character row is divided into ten scan lines, therefore, during the last scan line time, the controller takes control of the processor bus by generating a bus request. After acquiring the bus, it reads 80 characters from the CRT buffer and loads them into the 80 x 8 shift register. This data is then recirculated in the buffer for the next nine scan lines to produce one row of video characters. Therefore, there are twenty-four DMA cycles performed per vertical frame.

There are also twenty-five interrupts generated — one for each row scan and one extra during vertical blanking. During the first twenty-four, the processor sets or resets the video blanking depending on whether that row is displayed or not. During the vertical blanking interrupt, the address registers in the CRT controller are initialized to the correct top-of-page address and the cursor register is also updated.

The Interface Controller is basically three 8 bit I/O ports (8255). Through this device, the processor can obtain status bits from other devices and react to the status by setting/resetting individual bits in the 8255.

The Keyboard Encoder scans the keyboard for a key depression, determines its position, and generates the correct ASCII code for the key. The processor is flagged by the 'Data Ready' signal via the Interface Controller. The character is then input by the processor.

The Time/Date clock is accessed directly by uP1 through an I/O address. The clock has a battery power supply and will maintain the correct time and date when the external power is removed.

The clock is also available as a real time clock for the user's access.

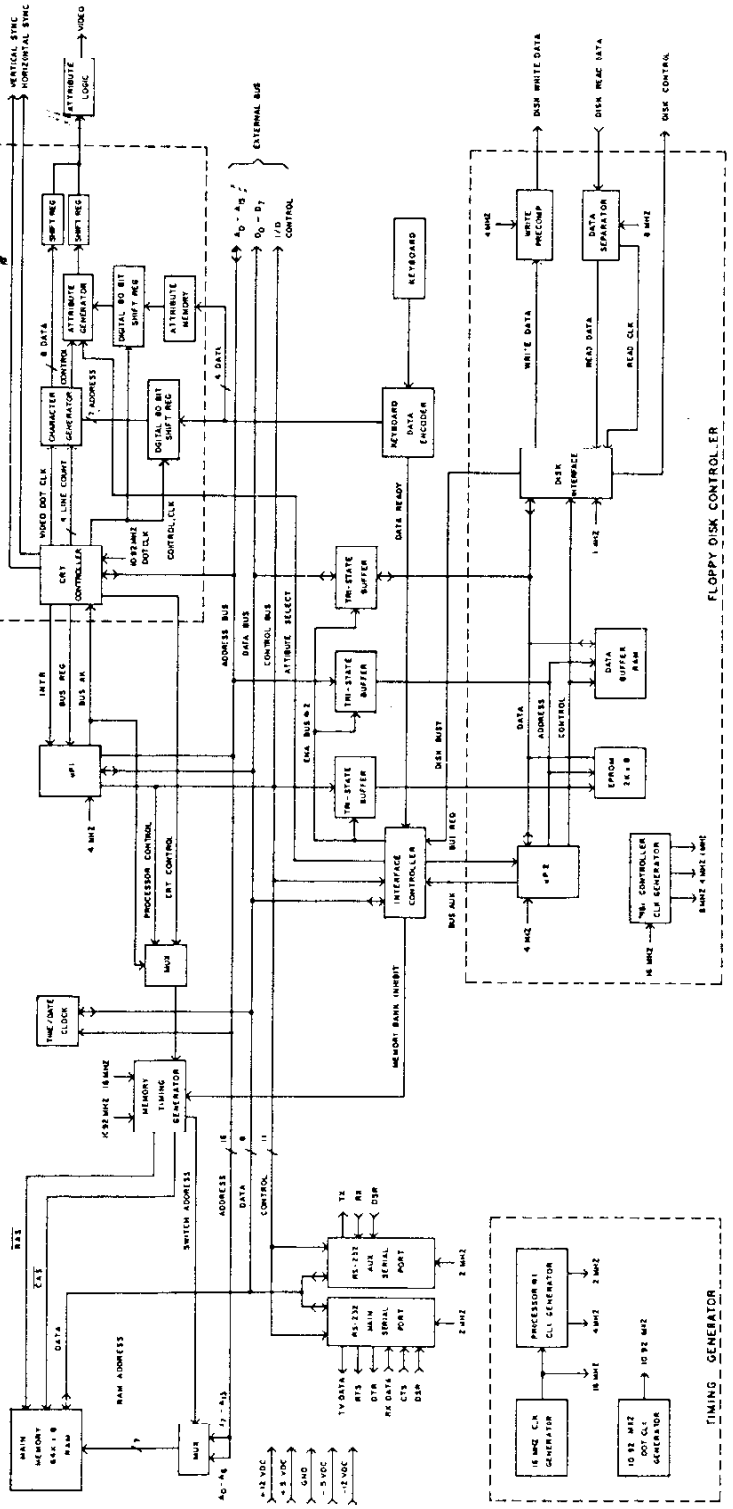
There are also two RS232C serial interface ports. The main port is capable of synchronous or asynchronous operation. The aux port is a simplified port used for asynchronous operation only. The baud rates are variable from 50 baud to 9600 baud. The mode of operation of the main port and the baud rate of both ports are set up by the operating system and can be changed by using the "CONFIGUR" program.

As previously mentioned, uP1 has the capability of communicating with the RAM and ROM in the FLOPPY DISK CONTROLLER. Because the amount of main memory used is the maximum that the processor addressing can support, different 16K banks of main memory must be switched off line when communicating with the disk RAM or EPROM. In these cases Bank 0 (0000H-3FFFH) is switched out when communicating with the EPROM, and Bank 2 (8000H-BFFFH) when communicating with the RAM.

The FLOPPY DISK CONTROLLER performs all disk related I/O functions upon command from the main processor. These commands are:

* Restore to track 0
* Read sector
* Write sector
* Write sector with verify
* Format

The parameters associated with drive, side, track, and sector numbers are loaded, a status word is set at a specified location in the disk RAM. When uP2 receives this status, it sets the 'disk busy' status bit and performs the indicated function. Upon completion, it resets the 'busy' bit thus allowing the main processor (uP1) to retrieve data and status from the RAM.



SUPERBRAIN II KEYBOARD / CPU II MODULE BLOCK DIAGRAM

INSTALLATION AND OPERATING INSTRUCTIONS

UNPACKING INSTRUCTIONS

Be sure to use extreme care when unpacking your SuperBrain II Video Computer System. The unit should be unpacked with the arrows on the outside of the shipping container facing up.

The MASTER SYSTEM DISKETTE is located inside the front cover of this manual. Be careful not to discard or misplace this diskette as it will be vital for the later operation of the equipment. If you ordered additional, optional software with your computer, it will be shipped under separate cover.

Now that you have located your system diskette you can proceed to remove the terminal. If you should experience any difficulties, rotate the carton on its side. With the terminal in this position, you should now be able to pull outward on the terminal and separate it from the box. Once the terminal is out of the carton, place it on a table and remove the protective plastic bag which should be surrounding the terminal. DO NOT DISCARD THE SHIPPING CARTON SINCE IT COULD POSSIBLY BE USED FOR RESHIPPING AT A LATER DATE.

SET UP

The first step in this procedure is to verify that your SuperBrain II is wired for a line voltage that is available in your area. This can be ascertained by checking the serial tag located at the right rear of the terminal. This tag should indicate that your unit is set up for either 110 or for a 220 VAC operation. DO NOT ATTEMPT TO CONNECT THE SUPERBRAIN II VIDEO COMPUTER SYSTEM TO YOUR LOCAL POWER OUTLET UNLESS THE VOLTAGE AT YOUR OUTLET IS IDENTICAL TO THE ONE SPECIFIED ON THE BACK OF YOUR TERMINAL. If the voltages differ, contact your dealer at once and do not proceed to connect the SuperBrain II to the power outlet.

Before connecting the SuperBrain II to the wall outlet, be sure that the power switch located at the left rear corner is turned OFF. You may now proceed to connect your computer system to the wall outlet. After completing this connection, turn the power switch to the ON position. At this time, you should hear a faint "whirring" sound coming from the fan in the computer. After approximately 60 seconds the message INSERT DISKETTE INTO DRIVE A will appear on the screen. If this message does not appear on the screen after approximately 60 seconds, simultaneously depress the two RED keys located on either side of the alphanumeric keyboard. These are the master system reset keys and should reinitialize the computer system, thereby displaying the 'INSERT' message on the screen. If, after several attempts at resetting the equipment you are unable to get this message to appear on the screen, turn the unit off for approximately 3 to 5 minutes and then reapply power to the unit. If you are still unable to get the appropriate message to appear on the screen, contact your Intertec representative.

SYSTEM DISKETTE

Now that you have power applied to the machine and the INSERT DISKETTE message has been displayed in the upper left hand corner, you are ready to proceed with loading the computer's operating system. This is accomplished by locating the small 5¼" diskette that was packed with this manual. Once you have located this diskette, you will notice that a small adhesive strip has been placed over the notch on the right hand side of the diskette. This aluminum strip is used to "WRITE PROTECT" the diskette. Therefore, you may only read programs from this diskette. If you wish to write or save programs on the system diskette, it will be necessary to remove the small adhesive aluminum strip from the diskette. This is NOT RECOMMENDED as it will subject your diskette to accidental errors that may be caused by you while you are getting familiar with the operating system.

You are now ready to proceed with inserting the system diskette into the machine. When facing

the front of the machine, you will notice that there are two small openings on the right hand side of the machine. The leftmost opening is designated as drive A. The rightmost opening is designated as drive B. This distinction is important since the disk operating system can only be loaded from drive A.

Open the disk drive door on drive A (the leftmost drive). The drive can be opened by applying a very slight pressure outward on the small flat door located in the center of the opening. Once the drive door has been opened, insert the Operating System Diskette. The front of the diskette should contain a small white sticker located in the upper left hand corner of the diskette. This diskette should contain a message indicating that it is the SuperBrain II DOS Diskette with CP/M Version 2.2. Be careful to insure that (1) the small aluminum write protect strip is oriented towards the top edge of the diskette and that (2) the label located in the upper left hand corner of the operating system diskette is facing AWAY from the screen towards the right hand side of the terminal. Once you have oriented the diskette in this fashion, insert it into the terminal.

It is **EXTREMELY** important that the diskette be properly oriented before inserting it into the machine since improper orientation will not allow the operating system to properly load. Once the diskette has been placed in the machine, be sure that it has been inserted all the way by applying a gentle pressure on the rear edge of the diskette. Once you are certain that the diskette is fully inserted, close the disk drive door. This can be accomplished by applying a slight pressure on the door, pulling it back into the direction from which it was originally opened. Once you have closed the door, you will notice a small "swishing" sound. This sound is normal and indicates that the computer is now attempting to load the operating system. Some drives are quieter than others and therefore this noise may not be audible.

After closing the door the following message should appear in the upper left-corner of the screen:

SUPERBRAIN II DOS VER X.X, FOR CP/M 2.2
A>

If this message does not appear on the screen, try depressing the two RED keys located on either side of the keyboard. This should reset the terminal and thereby attempt to reload the operating system. If after several seconds, the message does not appear on the screen, try depressing the RED keys several more times. If repeated depressions of the RED keys do not bring up the indicated message, then open the door on the disk drive A and remove the system diskette and check to see if it was properly inserted. If you are unsure as to the proper orientation of the diskette, please contact the representative from whom you originally purchased your equipment.

After you have checked the orientation of the diskette, try reinserting it into drive A (do **NOT** insert the system diskette into drive B as it will not load from drive B). Once the diskette has been reinserted, close the door on drive A and depress the RED keys. If after several repeated depressions of the RED keys, the message SUPERBRAIN II DOS VER X.X, for CP/M 2.2, does not appear on the terminal then contact your dealer.

REVIEWING THE SYSTEM DISKETTE

After you have successfully loaded the System Diskette and Disk Operating System (DOS), the SuperBrain II is ready to accept your disk operating system commands. At this time we will review several of the commands in the operating system. However, it is recommended that you refer to the appropriate section in this manual for a detailed description of all such commands. (Introduction to CP/M Features and Facilities). The most used system command is the DIR command. This command directs the operating system to display the directory of all programs contained on the system diskette. You may enter this command by simply typing the letters DIR on the keyboard.

After you have typed these letters, it is necessary to depress the **RETURN** key. Depressing this key instructs the computer to process the line of data that you have just typed. After you depress the **RETURN** key the computer should respond by displaying all of the programs on the system diskette. These programs will appear in a form somewhat similar to the following:

A:ED.COM
A:DDT.COM
A:ASM.COM
A:LOAD.COM
A:DUMP.COM

To obtain a better understanding of just what this information means, let's take a look at the first line:

A:ED.COM

The first letter on this line is the letter A. This tells you that the information following this letter is located on drive A. The colon serves as a separator between the drive designator ("A") and the file NAME and file TYPE. The file NAME is, in this case, "ED" and the file TYPE is "COM." This line tells the operator that a program called ED (the disk operating system text editor) is located on the "A" drive and is a COM type of file. A more detailed treatment of this information can be found in the CP/M sections of this manual.

DUPLICATING THE OPERATING DISKETTE

Now that you have successfully loaded the Disk Operating System on Drive A, it is important to duplicate this diskette. This is necessary in order to preserve the original copy of the diskette and guard against any possible damage to the original media. To generate a copy of the operating system you will first need a new blank diskette. We recommend an Intertec diskette for this purpose. If you do not have any blank diskettes of similar quality, please contact the representative from whom you purchased your equipment. The representative should be able to supply you with an ample quantity of these diskettes.

Insert the blank diskette into drive B. Follow the procedures outlined in the previous paragraphs regarding the insertion of the operating system diskette. The only difference is that you will be inserting the new blank diskette into drive B. Be sure and leave the system diskette installed in drive A.

Once you have installed the new blank diskette in drive B, you are ready to "FORMAT" the new diskette. It is necessary to format all previously unused diskettes before attempting to transfer data to them. This is necessary because all information is stored on diskettes in what is known as a SOFT SECTORED FORMAT which necessitates the writing of certain information on the disks before user programs or data can be stored on them.

To format the diskette in drive B, enter the command **FORMAT** and depress the **RETURN** key. The operating system will respond by asking you to select one of the following:

* J — For formatting SuperBrain II Jr diskettes
* Q — For formatting SuperBrain II QD diskettes
* S — For formatting SuperBrain II SD diskettes

CAUTION: SuperBrain II Jr and QD diskettes cannot be formatted on SD machines and vice-versa.

Once the appropriate option is selected, the operating system will prompt the user to insert a blank diskette into drive B in case that has not already been done. Next, the user should depress the **F** key to begin formatting.

When a diskette is being formatted, the read/write heads position to track 0 and sequentially writes each track. The screen displays the current track numbers. The track value displayed will range from:

* 0-34 for the SuperBrain II Jr
* 0-69 for the SuperBrain II QD
* 0-159 for the SuperBrain II SD

After the disk has been completely formatted, the operating system will respond by asking you whether to "REBOOT" the operating system or whether you wish to format another disk. If you wish to format another disk, remove the newly formatted disk from drive B and insert a new blank diskette into drive B. You may now proceed to format this new diskette by once again entering the letter **F**. If you do not wish to format any more diskettes, simply enter a **RETURN.**

The Operating System should now reload and once again be ready to accept new commands.

Since the intent of this procedure was to copy the original disk operating system we are now ready to begin that procedure. This can be accomplished by entering the following command on the keyboard:

A>PIP B:=*.*[V] <cr>

After you have entered the above command at the keyboard, depress the **RETURN** key.

The system will now begin to copy and verify all of the programs on drive A over to drive B. As each program is copied, its name will be displayed on the screen. This procedure takes approximately 5 to 10 minutes. When the procedure completes, the control of the operating system will be returned to the user.

Now that you have completed copying the programs from the A drive to the B drive it is necessary to copy the disk operating system itself (which is located on tracks 0, 1) onto drive B. This may be accomplished by entering the following command at the keyboard:

A>SYSGEN <cr>

The SYSGEN command is used to read the operating system from a diskette and place it on the desired diskette. Once you have entered this command at the keyboard and typed **RETURN,** the disk operating system will ask you to select which drive you want to take the source from. The correct answer to this question is the letter "A". After entering **A** depress the **RETURN.**

The next question the program will ask is where do you want the source to be placed (the destination drive). The correct answer to this is the letter "B" indicating drive B. Once you have entered this, the operating system will be copied from drive A onto drive B.

After this process has been completed the operating system will ask whether you wish to make another copy or to reload the operating system. The correct response is to simply enter a **RETURN** which will reload the operating system.

Once the operating system has been reloaded, you may remove the master disk operating

system in drive A. Once this disk has been removed, store it in a safe place, as you may need it later to generate additional copies of the disk operating system and its programs.

At this point you should have removed the master disk from drive A. Now remove the copy from drive B and reinstall it in drive A and close the door on drive A. After you have completed this, depress the RED reset keys located on either side of the keyboard. This will reset the machine and reload the newly installed operating system from the new system diskette.

IMPORTANT: If random, garbled information is displayed on the screen at this time, this indicates that an error was made in the use of the SYSGEN program. If this is the case, remove the new diskette from drive A and reinstall the original master system diskette and repeat the previously outlined procedure for generating a new disk operating system. If you still encounter difficulties, please refer to the CP/M sections of this manual for more detailed information concerning the SYSGEN procedure.

Now that you have successfully completed the generation of a new system diskette, please refer to the CP/M sections of this manual for a complete description of all of the operating system utility programs (DDT.COM, PIP.COM, SUBMIT.COM, etc.).

OPTIONAL SOFTWARE

MICROSOFT FORTRAN 80 — comparable to Fortran compilers on large mainframes and minicomputers. All of ANSI standard Fortran X3.9-1966 is included except the COMPLEX datatype. Therefore, users may take advantage of the many application programs already written in Fortran. Fortran 80 is unique in that it provides a microprocessor Fortran and assembly language development package that generates relocatable object modules. This means that only the subroutines and system routines required to run Fortran 80 programs are loaded before execution. Subroutines can be placed in a system library so that users develop a common set of subroutines that are used in their programs. Also, if only one module of a program is changed, it is necessary to recompile **only** that module. Additionally, numerous optional software packages are available for use with your SuperBrain II Video Computer System. If you would like additional information on these packages, please contact your local Intertec representative.

SUPERBRAIN II SOFTWARE SUMMARY

The software distributed with the SuperBrain II is basically of two types. First, CP/M and miscellaneous software from Digital Research provide an operating system, and various utility programs. Second, there are utility programs prepared by Intertec for special features or functions of the SuperBrain II and an interpreted BASIC from MicroSoft. A summary of both categories follows:

CP/M SUMMARY

PROGRAM NAME	FUNCTION	ENTRY EXAMPLE
PIP.COM	Copies files between devices, logical and physical.	**PIP B:=A:*.*⟨cr⟩** **PIP CON:=A:FILE.TYP⟨cr⟩**
SYSGEN.COM	Generates a new operating system on diskette.	**SYSGEN⟨cr⟩**
ED.COM	Text Editor, allows changes to text files.	**ED PROGRAM.ASM⟨cr⟩**
ASM.COM	Assembles an 8080-type assembly language that produces a source listing and a 'HEX' file.	**ASM PROG⟨cr⟩**
LOAD.COM	Creates a binary object file from a 'HEX' file that can be executed.	**LOAD PROG⟨cr⟩**
DDT.COM	Allows user to debug and step through a 'COM' or 'HEX' file's execution.	**DDT PROG.COM⟨cr⟩** **DDT PROG.HEX⟨cr⟩**
SUBMIT.COM	Performs successive execution of a list of 'COM' files.	**SUBMIT MORNING⟨cr⟩**
XSUB.COM	Forces data entry into a process under control of SUBMIT.	**XSUB⟨cr⟩**
DUMP.COM	Produces a hexadecimal listing of a disk file's contents.	**DUMP PROG.COM⟨cr⟩**
STAT.COM	Display file status, device status, or system characteristics.	**STAT B:*.*⟨cr⟩** **STAT B:DSK:⟨cr⟩**
DIR*	Displays a disk directory.	**DIR⟨cr⟩** **DIR B:⟨cr⟩**
ERA*	Erases a disk file.	**ERA B:PROG.BAK⟨cr⟩**
REN*	Renames a disk file.	**REN PROG.ASM=PROG⟨cr⟩**
SAVE*	Saves memory contents on the disk.	**SAVE 10 A.COM⟨cr⟩**
TYPE*	Displays an ASCII listing of a disk file's contents.	**TYPE PROG.PRN⟨cr⟩**

*These are CP/M command level functions.

Section 3

These programs or commands run under the CP/M 2.2 disk operating system (DOS). This DOS is customized for each SuperBrain II computer model available, which results in having three operating systems applicable to the SuperBrain II product line. These are:

* SBIICPM.COM — SuperBrain II Jr computer. The corresponding BIOS is SBIIBIOS.ASM.
* QDIICPM.COM — SuperBrain II QD computer. The corresponding BIOS is QDIIBIOS.ASM.
* SDIICPM.COM — SuperBrain II SD computer. The corresponding BIOS is SDIIBIOS.ASM.

The difference between these models of the SuperBrain II computer is the amount of on-board floppy disk storage each contains. The correct operating system is distributed with each computer.

Refer to later sections of this manual for detailed documentation of CP/M usage and capabilities.

INTERTEC UTILITY SUMMARY

Program Name	Function
CONFIGUR.COM	Establishes certain user selectable operating characteristics of the SuperBrain II.
FORMAT.COM	Prepares previously unused diskettes for use in the SuperBrain II disk drives by placing sector information on them.
HEXDUMP.COM	Generates an "Intel" hexadecimal format data stream from any binary object file in the SuperBrain II computer and outputs it to a port.
64KTEST.COM	Performs extensive memory testing for diagnostic purposes.
RX/TX.COM	A program pair that enables file transfers between two SuperBrain II computers.
CSEDIT.COM	A program that allows the user to generate or modify an alternate character set.
CSDUMP.COM	A program that allows the user to generate printed output of the alternate character set built with CSEDIT for documentation purposes.
TIME.COM	A program that allows the time maintained by the real time clock to be set and/or displayed.
DATE.COM	A program that allows the date to be entered or displayed.
MBASIC.COM	An interpreted type BASIC.

In general, the Intertec utility programs are self-documenting and designed for ease of use. To support this design further, documentation of these programs follows. The interpreted BASIC from MicroSoft is documented in a separate manual available from Intertec.

CONFIGUR.COM

This program enables the user to select various operating parameters for the SuperBrain II. This feature allows flexibility in your computer's use. The parameters affect the MAIN and AUXILIARY ports, the AC line frequency, keypad assignments, audio and visual feedback, and disk

verification. By allowing the user to change these parameters, a variety of peripheral devices can be used with your SuperBrain II.

The CONFIGUR program is menu-driven; the user selects the parameter to change, and then follows the instructions listed. To initiate the CONFIGUR command, type **CONFIGUR**<cr> at the keyboard. CONFIGUR will then accept your commands for parameter changes. After you are finished, press the **RETURN** key (you may change several of the parameters if you wish); the screen will clear, and you will be instructed to press both RED keys on the keyboard. This action will force an operating system to reload containing your new parameters, and these parameters will be reloaded each time you reset the operating system.

Note that the CONFIGUR program will change the copy of the operating system located on the diskette in drive A. Even if your copy of CONFIGUR.COM is located on drive B, drive A will be affected. A summary of parameter selections is included for reference.

Vertical Scan Frequency
The vertical scan frequency is selectable for 50 or 60 Hertz. This compensates for the local AC line frequency to prevent the display from flickering.

Disk Write Verification
You may select to have the Operating System perform disk read-back verification after each floppy disk write. This feature will 'double-check' the write operation.

Time Display Enable/Disable
If you wish for the time of day to be constantly displayed in the upper right corner of the screen upon power-up, you may select this feature here. Note that the time is always maintained internally, even if you choose not to display it. Also note that this setting is only for power-up, and you may select/deselect the time during operation by typing a Control-T (14H).

Key Click Enable/Disable
You may choose to have the audible feedback feature enabled upon system power-up. Whenever the audible feedback is enabled, the computer will inform the operator with a slight 'click' at each key depression. Note that this setting is only for system power-up, and the key click feature can be changed during operation by typing a Control-B (02H).

Main and Aux Port Operation
Choosing these selections will permit you to change the operating parameters of the MAIN and AUX serial I/O ports located on the rear of your computer. The details of this selection are covered below including which ports are applicable for a given feature.

Operating Mode (MAIN Port Only)
The MAIN port operating mode selections are synchronous and asynchronous. Be certain that the peripheral with which you are communicating is capable of operating in the same mode; they cannot be different. Note also that when changing to synchronous mode, you may need to change the number of SYNC Characters and the SYNC Character value. When changing to the asynchronous mode, you may need to change the number of stop bits. Using the synchronous mode requires different switch settings to be modified on the Keyboard/CPU module. Refer to the Synchronous Communication topic in this section for further information.

Baud Rate (MAIN and AUX Ports)
A wide range of baud rates can be selected for the port including rates from 9600 baud (approximately 960 characters/second) to 50 baud (5 characters/second). Select the baud rate needed to communicate with your peripheral.

Number of SYNC Characters (Main Port Only)

This selection will affect the number of SYNC Characters sent to the USART upon system power-up. Select either one or two.

Number of Stop Bits (MAIN and AUX Ports)

This selection will choose the number of stop bits sent after each character when the port is operating in asynchronous mode. Select either 1, 1.5, or 2 stop bits.

Character Length (MAIN and AUX Ports)

You may select the length of the character to be transmitted and received. Many selections are provided to insure compatibility with older TTY and Baudot machines. Usually, eight bits is the standard character length. You may, however, select 5, 6, 7, or 8 bit character lengths.

Parity (MAIN and AUX Ports)

You may choose to check parity with each transmission. This will provide a limited 'checksum' to help insure that proper transmission has occurred. However, if parity is enabled, the application program will have to test the USART status register for parity error. You may also select Even or Odd parity. If you choose to check parity, be certain that the device with which you are communicating matches your setting.

Handshaking (MAIN and AUX Ports)

If you wish to check Data Set Ready prior to each character transmission, you should enable this function. This will permit a peripheral device to signal the computer whenever it cannot receive anymore characters.

SYNC Character Value (MAIN Port Only)

The SYNC Character is the byte that is sent to the USART after it has been programmed for synchronous communication. Generally, the ASCII value of 13H (SYN) is used, but any binary value may be substituted. Make certain that the SYNC Character value matches that of the peripheral device with which you are communicating. Enter the hexadecimal number desired.

KEYPAD REPROGRAMMING

The 18 key numeric keypad on the right side of the keyboard can be reprogrammed to any input values desired. You may, for example, wish to invert the numeric keys on the pad. They will then correspond to 'telephone style' with 1-2-3 on the top row and 7-8-9 on the bottom. You may wish to replace the keys with control-codes which are accepted by a word processing or text editing program. The key cap values could then be changed to descriptive messages which are easier to learn and understand. Any value from OOH to FFH can now be assigned to the numeric keys with CONFIGUR.

When this selection is entered, an image of the keypad appears on the screen. To change the value of any key, depress the **TAB** key until the cursor is over the key you wish to change. Then press the escape **ESC** key to indicate the change needed. The cursor will position itself on the last line, and a blinking asterisk will replace the cursor on the key being changed. Enter the new hexadecimal value for this key. Your input must be a valid hex number between O-F as invalid numbers will not be accepted. Press the **RETURN** key when you are finished.

*To restore the keypad to its original values press the **R** key instead of the **ESC** or **TAB** keys. The* screen will be updated instantly, and the cursor will be repositioned at the beginning of the display. When all changes have been entered, pressing the **RETURN** key (instead of the **ESC** or **TAB** keys) will return you to the main menu of selections.

FORMAT.COM

Before diskettes can be used by an Intertec computer, they must first be formatted. This process will erase the diskette of all data and write certain sector-header information on the diskette so that the operating system is able to properly locate data on the diskette. FORMAT.COM is a versatile program that will allow the user to format diskettes for the SuperBrain II.

To load the format program from diskette, type **FORMAT**⟨**cr**⟩ at the keyboard. After loading, you should select the type of diskette you wish to format. Once your selection has been entered, you will be asked to place an unformatted diskette into drive B and type the **F** key to begin formatting. When the formatting is completed, you may continue formatting by placing another diskette into drive B and pressing the **F** key. You may repeat this process until all of your diskettes have been formatted. Press the **RETURN** key to end the formatting session.

The diskette that you format does not have to be a blank diskette. You may format an old diskette if you wish, but you should remember that **FORMAT** will destroy all data on a diskette. However, if the data on a diskette becomes damaged (or if you suspect that the data is damaged), copy the diskette onto another diskette and reformat the original. This way, you save some (or all) of the original data and you don't lose any diskettes.

HEXDUMP.COM

This is a utility designed to convert a **COM** file to the Intel Hex format and transmit it from the Aux or MAIN port to a desired port. Since the PIP program cannot transfer **COM** files, this utility is useful in effecting file transfers without the PIP program. To initiate the HEXDUMP facility, type the following at the keyboard: **HEXDUMP**⟨**cr**⟩. The program will be loaded and then await your instructions.

The first thing that the HEXDUMP procedure requests is the port to which you wish to dump the file. Here enter **1** for the MAIN port (corresponding to CP/M's PUN: and RDR: device), or **2** for the AUXILIARY port (corresponding to CP/M's LST: device). You must enter either a **1** or **2**; invalid entries will be ignored. Next you may choose whether or not you wish to have the **HEX** file echoed to the console (this will display the file as transmitted). Enter **1** if you do not wish to have the file echoed on the screen, or **2** if you wish to have the contents echoed. Again, invalid entries will be ignored.

Now you are ready to enter the file name. You must enter the drive designator, the file name and the file type. Separate the drive indicator from the file name with a colon (':'), and separate the type from the name with a period (.). Press the **RETURN** key after entering the name.

Example:

```
A>HEXDUMP<cr>
                        HEXDUMP FILE UTILITY VER. 3.1
SELECT ONE OF THE FOLLOWING: (TYPE THE NUMBER)
    1 — THE MAIN PORT (PUN:)
    2 — THE AUX PORT (LST:)
2
SELECT ECHO ON THE CONSOLE:
    1 — DO NOT ECHO ON THE CONSOLE
    2 — ECHO TO THE CONSOLE
1
ENTER DISC, FILE-NAME, AND FILE-TYPE TO BE TRANSFERRED.
```

A:STAT.COM⟨cr⟩
FILE TRANSFER COMPLETED.
In the example above, the file STAT.COM was transferred from disk A through the auxiliary port.

HEXDUMP.COM will only transfer files which exist on drives A and B. If you enter an erroneous file-name or disk drive, the program will display an error message. If HEXDUMP.COM is unable to locate the given file, another error message will be given. When the transmission has completed, the screen will indicate this and return to the operating system.

64KTEST.COM

This program performs an extensive test on main memory by writing and reading all possible binary patterns to all locations in the random access memory (RAM). The process takes between eight and ten minutes to complete.

The test procedure begins by typing **64KTEST⟨cr⟩** at the keyboard. After the program is loaded into memory, you will be asked to remove all diskettes from their drives. If you have a Hard Disk Storage System connected to the terminal to be tested, either power down the hard disk or disconnect it from the terminal by removing the interconnecting cable. Be sure the Key Click feature is turned off before running the 64KTEST program. Otherwise, errors will be indicated that do not exist.

Once you have pressed the **G** key to start the test, the screen should fill with random text. The patterns on the screen should move around. This is because the memory for the screen is also undergoing the test. After the test is completed, the screen will display RAM OK, indicating that the test was successful. The test is an endless loop, and will repeat until the RED keys are depressed simultaneously. Therefore, you can test the RAM as long as you desire.

If an error is detected by the test, the test will stop and the audible tone will sound continuously. Should this occur, retry the test. If the error occurs frequently, please contact Intertec Customer Services Department.

TX.COM

The TX utility is written in standard CP/M assembly language. TX is designed to communicate via the computer's Main Port with the program RX running in the destination machine. Therefore, TX is considered the "Master" program, and RX is the "Slave" program. RX receives commands from TX such as "Open file", "Read incoming data block", "Write block to file", and so on. For this reason, the user should only be concerned with console operations for the machine in which TX is running. RX receives all directions from the communications link.

Unlike data transfer operations initiated with PIP, the TX/RX pair perform block verification, and retransmission in the event of error. TX/RX may be used to send any type of CP/M file without modification including .COM files.

TX is initiated by typing the command/ **TX⟨cr⟩**. The TX program will then "sign-on" with an identifying message and version number and then give the user an option to proceed or abort. The actual console dialogue appears as:

A > **TX⟨cr⟩**

INTERTEC File Transfer Utility Vers 1.X
HIT CR WHEN RECEIVE MACHINE READY OR Q TO ABORT

At this point, start up RX in the destination machine (See the RX.COM description that follows this TX description).

When a carriage return is entered to TX, it will attempt to establish a linkage to the destination RX machine over the computer's Main Port. Given that a link can be established, TX will display the message:

LINK TO SLAVE MACHINE ESTABLISHED

or, if many attempts to link fail:

UNABLE TO ESTABLISH/MAINTAIN DATA LINK

(This probably indicates that some aspect of the connection with the destination machine is not correct, i.e. inconsistent baud rates, improper cabling, or excessive line noise.)

The TX program then prompts the user to enter both the source file name and the destination file name. These names must be fully qualified, non-ambiguous file references. This includes disk specifiers.

If the specified file already exists on the receiving machine, TX will display:

FILE ALREADY EXISTS ON RECEIVING MACHINE

and the link is terminated.

As an expediency, send the file again, but with a temporary destination file name.

As a file is being transmitted under TX/RX, both TX and RX will display a record count. This serves to indicate that the data is being transferred correctly. It is normal to see a difference of one record between the two counts upon completion of a file transfer.

If TX detects a failure in the data link, it will output the message:

UNABLE TO ESTABLISH/MAINTAIN DATA LINK

When a file has been transmitted, TX displays the message:

FUNCTION COMPLETE
TYPE R TO REPEAT, CR TO EXIT

If another file is to be transferred, enter the letter **R** and TX will request another pair of file names. Entry of a carriage return will cause TX to command RX to shutdown and both will terminate.

There are two other messages that could be output by TX.

As each data block is sent, a checksum is calculated and transmitted. If RX detects a discrepancy between the received checksum and that which has been calculated for the received data, it will request that TX re-send the block in question. If the block cannot be received correctly after several re-transmissions, the message:

HARD DATA TRANSMISSION ERROR

will be rendered. The most likely cause of this failure is hardware error.

If the diskette on which RX attempts to place the incoming data file is write protected, or if there is not enough space to contain the incoming file, TX will display:

RECEIVE CANNOT CLOSE FILE

RX.COM

RX is an assembly language program designed to receive data files transmitted by TX from the computer's Main Port. It operates as a slave to the TX program, receiving commands from TX to perform operations on the destination machine.

RX is initiated by typing the command **RX⟨cr⟩**. Upon initiation, RX displays a "sign-on" message of the form:

INTERTEC File Transfer Utility Vers 1.X

From this point on, unless an error condition occurs, no further operator action is required.

As each data block is received, RX outputs a running count of the data blocks received. At the end of each received file, RX displays the message:

END-OF-FILE RECEIVED

When all files have been received, TX will command RX to terminate and RX will display:

LINK TERMINATED

If the data link cannot be established or maintained (indicated by a message on the TX system), it will be necessary to reset the destination system. This is accomplished on the destination computer by depressing both RED keys simultaneously.

TIME

The TIME program is used to set or display the time data kept by the real time clock. To set the time, enter:

A > **TIME hh:mm (AM)(PM)⟨cr⟩**

To enter "military" time (0000 thru 2400), it is not necessary to enter AM or PM. Once the entry is made, the TIME program will request that any key be depressed to set the time. This allows the user an opportunity to synchronize the time with another timepiece. To display the time, enter:

A > **TIME⟨cr⟩**

DATE

The DATE program is used to set or display the date maintained by the real time clock. To set the date, enter:

A > **DATE 04/07/82 WED⟨cr⟩**

or

A > **DATE 04/07/82 WEDNESDAY⟨cr⟩**

To display the date, enter:

A > **DATE⟨cr⟩**

SECONDARY CHARACTER SET OPTION

As was stated in the theory of operation section, the SuperBrain II provides a means by which a secondary character set option may be added. This gives the user the ability, via the software, to select either set. Intertec will provide a limited number of these alternate character sets, or if required, the customer may create a character set using software that is supplied by Intertec. In the following sections, both of these methods will be explained.

INTERTEC-FURNISHED SECONDARY CHARACTER SETS

The easiest and quickest way to have access to a secondary character set would be to purchase one of the sets available from Intertec. This character set would be contained on an EPROM that would be inserted into a vacant IC socket on the processor board. After the EPROM has been inserted into its socket, it can be initialized via the escape sequence given in the attribute program section. Secondary character set installation procedures will be provided with each set purchased from Intertec.

CUSTOMER CREATED SECONDARY CHARACTER SETS

For those requirements where Intertec does not offer a suitable secondary character set, one can be created by the user. The CP/M disk provided with the SuperBrain II contains two utility programs that provide the means for creating and verifying secondary character sets. These two programs are CSEDIT.COM and CSDUMP.COM.

CSEDIT.COM

The CSEDIT utility provides the means for creating a secondary character set. The program is loaded from the disk by typing **CSEDIT** and then pressing **RETURN**. The initial screen message will read:

SuperBrain II Character Set Editor — Ver 1.X

Enter the character set file name:

The new character set file name should then be entered in the normal format of ***filename.typ*** *and* then pressing **RETURN**. The next screen message will read:

Enter hex value of character to edit (0-7F, eXit, Quit, or ?)

As indicated by the parenthesis, there are four options (0-7F, eXit, Quit, or ?) available at this point. Since the "?" is the help page and will explain the other 3 entries, type **?** and press **RETURN**. The following page will appear on the screen:

The input required at this point is the hex value of the ASCII character that you wish to edit. This *value must be in the range of 00 to 7F hex. You may also enter a "X" to exit the program and* update the character set file, or a "Q" to abort the program and not update the character set file.

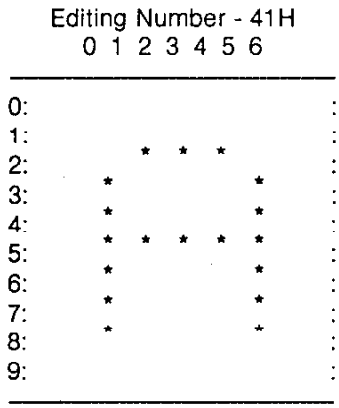
"0" — Clear dot at current position
"." — Put dot at current position
ENT — *Go to start of next line*
"-" — Clear current line
"1" — Invert pattern dots
"2" — Save pattern in temp. buffer
"3" — Recall previously saved pattern
"7" — *Clear character cell*
ESC — End editing of character
BRK — Abort with no change to character

SECONDARY CHARACTER SET OPTION (continued)

All cursor keys on the keypad work as would be expected.

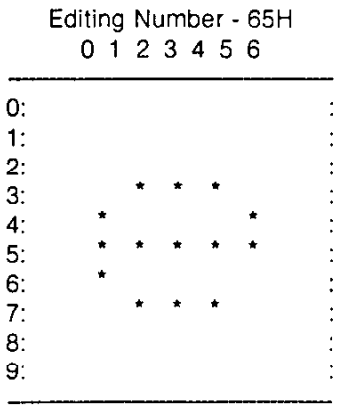
Hit **RETURN** to continue:

After reading the help page, pressing **RETURN** will cause the initial screen message of the program to reappear. At this time the user should be ready to start the process to create an alternate character set. The following examples are from the standard character set provided with the SuperBrain II.



"." — Put dot at current position
"_" — Clear current line
"1" — Invert pattern dots
"3" — Recall previously saved pattern
ESC — End editing of character

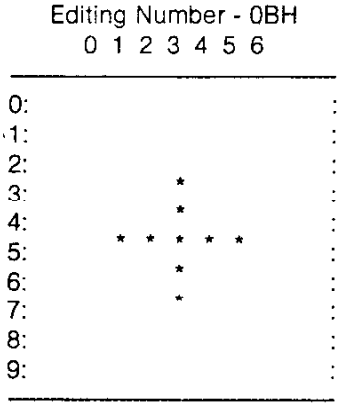
"0" — Clear dot at current position
ENT — Go to start of next line
"2" — Save pattern in temp. buffer
"7" — Clear character cell
BRK — Abort with no change to pattern



"." Put dot at current position
"_" — Clear current line
"1" — Invert pattern dots
"3" — Recall previously saved pattern
ESC — End editing of character

"0" — Clear dot at current position
ENT — Go to start of next line
"2" — Save pattern in temp. buffer
"7" — Clear character cell
BRK — Abort with no change to pattern

SECONDARY CHARACTER SET OPTION (continued)



"." — Put dot at current position
"_" — Clear current line
"1" — Invert pattern dots
"3" — Recall previously saved pattern
ESC — End editing of character
"0" — Clear dot at current position
ENT — Go to start of next line
"2" — Save pattern in temp. buffer
"7" — Clear character cell
BRK — Abort with no change to pattern

After all the secondary characters have been created, by typing "X" and pressing RETURN, the new character set will be written on the disk as a binary file and the verification process can begin.

CSDUMP.COM

The CSDUMP utility will be used to verify that the character set that was just created is what is needed. To run the CSDUMP program, insure the SuperBrain II is connected to a printer via the Auxiliary port. The printer is the only output device that will display the dump. Once this is accomplished, type **CSDUMP**, and press the **RETURN** key. The following message will appear on the screen.

SuperBrain II Character Set Dump - Ver 1.X

Enter character set file name :

Enter the file name and press the **RETURN** key. The character set will be dumped out to the printer and the resulting page set should look similar to the one shown on the Sample Page — Character Set Dump exhibit.

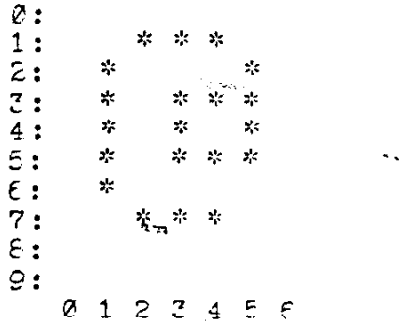
The character file generated by this procedure can then be transferred to an EPROM programming machine using the HEXDUMP.COM utility. Once the EPROM has been created, it should then be inserted into the empty IC socket Z75, as indicated in the Socket Z75 exhibit. The initialization of the new character set is contained in the Escape Sequence covered in the Attribute section of this manual.

The part numbers for the blank EPROM are, Intertec part number 30122516 or Texas Instruments part number TMS-2516JL-35 or equivalent.

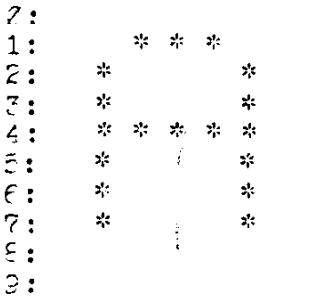
Any questions concerning Intertec created secondary character sets or the procedures or materials necessary to create secondary character sets should be referred to the Customer Services Department at Intertec Data Systems Corporate Headquarters.

SAMPLE PAGE — CHARACTER SET DUMP EXHIBIT

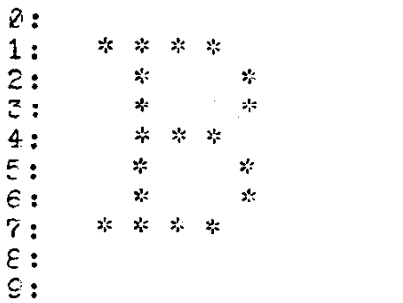
File Name : A:STISET



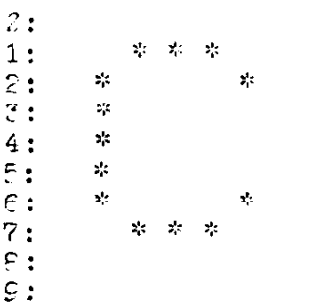
ASCII value - 40h



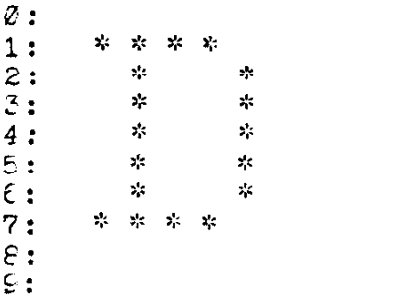
ASCII value - 41h



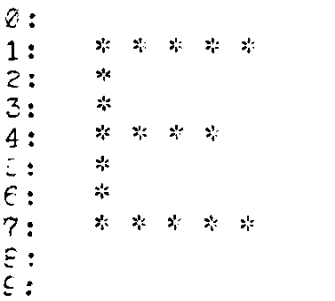
ASCII value - 42h



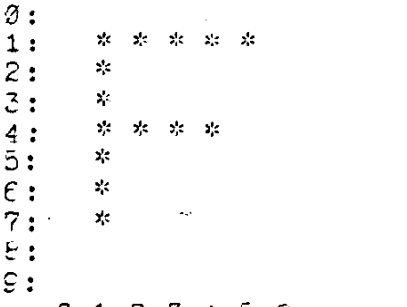
ASCII value - 43h



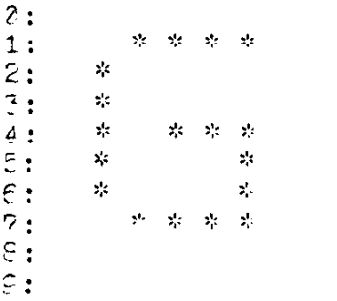
ASCII value - 44h



ASCII value - 45h

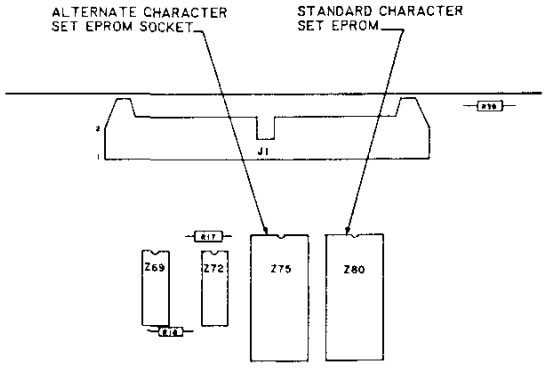


ASCII value - 46h



ASCII value - 47h

SOCKET Z75 EXHIBIT



MISCELLANEOUS OPERATIONAL INFORMATION

USING THE "INP:" AND "OUT:" FEATURES OF PIP

Files can be transferred using the PIP program as described in the SuperBrain II manual section entitled 'An Introduction to CP/M-Features and Facilities.' The SuperBrain II is equipped with two RS232C Serial interface ports (labeled 'MAIN' and 'AUX' on the rear panel). Whenever the SuperBrain II transmits serial data via the 'MAIN' port, the destination is designated as a punch (PUN:); when receiving, the data source device is considered a reader (RDR:). When transmitting data to the 'AUX' port, the destination device is considered a list (LST:).

The 'MAIN' serial port may also be considered as an input (INP:) or output (OUT:) device. When used in this mode, the operator has the option of communicating with the sending or receiving device prior to file transfer by means of the SuperBrain II console. This interface is factory programmed for the following operational mode:

Asynchronous Communication
1200 Baud Rate
8 Bit Character Length
1 Stop Bit
No Parity
DSR Disabled

Files transferred via the 'MAIN' port must be in Intel 'HEX' or ASCII format. BASIC source programs must be saved in ASCII format before they can be transferred. Binary files (i.e., programs) must be transferred as HEX files, using the program HEXDUMP.COM.

PLEASE NOTE THE FOLLOWING:

1) Connect the SuperBrain II 'MAIN' port to the console input of the host computer. Make certain that the host computer and the SuperBrain are sending and receiving data in a compatible fashion (i.e., baud rate, character length, et.al.).

2) The largest file that can be transferred by PIP is 25K. If files are larger than 25K, they must be broken down into smaller segments of 25K or less.

3) Binary files (or .COM files) cannot be transferred via the serial ports using PIP. The DOS Diskette supplied with your SuperBrain II includes two facilities for binary file transfer. See TX/RX and HEXDUMP for more information.

4) The Clear-to-Send (CTS - Pin 5) line on the 'MAIN' port must be high (logical '1') before the SuperBrain II will send data through this port. Insure that these signals are properly connected between SuperBrain II and the host computer.

5) The 'MAIN' port is arranged so that the SuperBrain II appears as a processor rather than a terminal. If it is to be used as a terminal, pins 2 and 3 in the RS-232-C cable must be interchanged.

The following represents a sample file transfer session. Please note that bold characters are those typed by the operator, and the symbol '(cr)' means the 'RETURN' key.

A. Transfer an ASCII file from SuperBrain II to host computer:

(File name is ABC.FIL)

A>**PIP OUT: = ABC.FIL**<cr>
ECHO (Y/N) **Y**

NOTE — The SuperBrain II will now perform as a terminal for the host computer. If you wish, you may transmit a line of text to the host computer before the file ABC.FIL is actually transferred. Anything typed at the console will be sent to the host computer. To initiate the file transfer, type Control-B.

Control-B (Hold down the CTRL Key, then 'B')

The file will be transferred, and should be displayed on the screen. Upon completion, PIP will exit and return to the operating system. When finished, it is necessary to signal end-of-file for the host computer. This is best done by using the EOF: facility of PIP:

A>**PIP OUT:=EOF:**⟨cr⟩
ECHO (Y/N) **Y**
+
CTRL B (Hold down the CTRL key, then 'B')

NOTE — The EOF presumes that the target machine uses a hex 1A (CTRL-Z) to indicate end of file.

The file transfer is now complete.

B. Transfer an ASCII file to the SuperBrain II from the host computer:

(File name is ABC.FIL)

A>**PIP ABC.PRN = INP:**⟨cr⟩
ECHO (Y/N) **Y**

The SuperBrain II is now ready to receive input from the host computer. Any further console entry at the SuperBrain II will be sent to the host computer. If the host computer does not send an end-of-file character, it will be necessary for you to place one into the file. This is done with the following command:

Control Z (Hold down the CTRL key, then 'Z')
End of File, Control Z? (The computer asks for confirmation)
Control Z (Hold down the CTRL key, then 'Z')

C. Transfer a Binary (or COM) file.

PIP does not permit binary files to be transferred via the serial port. Two system utilities, HEXDUMP and TX/RX, are provided to facilitate this. HEXDUMP will convert a binary file into a HEX format, and transmit out the 'MAIN' port. If HEXDUMP is used, the receiving unit must use PIP to accept the input from the sending unit. After the file transfer, the file can be converted back into a binary file using the DDT system program or the LOAD system program.

SYNCHRONOUS COMMUNICATION

Your computer system is factory configured to program the Universal Synchronous/Asynchronous Receiver/Transmitter (USART) to operate in the asynchronous mode. It is possible, however, to change this and permit the synchronous communication mode. You will be responsible for writing the software drivers that send and receive synchronous data through to the MAIN port at the rear of your terminal. This section will

instruct you to properly program the USART which is the interface between the CPU and the main port of your computer.

Before proceeding, it would be helpful to read the specifications sheets for the 8251-type USART. On these sheets you are given the control words to reprogram the USART to enable synchronous communication. It is important that the timing dipswitch, located on the processor board, be properly set. This is necessary to coordinate the clock pulses between the two terminals communicating in the synchronous mode.

The SuperBrain II computer system stores the command byte for the 8251 USART in memory. To use a different type of communication, several steps are necessary. The USART command word must be changed in order to change the USART's operating mode. The operating system must also be prevented from resetting the USART during an interrupt cycle.

SuperBrain II Serial Communications DIPSWITCH

The serial communication DIP switch is located on the Keyboard/CPU printed circuit board inside the cabinet. It is accessed by removing the four screws from the bottom of the base that holds the cover in place. Next, make sure that the disk drive doors are closed, then lift off the cover. This will expose the Keyboard/CPU Module. The Dip switch is a five position switch on the top edge of the Keyboard/CPU Module. It is the only user settable switch on this module.

NOTE: When completing the procedures above, you may encounter a warranty certification seal. The seal will be positioned over one of the four bottom cover screws and clearly displays the warning, WARRANTY IS VOID IF LABEL REMOVED. This seal should not be removed if you intend to participate in any of Intertec's Satisfaction Assurance programs. Once this seal has been removed, the unit no longer qualifies for participation within these programs. For additional information concerning Intertec's Satisfaction Assurance programs, contact Intertec's Customer Services Department.

For the normal mode (*asynchronous communication mode), these switches should be set as follows:

1 — OFF, 2 — OFF, 3 — ON, 4 — ON, 5 — OFF

For the synchronous communication mode with another unit providing the transmitter and receiver clock, the switches should be set as follows:

1 — ON, 2 — ON, 3 — OFF, 4 — OFF, 5 — OFF

Listed below is a brief description of the function of each of these switches:

1 — External Clock to transmitter section of MAIN USART — originates from PIN #15 on MAIN RS232 connector at rear of terminal.

2 — External Clock to receiver section of MAIN USART — originates from PIN #17 on MAIN RS232 connector at rear of terminal.

3 — Internal TX Clock to MAIN USART — When on, this switch enables the built-in baud rate generator (Western Digital BR-1941).

NOTE: When this switch is in the 'ON' position, switch 1 **MUST** be in the 'OFF' position.

*THE SWITCHES WERE SET FOR THE ASYNCHRONOUS COMMUNICATION MODE BEFORE SHIPPING FROM THE FACTORY.

4— Internal RX Clock to MAIN USART — When this switch is in the 'ON' position, switch 2 **MUST** be in the 'OFF' position.

5— Internal Baud Clock to MAIN Port — This switch enables the transmission of the internal baud rate clock (Western Digital BR-1941) to the main RS232 port — this signal will also appear on PIN #24 of the main port when this switch is in the 'ON' position. If this switch is not used; it should be left in the 'OFF' position to avoid any possible conflict with external RS232 signals.

8251A/S2657
PROGRAMMABLE COMMUNICATION INTERFACE

- Synchronous and Asynchronous Operation
- Synchronous 5-8 Bit Characters; Internal or External Character Synchronization; Automatic Sync Insertion
- Asynchronous 5-8 Bit Characters; Clock Rate—1, 16 or 64 Times Baud Rate; Break Character Generation; 1, 1½, or 2 Stop Bits; False Start Bit Detection; Automatic Break Detect and Handling
- Synchronous Baud Rate — DC to 64K Baud
- Asynchronous Baud Rate — DC to 19.2K Baud
- Full Duplex, Double Buffered, Transmitter and Receiver
- Error Detection — Parity, Overrun and Framing
- Fully Compatible with 8080/8085 CPU
- 28-Pin DIP Package
- All Inputs and Outputs are TTL Compatible
- Single +5V Supply
- Single TTL Clock

Section 4

The Intel® 8251A is the enhanced version of the industry standard, Intel® 8251 Universal Synchronous/Asynchronous Receiver/Transmitter (USART), designed for data communications with Intel's new high performance family of microprocessors such as the 8085. The 8251A is used as a peripheral device and is programmed by the CPU to operate using virtually any serial data transmission technique presently in use (including IBM "bi-sync"). The USART accepts data characters from the CPU in parallel format and then converts them into a continuous serial data stream for transmission. Simultaneously, it can receive serial data streams and convert them into parallel data characters for the CPU. The USART will signal the CPU whenever it can accept a new character for transmission or whenever it has received a character for the CPU. The CPU can read the complete status of the USART at any time. These include data transmission errors and control signals such as SYNDET, TxEMPTY. The chip is constructed using N-channel silicon gate technology.

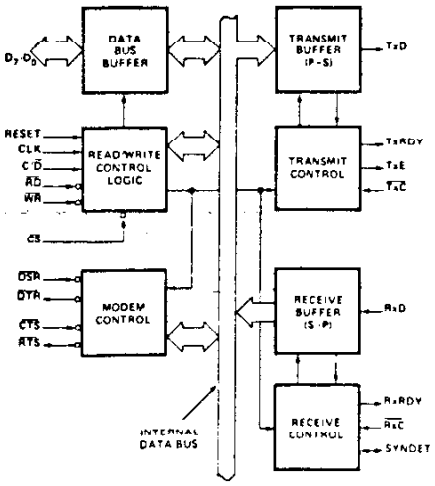


Figure 1. Block Diagram

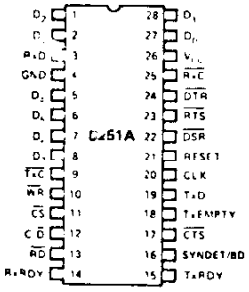


Figure 2. Pin Configuration

FEATURES AND ENHANCEMENTS

8251A is an advanced design of the industry standard USART, the Intel® 8251. The 8251A operates with an extended range of Intel microprocessors that includes the new 8085 CPU and maintains compatibility with the 8251. Familiarization time is minimal because of compatibility and involves only knowing the additional features and enhancements, and reviewing the AC and DC specifications of the 8251A.

The 8251A incorporates all the key features of the 8251 and has the following additional features and enhancements:

- 8251A has double-buffered data paths with separate I/O registers for control, status, Data In, and Data Out, which considerably simplifies control programming and minimizes CPU overhead.
- In asynchronous operations, the Receiver detects and handles "break" automatically, relieving the CPU of this task.
- A refined Rx initialization prevents the Receiver from starting when in "break" state, preventing unwanted interrupts from a disconnected USART.
- At the conclusion of a transmission, TxD line will always return to the marking state unless SBRK is programmed.
- Tx Enable logic enhancement prevents a Tx Disable command from halting transmission until all data previously written has been transmitted. The logic also prevents the transmitter from turning off in the middle of a word.
- When External Sync Detect is programmed, Internal Sync Detect is disabled, and an External Sync Detect status is provided via a flip-flop which clears itself upon a status read.
- Possibility of false sync detect is minimized by ensuring that if double character sync is programmed, the characters be contiguously detected and also by clearing the Rx register to all ones whenever Enter Hunt command is issued in Sync mode.
- As long as the 8251A is not selected, the RD and WR do not affect the internal operation of the device.
- The 8251A Status can be read at any time but the status update will be inhibited during status read.
- The 8251A is free from extraneous glitches and has enhanced AC and DC characteristics, providing higher speed and better operating margins.
- Synchronous Baud rate from DC to 64K.
- Fully compatible with Intel's new industry standard, the MCS-85.

FUNCTIONAL DESCRIPTION

General

The 8251A is a Universal Synchronous/Asynchronous Receiver/Transmitter designed specifically for the 80/85 Microcomputer Systems. Like other I/O devices in a Microcomputer System, its functional configuration is programmed by the system's software for maximum flexibility. The 8251A can support virtually any serial data technique currently in use (including IBM "bi-sync").

In a communication environment an interface device must convert parallel format system data into serial format for transmission and convert incoming serial format data into parallel system data for reception. The interface device must also delete or insert bits or characters that are functionally unique to the communication technique. In essence, the interface should appear "transparent" to the CPU, a simple input or output of byte-oriented system data.

Data Bus Buffer

This 3-state, bidirectional, 8-bit buffer is used to interface the 8251A to the system Data Bus. Data is transmitted or received by the buffer upon execution of INput or OUTput instructions of the CPU. Control words, Command words and Status information are also transferred through the Data Bus Buffer. The command status and data in, and data out are separate 8-bit registers to provide double buffering.

This functional block accepts inputs from the system Control bus and generates control signals for overall device operation. It contains the Control Word Register and Command Word Register that store the various control formats for the device functional definition.

RESET (Reset)

A "high" on this input forces the 8251A into an "Idle" mode. The device will remain at "Idle" until a new set of control words is written into the 8251A to program its functional definition. Minimum RESET pulse width is 6 t_{CY} (clock must be running).

CLK (Clock)

The CLK input is used to generate internal device timing and is normally connected to the Phase 2 (TTL) output of the 8224 Clock Generator. No external inputs or outputs are referenced to CLK but the frequency of CLK must be greater than 30 times the Receiver or Transmitter data bit rates.

$\overline{WR}$ (Write)

A "low" on this input informs the 8251A that the CPU is writing data or control words to the 8251A.

$\overline{RD}$ (Read)

A "low" on this input informs the 8251A that the CPU is reading data or status information from the 8251A.

C/$\overline{D}$ (Control/Data)

This input, in conjunction with the $\overline{WR}$ and $\overline{RD}$ inputs, informs the 8251A that the word on the Data Bus is either a data character, control word or status information.
1 = CONTROL/STATUS 0 = DATA

$\overline{CS}$ (Chip Select)

A "low" on this input selects the 8251A. No reading or writing will occur unless the device is selected. When $\overline{CS}$ is high, the Data Bus in the float state and $\overline{RD}$ and $\overline{WR}$ will have no effect on the chip.

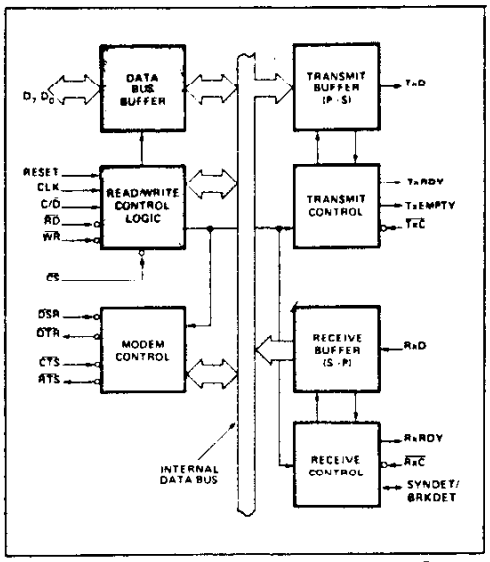


Figure 3. 8251A Block Diagram Showing Data Bus Buffer and Read/Write Logic Functions

C/$\overline{D}$	$\overline{RD}$	$\overline{WR}$	$\overline{CS}$	
0	0	1	0	8251A DATA → DATA BUS
0	1	0	0	DATA BUS → 8251A DATA
1	0	1	0	STATUS → DATA BUS
1	1	0	0	DATA BUS → CONTROL
X	1	1	0	DATA BUS → 3-STATE
X	X	X	1	DATA BUS → 3-STATE

Modem Control

The 8251A has a set of control inputs and outputs that can be used to simplify the interface to almost any Modem. The Modem control signals are general purpose in nature and can be used for functions other than Modem control, if necessary.

$\overline{DSR}$ (Data Set Ready)

The $\overline{DSR}$ input signal is a general purpose, 1-bit inverting input port. Its condition can be tested by the CPU using a *Status Read operation. The $\overline{DSR}$ input is normally used to* test Modem conditions such as Data Set Ready.

$\overline{DTR}$ (Data Terminal Ready)

The $\overline{DTR}$ output signal is a general purpose, 1-bit inverting output port. It can be set "low" by programming the appropriate bit in the Command Instruction word. The $\overline{DTR}$ output signal is normally used for Modem control such as *Data Terminal Ready or Rate Select.*

$\overline{RTS}$ (Request to Send)

The $\overline{RTS}$ output signal is a general purpose, 1-bit inverting output port. It can be set "low" by programming the appropriate bit in the Command Instruction word. The $\overline{RTS}$ output signal is normally used for Modem control such as Request to Send.

$\overline{CTS}$ (Clear to Send)

A "low" on this input enables the 8251A to transmit serial data if the Tx Enable bit in the Command byte is set to a "one." If either a Tx Enable off or CTS off condition occurs while the Tx is in operation, the Tx will transmit all the data in the USART, written prior to Tx *Disable command before shutting down. On the 8251A/* S2657 if CTS off or Tx Enable off condition occurs before the last character written appears in the serial bit stream, that character will be transmitted again upon CTS on or Tx Enable on condition.

Transmitter Buffer

The Transmitter Buffer accepts parallel data from the Data *Bus Buffer, converts it to a serial bit stream, inserts the* appropriate characters or bits (based on the communication technique) and outputs a composite serial stream of data on the TxD output pin on the falling edge of $\overline{TxC}$. The transmitter will begin transmission upon being enabled if $\overline{CTS}$ = 0. The TxD line will be held in the marking state immediately upon a master Reset or when Tx Enable/ $\overline{CTS}$ off or TxEMPTY.

Transmitter Control

The transmitter Control manages all activities associated with the transmission of serial data. It accepts and issues signals both externally and internally to accomplish this function.

TxRDY (Transmitter Ready)

This output signals the CPU that the transmitter is ready to accept a data character. The TxRDY output pin can be used as an interrupt to the system, since it is masked by Tx Disabled, or, for Polled operation, the CPU can check TxRDY using a Status Read operation. TxRDY is automatically reset by the leading edge of $\overline{WR}$ when a data character is loaded from the CPU.

Note that when using the Polled operation, the TxRDY status bit is *not* masked by Tx Enabled, but will only indicate the Empty/Full Status of the Tx Data Input Register.

TxE (Transmitter Empty)

When the 8251A has no characters to transmit, the TxEMPTY output will go "high". It resets automatically upon re*ceiving a character from the CPU if the transmitter is* enabled. TxEMPTY can be used to indicate the end of a transmission mode, so that the CPU "knows" when to "turn the line around" in the half-duplexed operational mode.

In SYNChronous mode, a "high" on this output indicates that a character has not been loaded and the SYNC character or characters are about to be or are being transmitted *automatically as "fillers". TxEMPTY does not go low* when the SYNC characters are being shifted out.

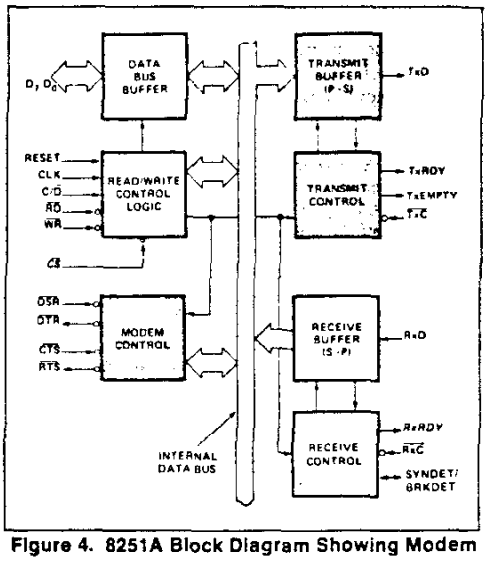


Figure 4. 8251A Block Diagram Showing Modem and Transmitter Buffer and Control *Functions*

$\overline{TxC}$ (Transmitter Clock)

The Transmitter Clock contro s the rate at which the character is to be transmitted. In the Synchronous transmission mode, the Baud Rate (1x) is equal to the $\overline{TxC}$ frequency. In Asynchronous transmission mode the baud rate is a fraction of the actual $\overline{TxC}$ frequency. *A portion of the* mode instruction selects this factor; it can be 1, 1/16 or 1/64 the $\overline{TxC}$.

For Example:

If Baud Rate equals 110 Baud,
$\overline{TxC}$ equals 110 Hz (1x)
$\overline{TxC}$ *equals 1.76 kHz (16x)*
$\overline{TxC}$ equals 7.04 kHz (64x).

The falling edge of $\overline{TxC}$ shifts the serial data out of the 8251A.

Receiver Buffer

The Receiver accepts serial data, converts this serial input to parallel format, checks for bits or characters that are unique to the communication technique and sends an "assembled" character to the CPU. Serial data is input to RxD pin, and is clocked in on the rising edge of $\overline{RxC}$.

Receiver Control

This functional block manages all receiver-related activities which consist of the following features:

The RxD initialization circuit prevents the 8251A from mistaking an unused input line for an active low data line in the "break condition". Before starting to receive serial characters on the RxD line, a valid "1" must first be detected after a chip master Reset. Once this has been determined, a search for a valid low (Start bit) is enabled. This feature is only active in the asynchronous mode, and is only done once for each master Reset.

The False Start bit detection circuit prevents false starts due to a transient noise spike by first detecting the falling edge and then strobing the nominal center of the Start bit (RxD = low).

The Parity Toggle F/F and Parity Error F/F circuits are used for parity error detection and set the corresponding status bit.

The Framing Error Flag F/F is set if the Stop bit is absent at the end of the data byte (asynchronous mode), and also sets the corresponding status bit.

RxRDY (Receiver Ready)

This output indicates that the 8251A contains a character that is ready to be input to the CPU. Rx RDY can be connected to the interrupt structure of the CPU or, for Polled operation, the CPU can check the condition of RxRDY using a Status Read operation.

Rx Enable off both masks and holds RxRDY in the Reset Condition. For Asynchronous mode, to set RxRDY, the Receiver must be Enabled to sense a Start Bit and a complete character must be assembled and transferred to the Data Output Register. For Synchronous mode, to set RxRDY, the Receiver must be enabled and a character must finish assembly and be transferred to the Data Output Register.

Failure to read the received character from the Rx Data Output Register prior to the assembly of the next Rx Data character will set overrun condition error and the previous character will be written over and lost. If the Rx Data is being read by the CPU when the internal transfer is occurring, overrun error will be set and the old character will be lost.

$\overline{RxC}$ (Receiver Clock)

The Receiver Clock controls the rate at which the character is to be received. In Synchronous Mode, the Baud Rate (1x) is equal to the actual frequency of $\overline{RxC}$. In Asynchronous Mode, the Baud Rate is a fraction of the actual $\overline{RxC}$ frequency. A portion of the mode instruction selects this factor; 1, 1/16 or 1/64 the $\overline{RxC}$.

For Example:

Baud Rate equals 300 Baud, if
$\overline{RxC}$ equals 300 Hz (1x)
$\overline{RxC}$ equals 4800 Hz (16x)
$\overline{RxC}$ equals 19.2 kHz (64x).

Baud Rate equals 2400 Baud, if
$\overline{RxC}$ equals 2400 Hz (1x)
$\overline{RxC}$ equals 38.4 kHz (16x)
$\overline{RxC}$ equals 153.6 kHz (64x).

Data is sampled into the 8251A on the rising edge of $\overline{RxC}$.

NOTE: In most communications systems, the 8251A will be handling both the transmission and reception operations of a single link. Consequently, the Receive and Transmit Baud Rates will be the same. Both $\overline{TxC}$ and $\overline{RxC}$ will require identical frequencies for this operation and can be tied together and connected to a single frequency source (Baud Rate Generator) to simplify the interface.

SYNDET (SYNC Detect)/BRKDET (Break Detect)

This pin is used in SYNChronous Mode for SYNDET and may be used as either input or output, programmable through the Control Word. It is reset to output mode low upon RESET. When used as an output (internal Sync mode), the SYNDET pin will go "high" to indicate that the 8251A has located the SYNC character in the Receive mode. If the 8251A is programmed to use double Sync characters (bisync), then SYNDET will go "high" in the middle of the last bit of the second Sync character. SYNDET is automatically reset upon a Status Read operation.

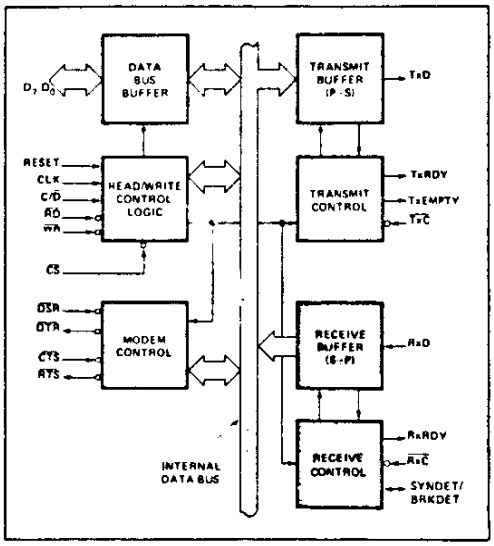


Figure 5. 8251A Block Diagram Showing Receiver Buffer and Control Functions

When used as an input (external SYNC detect mode), a positive going signal will cause the 8251A to start assembling data characters on the rising edge of the next $\overline{RxC}$. Once in SYNC, the "high" input signal can be removed. When External SYNC Detect is programmed, the Internal SYNC Detect is disabled.

BREAK DETECT (Async Mode Only)

This output will go high whenever the receiver remains low through two consecutive stop bit sequences (including the start bits, data bits, and parity bits). Break Detect may also be read as a Status bit. It is reset only upon a master chip Reset or Rx Data returning to a "one" state.

NOTE: On the 8251A/S2657, if the RxData returns to a "one" state during the last bit of the next character after the break, break detect will latch-up, and the device must be cleared by a Chip Reset.

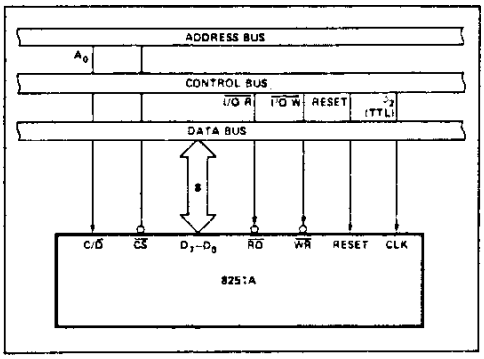


Figure 6. 8251A Interface to 8080 Standard System Bus

DETAILED OPERATION DESCRIPTION

General

The complete functional definition of the 8251A is programmed by the system's software. A set of control words must be sent out by the CPU to initialize the 8251A to support the desired communications format. These control words will program the: BAUD RATE, CHARACTER LENGTH, NUMBER OF STOP BITS, SYNCHRONOUS or ASYNCHRONOUS OPERATION, EVEN/ODD/OFF PARITY, etc. In the Synchronous Mode, options are also provided to select either internal or external character synchronization.

Once programmed, the 8251A is ready to perform its communication functions. The TxRDY output is raised "high" to signal the CPU that the 8251A is ready to receive a data character from the CPU. This output (TxRDY) is reset automatically when the CPU writes a character into the 8251A. On the other hand, the 8251A receives serial data from the MODEM or I/O device. Upon receiving an entire character, the RxRDY output is raised "high" to signal the CPU that the 8251A has a complete character ready for the CPU to fetch. RxRDY is reset automatically upon the CPU data read operation.

The 8251A cannot begin transmission until the Tx Enable (Transmitter Enable) bit is set in the Command Instruction and it has received a Clear To Send ($\overline{CTS}$) input. The TxD output will be held in the marking state upon Reset.

Programming the 8251A

Prior to starting data transmission or reception, the 8251A must be loaded with a set of control words generated by the CPU. These control signals define the complete functional definition of the 8251A and must immediately follow a Reset operation (internal or external).

The control words are split into two formats:

1. Mode Instruction
2. Command Instruction

Mode Instruction

This format defines the general operational characteristics of the 8251A. It must follow a Reset operation (internal or external). Once the Mode Instruction has been written into the 8251A by the CPU, SYNC characters or Command Instructions may be inserted.

Command Instruction

This format defines a status word that is used to control the actual operation of the 8251A.

Both the Mode and Command Instructions must conform to a specified sequence for proper device operation. The Mode Instruction must be inserted immediately following a Reset operation, prior to using the 8251A for data communication.

All control words written into the 8251A after the Mode Instruction will load the Command Instruction. Command Instructions can be written into the 8251A at any time in the data block during the operation of the 8251A. To return to the Mode Instruction format, the master Reset bit in the Command Instruction word can be set to initiate an internal Reset operation which automatically places the 8251A back into the Mode Instruction format. Command Instructions must follow the Mode Instructions or Sync characters.

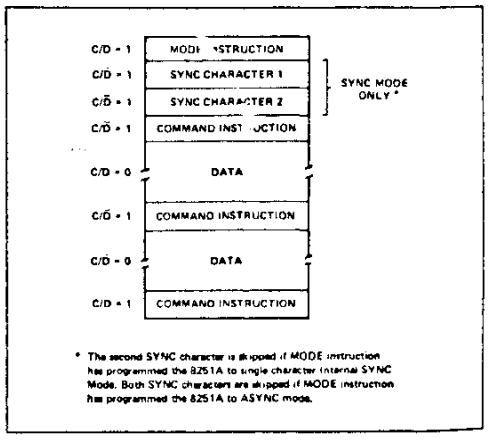


Figure 7. Typical Data Block

Mode Instruction Definition

The 8251A can be used for either Asynchronous or Synchronous data communication. To understand how the Mode Instruction defines the functional operation of the 8251A, the designer can best view the device as two separate components sharing the same package, one Asynchronous the other Synchronous. The format definition can be changed only after a master chip Reset. For explanation purposes the two formats will be isolated.

NOTE: When parity is enabled it is not considered as one of the data bits for the purpose of programming the word length. The actual parity bit received on the Rx Data line cannot be read on the Data Bus. In the case of a programmed character length of less than 8 bits, the least significant Data Bus bits will hold the data; unused bits are "don't care" when writing data to the 8251A, and will be "zeros" when reading the data from the 8251A.

Asynchronous Mode (Transmission)

Whenever a data character is sent by the CPU the 8251A automatically adds a Start bit (low level) followed by the data bits (least significant bit first), and the programmed number of Stop bits to each character. Also, an even or odd Parity bit is inserted prior to the Stop bit(s), as defined by the Mode Instruction. The character is then transmitted as a serial data stream on the TxD output. The serial data is shifted out on the falling edge of $\overline{TxC}$ at a rate equal to 1, 1/16, or 1/64 that of the $\overline{TxC}$, as defined by the Mode Instruction. BREAK characters can be continuously sent to the TxD if commanded to do so.

When no data characters have been loaded into the 8251A the TxD output remains "high" (marking) unless a Break (continuously low) has been programmed.

Asynchronous Mode (Receive)

The RxD line is normally high. A falling edge on this line triggers the beginning of a START bit. The validity of this START bit is checked by again strobing this bit at its nominal center (16X or 64X mode only). If a low is detected again, it is a valid START bit, and the bit counter will start counting. The bit counter thus locates the center of the data bits, the parity bit (if it exists) and the stop bits. If parity error occurs, the parity error flag is set. Data and parity bits are sampled on the RxD pin with the rising edge of $\overline{RxC}$. If a low level is detected as the STOP bit, the Framing Error flag will be set. The STOP bit signals the end of a character. Note that the *receiver* requires only *one* stop bit, regardless of the number of stop bits programmed. This character is then loaded into the parallel I/O buffer of the 8251A. The RxRDY pin is raised to signal the CPU that a character is ready to be fetched. If a previous character has not been fetched by the CPU, the present character replaces it in the I/O buffer, and the OVERRUN Error flag is raised (thus the previous character is lost). All of the error flags can be reset by an Error Reset Instruction. The occurrence of any of these errors will not affect the operation of the 8251A.

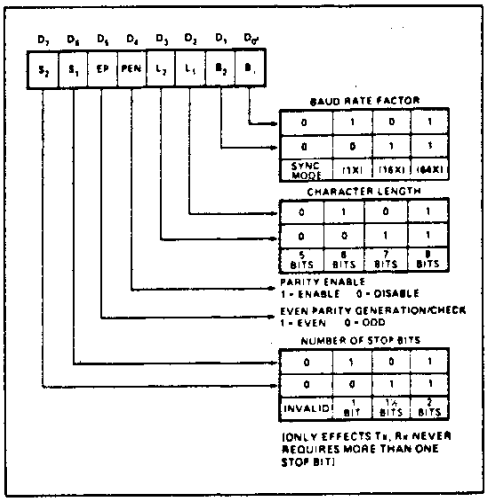


Figure 8. Mode Instruction Format, Asynchronous Mode

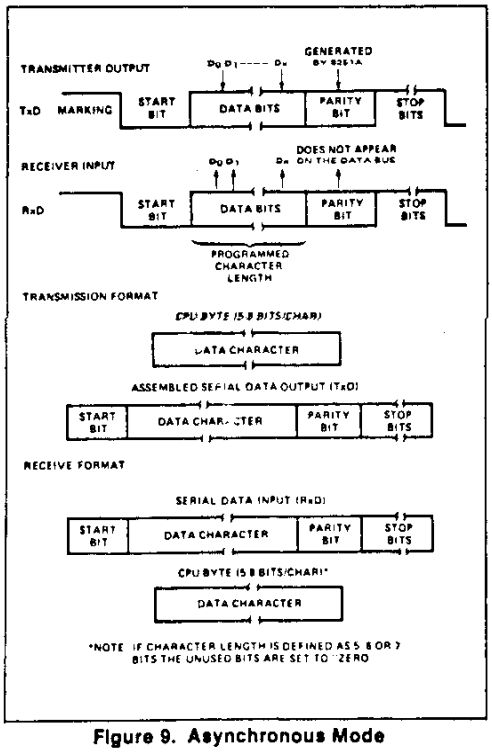
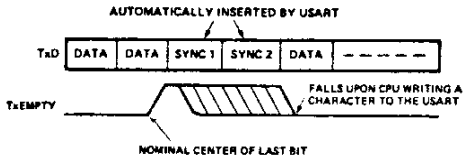


Figure 9. Asynchronous Mode

Synchronous Mode (Transmission)

The TxD output is continuously high until the CPU sends its first character to the 8251A which usually is a SYNC character. When the $\overline{CTS}$ line goes low, the first character is serially transmitted out. All characters are shifted out on the falling edge of $\overline{TxC}$. Data is shifted out at the same rate as the $\overline{TxC}_{rate}$.

Once transmission has started, the data stream at the TxD output must continue at the $\overline{TxC}$ rate. If the CPU does not provide the 8251A with a data character before the 8251A Transmitter Buffers become empty, the SYNC characters (or character if in single SYNC character mode) will be automatically inserted in the TxD data stream. In this case, the TxEMPTY pin is raised high to signal that the 8251A is empty and SYNC characters are being sent out. TxEMPTY does not go low when the SYNC is being shifted out (see figure below). The TxEMPTY pin is internally reset by a data character being written into the 8251A.



Synchronous Mode (Receive)

In this mode, character synchronization can be internally or externally achieved. If the SYNC mode has been programmed, ENTER HUNT command should be included in the first command instruction word written. Data on the RxD pin is then sampled in on the rising edge of $\overline{RxC}$. The content of the Rx buffer is compared at every bit boundary with the first SYNC character until a match occurs. If the 8251A has been programmed for two SYNC characters, the subsequent received character is also compared; when both SYNC characters have been detected, the USART ends the HUNT mode and is in character synchronization. The SYNDET pin is then set high, and is reset automatically by a STATUS READ. If parity is programmed, SYNDET will not be set until the middle of the parity bit instead of the middle of the last data bit.

In the external SYNC mode, synchronization is achieved by applying a high level on the SYNDET pin, thus forcing the 8251A out of the HUNT mode. The high level can be removed after one $\overline{RxC}$ cycle. An ENTER HUNT command has no effect in the asynchronous mode of operation.

Parity error and overrun error are both checked in the same way as in the Asynchronous Rx mode. Parity is checked when not in Hunt, regardless of whether the Receiver is enabled or not.

The CPU can command the receiver to enter the HUNT mode if synchronization is lost. This will also set all the used character bits in the buffer to a "one", thus preventing a possible false SYNDET caused by data that happens to be in the Rx Buffer at ENTER HUNT time. Note that the SYNDET F/F is reset at each Status Read, regardless of whether internal or external SYNC has been programmed. This does not cause the 8251A to return to the HUNT mode. When in SYNC mode, but not in HUNT, Sync Detection is still functional, but only occurs at the "known" word boundaries. Thus, if one Status Read indicates SYNDET and a second Status Read also indicates SYNDET, then the programmed SYNDET characters have been received since the previous Status Read. (If double character sync has been programmed, then both sync characters have been contiguously received to gate a SYNDET indication.) When external SYNDET mode is selected, internal Sync Detect is disabled, and the SYNDET F/F may be set at any bit boundary.

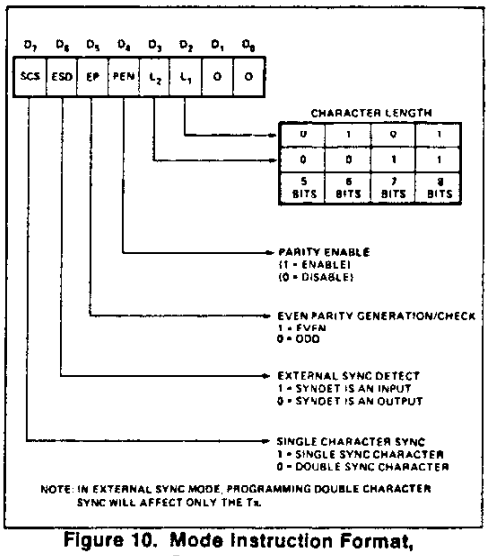


Figure 10. Mode Instruction Format, Synchronous Mode

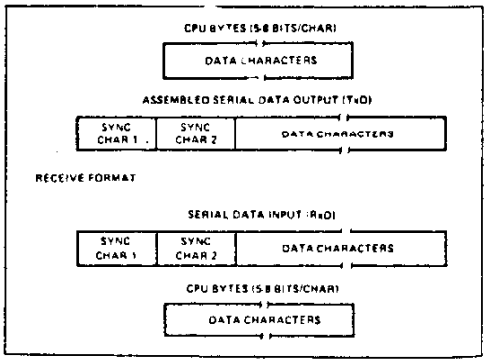


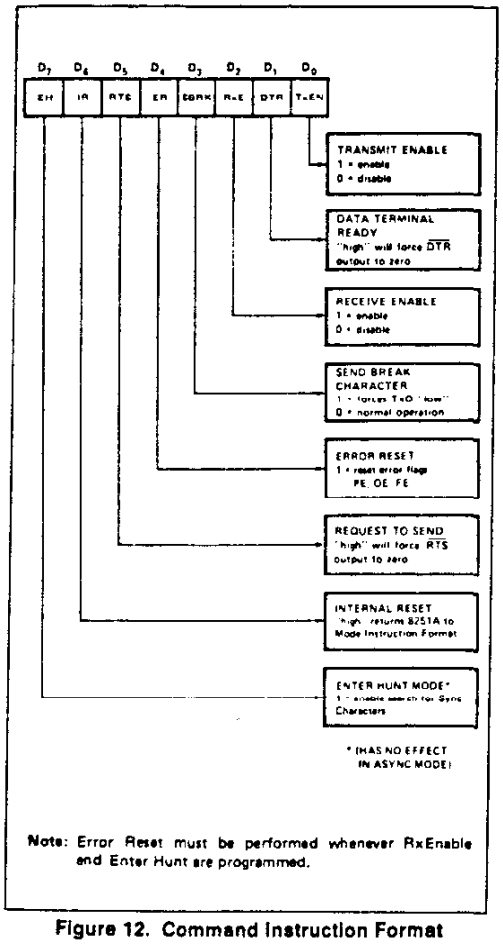
Figure 11. Data Format, Synchronous Mode

AFN-01573B

COMMAND INSTRUCTION DEFINITION

Once the functional definition of the 8251A has been programmed by the Mode Instruction and the Sync Characters are loaded (if in Sync Mode) then the device is ready to be used for data communication. The Command Instruction controls the actual operation of the selected format. Functions such as: Enable Transmit/Receive, Error Reset and Modem Controls are provided by the Command Instruction.

Once the Mode Instruction has been written into the 8251A and Sync characters inserted, if necessary, then all further "control writes" ($C/\overline{D}$ = 1) will load a Command Instruction. A Reset Operation (internal or external) will return the 8251A to the Mode Instruction format.



Note: Error Reset must be performed whenever RxEnable and Enter Hunt are programmed.

Figure 12. Command Instruction Format

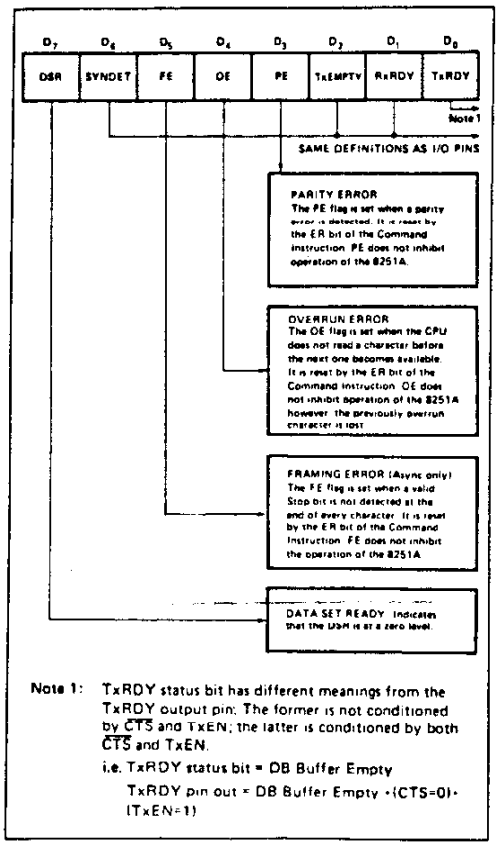
STATUS READ DEFINITION

In data communication systems it is often necessary to examine the "status" of the active device to ascertain if errors have occurred or other conditions that require the processor's attention. The 8251A has facilities that allow the programmer to "read" the status of the device at any time during the functional operation. (The status update is inhibited during status read).

A normal "read" command is issued by the CPU with $C/\overline{D}$ = 1 to accomplish this function.

Some of the bits in the Status Read Format have identical meanings to external output pins so that the 8251A can be used in a completely Polled environment or in an interrupt driven environment. TxRDY is an exception.

Note that status update can have a maximum delay of 28 clock periods from the actual event affecting the status.



Note 1: TxRDY status bit has different meanings from the TxRDY output pin: The former is not conditioned by $\overline{CTS}$ and TxEN; the latter is conditioned by both $\overline{CTS}$ and TxEN.

i.e. TxRDY status bit = DB Buffer Empty

TxRDY pin out = DB Buffer Empty •(CTS=0)• (TxEN=1)

Figure 13. Status Read Format

APPLICATIONS OF THE 8251A

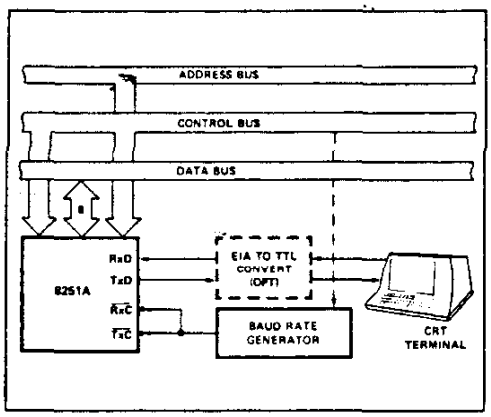


Figure 14. Asynchronous Serial Interface to CRT Terminal, DC—9600 Baud

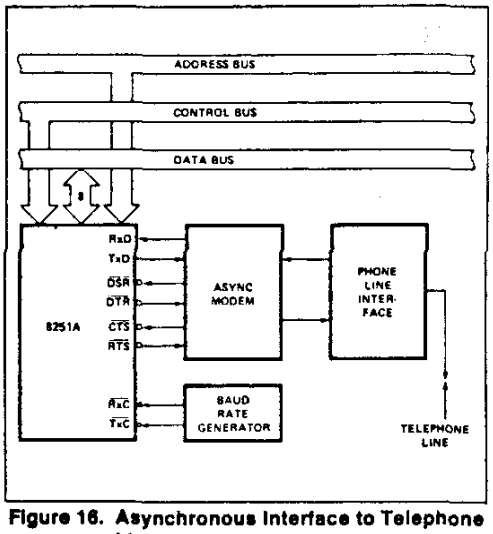


Figure 16. Asynchronous Interface to Telephone Lines

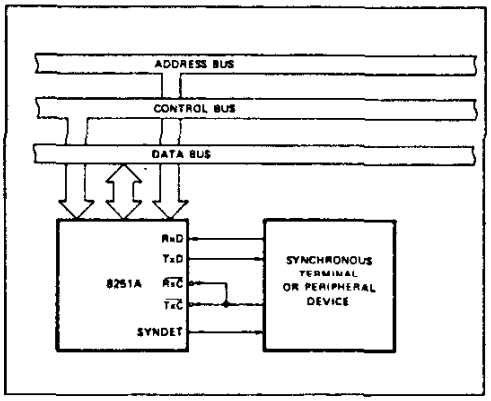


Figure 15. Synchronous Interface to Terminal or Peripheral Device

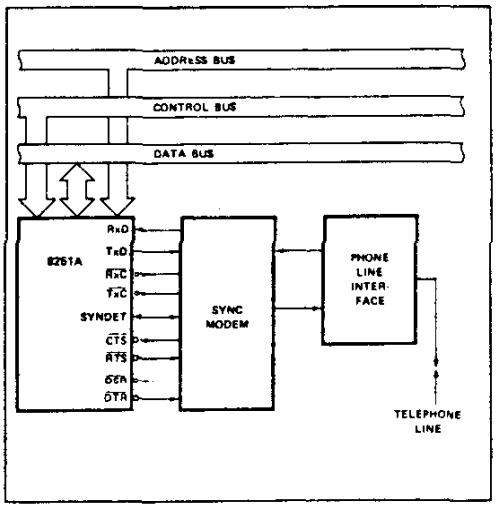


Figure 17. Synchronous Interface to Telephone Lines

ABSOLUTE MAXIMUM RATINGS*

Ambient Temperature Under Bias . . . . . 0°C to 70°C
Storage Temperature . . . . . −65°C to +150°C
Voltage On Any Pin
With Respect to Ground . . . . . −0.5V to +7V
Power Dissipation . . . . . 1 Watt

NOTICE: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

D.C. CHARACTERISTICS (T_A = 0°C to 70°C, V_{CC} = 5.0V ±5%, GND = 0V)

Symbol	Parameter	Min.	Max.	Unit	Test Conditions
V_{IL}	Input Low Voltage	−0.5	0.8	V	
V_{IH}	Input High Voltage	2.2	V_{CC}	V	
V_{OL}	Output Low Voltage		0.45	V	I_{OL} = 2.2 mA
V_{OH}	Output High Voltage	2.4		V	I_{OH} = −400 μA
I_{OFL}	Output Float Leakage		±10	μA	V_{OUT} = V_{CC} TO 0.45V
I_{IL}	Input Leakage		±10	μA	V_{IN} = V_{CC} TO 0.45V
I_{CC}	Power Supply Current		100	mA	All Outputs = High

CAPACITANCE (T_A = 25°C, V_{CC} = GND = 0V)

Symbol	Parameter	Min.	Max.	Unit	Test Conditions
C_{IN}	*Input Capacitance*		*10*	*pF*	*fc = 1MHz*
$C_{I/O}$	I/O Capacitance		20	pF	Unmeasured pins returned to GND

A.C. CHARACTERISTICS (T_A = 0°C to 70°C, V_{CC} = 5.0V ±5%, GND = 0V)

Bus Parameters (Note 1)

READ CYCLE

Symbol	Parameter	Min.	Max.	Unit	Test Conditions
t_{AR}	Address Stable Before $\overline{READ}$ ($\overline{CS}$, C/$\overline{D}$)	50		ns	Note 2
t_{RA}	Address Hold Time for $\overline{READ}$ ($\overline{CS}$, C/$\overline{D}$)	50		ns	Note 2
t_{RR}	$\overline{READ}$ Pulse Width	250		ns	
t_{RD}	Data Delay from $\overline{READ}$		250	ns	3, C_L = 150 pF
t_{DF}	$\overline{READ}$ to Data Floating	10	100	ns	

AFN-01573B

A.C. CHARACTERISTICS (Continued)

WRITE CYCLE

Symbol	Parameter	Min.	Max.	Unit	Test Conditions
t_{AW}	Address Stable Before $\overline{WRITE}$	50		ns	
t_{WA}	Address Hold Time for $\overline{WRITE}$	50		ns	
t_{WW}	$\overline{WRITE}$ Pulse Width	250		ns	
t_{DW}	Data Set Up Time for $\overline{WRITE}$	150		ns	
t_{WD}	Data Hold Time for $\overline{WRITE}$	50		ns	
t_{RV}	Recovery Time Between WRITES	6		t_{CY}	Note 4

OTHER TIMINGS

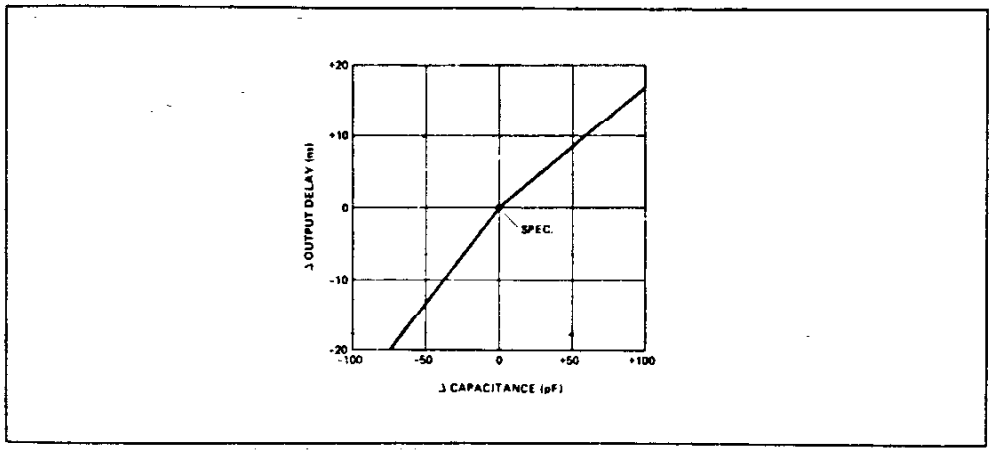
Symbol	Parameter	Min.	Max.	Unit	Test Conditions
t_{CY}	Clock Period	320	1350	ns	Notes 5, 6
t_{ϕ}	Clock High Pulse Width	140	t_{CY-90}	ns	
$t_{\overline{\phi}}$	Clock Low Pulse Width	90		ns	
t_R, t_F	Clock Rise and Fall Time		20	ns	
t_{DTx}	TxD Delay from Falling Edge of $\overline{TxC}$		1	μs	
f_{Tx}	Transmitter Input Clock Frequency				
	1x Baud Rate	DC	64	kHz	
	16x Baud Rate	DC	310	kHz	
	64x Baud Rate	DC	615	kHz	
t_{TPW}	Transmitter Input Clock Pulse Width				
	1x Baud Rate	12		t_{CY}	
	16x and 64x Baud Rate	1		t_{CY}	
t_{TPD}	Transmitter Input Clock Pulse Delay				
	1x Baud Rate	15		t_{CY}	
	16x and 64x Baud Rate	3		t_{CY}	
f_{Rx}	Receiver Input Clock Frequency				
	1x Baud Rate	DC	64	kHz	
	16x Baud Rate	DC	310	kHz	
	64x Baud Rate	DC	615	kHz	
t_{RPW}	Receiver Input Clock Pulse Width				
	1x Baud Rate	12		t_{CY}	
	16x and 64x Baud Rate	1		t_{CY}	
t_{RPD}	Receiver Input Clock Pulse Delay				
	1x Baud Rate	15		t_{CY}	
	16x and 64x Baud Rate	3		t_{CY}	
t_{TxRDY}	TxRDY Pin Delay from Center of last Bit		8	t_{CY}	Note 7
$t_{TxRDY\ CLEAR}$	TxRDY ↓ from Leading Edge of $\overline{WR}$		6	t_{CY}	Note 7
t_{RxRDY}	RxRDY Pin Delay from Center of last Bit		24	t_{CY}	Note 7
$t_{RxRDY\ CLEAR}$	RxRDY ↓ from Leading Edge of $\overline{RD}$		6	t_{CY}	Note 7
t_{IS}	Internal SYNDET Delay from Rising Edge of $\overline{RxC}$		24	t_{CY}	Note 7
t_{ES}	External SYNDET Set-Up Time Before Falling Edge of $\overline{RxC}$	16		t_{CY}	Note 7
$t_{TxEMPTY}$	TxEMPTY Delay from Center of Last Bit	20		t_{CY}	Note 7
t_{WC}	Control Delay from Rising Edge of WRITE (TxEn, $\overline{DTR}$, $\overline{RTS}$)	8		t_{CY}	Note 7
t_{CR}	Control to READ Set-Up Time (DSR, CTS)	20		t_{CY}	Note 7

AFN-015738

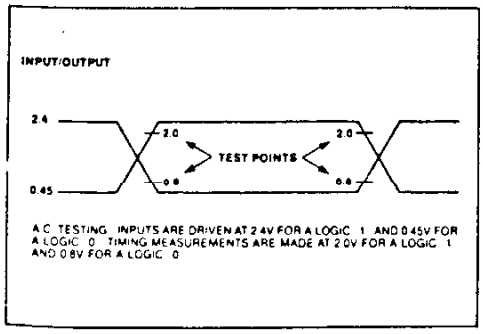
A.C. CHARACTERISTICS (Continued)

NOTES:
1. AC timings measured V_{OH} = 2.0, V_{OL} = 0.8, and with load circuit of Figure 1.
2. Chip Select (CS) and Command/Data (C/D) are considered as Addresses.
3. Assumes that Address is valid before $R_D\downarrow$.
4. This recovery time is for Mode Initialization only. Write Data is allowed only when TxRDY = 1. Recovery Time between Writes for Asynchronous Mode is 8 t_{CY} and for Synchronous Mode is 16 t_{CY}.
5. The TxC and RxC frequencies have the following limitations with respect to CLK: For 1x Baud Rate, f_{Tx} or $f_{Rx} \leq 1/(30\ t_{CY})$; For 16x and 64x Baud Rate, f_{Tx} or $f_{Rx} \leq 1/(4.5\ t_{CY})$.
6. Reset Pulse Width = 6 t_{CY} minimum; System Clock must be running during Reset.
7. Status update can have a maximum delay of 28 clock periods from the event affecting the status.

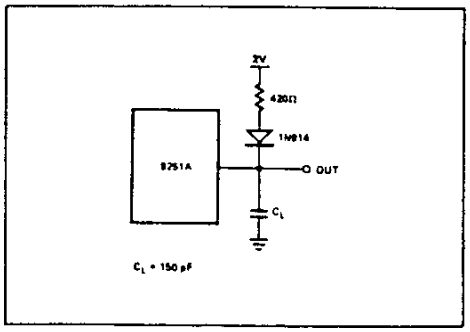
TYPICAL Δ OUTPUT DELAY VS. Δ CAPACITANCE (pF)



A.C. TESTING INPUT, OUTPUT WAVEFORM



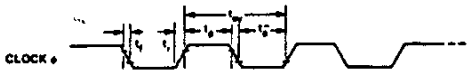
A.C. TESTING LOAD CIRCUIT



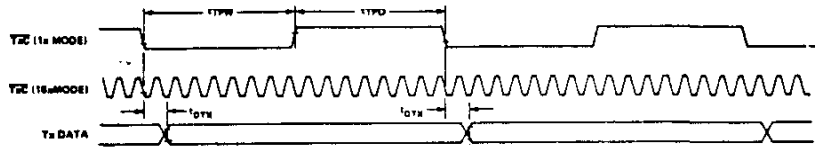
AFN-01573B

WAVEFORMS

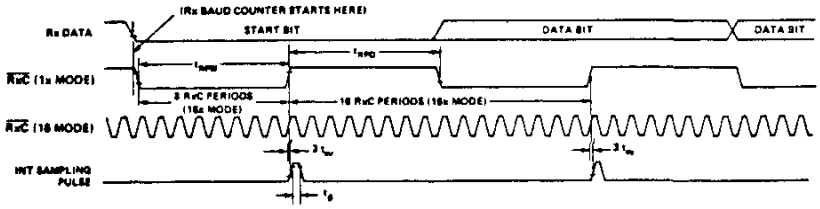
SYSTEM CLOCK INPUT



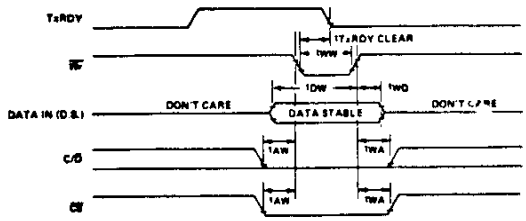
TRANSMITTER CLOCK AND DATA



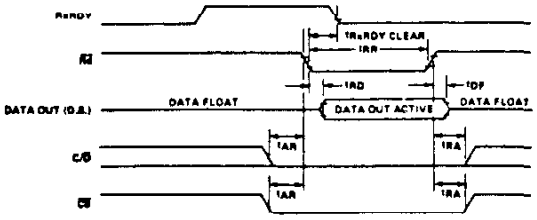
RECEIVER CLOCK AND DATA



WRITE DATA CYCLE (CPU → USART)



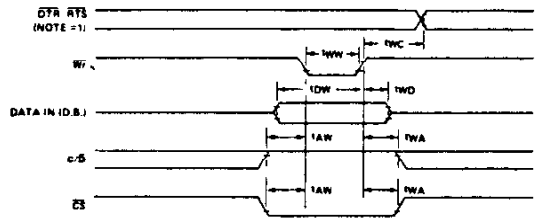
READ DATA CYCLE (CPU ← USART)



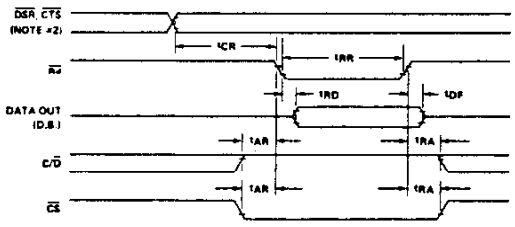
AFN-01573B

WAVEFORMS (Continued)

WRITE CONTROL OR OUTPUT PORT CYCLE (CPU → USART)

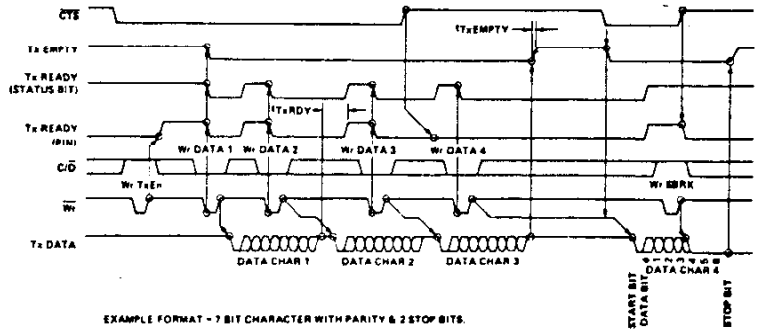


READ CONTROL OR INPUT PORT (CPU ← USART)



NOTE 1: T_{WC} INCLUDES THE RESPONSE TIMING OF A CONTROL BYTE.
NOTE 2: T_{CR} INCLUDES THE EFFECT OF CTS ON THE TXENBL CIRCUITRY.

TRANSMITTER CONTROL AND FLAG TIMING (ASYNC MODE)

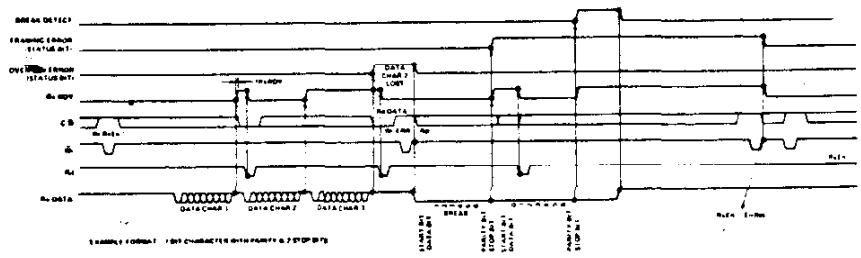


EXAMPLE FORMAT – 7 BIT CHARACTER WITH PARITY & 2 STOP BITS.

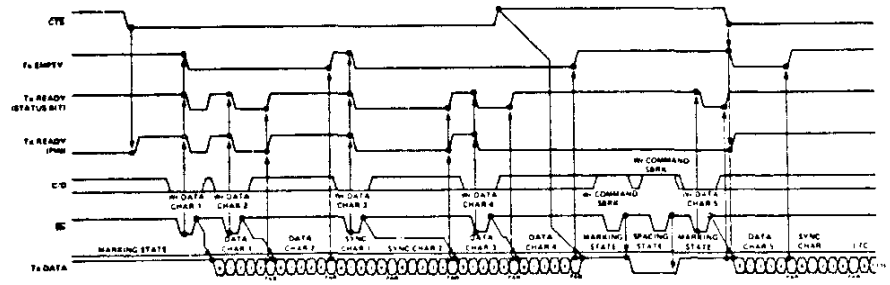
AFN-01573B

WAVEFORMS (Continued)

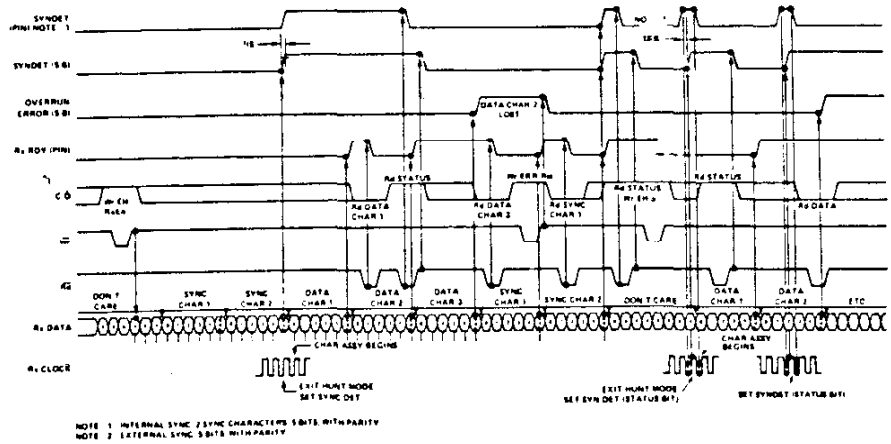
RECEIVER CONTROL AND FLAG TIMING (ASYNC MODE)



TRANSMITTER CONTROL AND FLAG TIMING (SYNC MODE)



RECEIVER CONTROL AND FLAG TIMING (SYNC MODE)



AFN-01573B

MASTER RESET FEATURE

A Master Reset of all computer hardware may be accomplished by depressing the solid colored RED keys located on either side of the alphanumeric keyboard.

CURSOR CONTROL KEYS

There are four cursor control keys located on every SuperBrain II. These keys are located on the right-hand side of the numeric keypad. These keys will transmit codes to any program running on the SuperBrain II. These codes may in turn be interpreted by the program to result in cursor movement on the screen. It is important to know that these keys will not produce cursor movement when you are in the operating system mode. The reason for this is that CP/M does not define any use of cursor positioning on the screen. As such, depression of these keys while in the operating system mode will result in the control codes assigned to the individual keys being displayed as control codes on the screen.

ACCESSING TIME/DATE DATA

Accessing the TIME/DATE data is accomplished by reading the appropriate port (31H through 3CH as specified in the Table of I/O Ports in this section). If the real time clock is being updated when the read is attempted, the low order four bits returned will be 1111, indicating a hexadecimal F. The read must be retried if this occurs until a correct value is returned. The subroutine program that follows illustrates one way to do this. It is written in MBASIC.

```
2000 REM SuperBrain II Time of Day Routine
2010 REM
2020 REM This subroutine returns the time-of-day which is currently set in the SuperBrain II TOD
2030 REM clock. The time is returned in the variable T$. It is a string of length 10 where the
2040 REM format is HH:MM:SS:T.
2050 REM
2060 T$ = " "
2070 FOR I = 6 to 0 STEP -1
2080 V = (INP(&H31+I) AND &HF)
2090 IF V = 15 THEN 2080
2100 T$ = T$ + MID$ (STR$(V),2)
2110 IF I MOD 2 = 1 THEN T$ = T$ + ":"
2120 RETURN
```

INTERFACING INFORMATION

RS232C SERIAL INTERFACE

The following chart illustrates the pinouts for the MAIN and AUXILIARY serial ports and the direction of signal flow.

SUPERBRAIN II SERIAL PORT PIN ASSIGNMENTS

MAIN PORT

PIN #	ASSIGNMENT	DIRECTION
1	GND	–
2	TRANSMITTED DATA	(FROM SB)
3	RECEIVED DATA	(TO SB)
4	REQUEST TO SEND	(FROM SB)
5*	CLEAR TO SEND	(TO SB)
6	DATA SET READY	(TO SB)
7	GND	–
15	TRANSMIT CLOCK	(TO SB)
17	RECEIVE CLOCK	(TO SB)
20	DATA TERMINAL READY	(FROM SB)
22	RING INDICATOR	(TO SB)
24	CLOCK	(FROM SB)

*Pin 5 must be at a high level at the connector in order for successful transmission.

AUXILIARY PORT

PIN #	ASSIGNMENT	DIRECTION
1	GND	–
2	RECEIVED DATA	(TO SB)
3	TRANSMITTED DATA	(FROM SB)
7	GND	–
20	DATA TERMINAL READY	(TO SB)

BUS ADAPTOR INTERFACE

The SuperBrain II contains a Z80 bus interface to the main processor bus. These signals occupy the lower 34 pins of a 50 pin connector and are shown on the following pages.

When using this interface, it is recommended that all signals be buffered so as not to excessively load the main processor bus. The external bus should **ONLY** be utilized for **I/O** devices using addresses 80 to FFH. Memory mapped I/O is **NOT** possible for user applications since the SuperBrain II is internally configured for 64K of RAM.

PIN CONNECTIONS FOR EXTERNAL BUS

PIN NO.	SIGNAL NAME	INPUT OR OUTPUT	DESCRIPTION
1	OUT*	OUTPUT	PERIPHERAL WRITE STROBE OUTPUT
2	A11	OUTPUT	ADDRESS OUTPUT
3	WR*	OUTPUT	MEMORY WRITE STROBE OUTPUT
4	A14	OUTPUT	ADDRESS OUTPUT
5	RD*	OUTPUT	MEMORY READ STROBE OUTPUT
6	D4	BOTH	BIDIRECTIONAL DATA BUS
7	IN*	OUTPUT	PERIPHERAL READ STROBE OUTPUT
8	D7	BOTH	BIDIRECTIONAL DATA BUS

PIN CONNECTIONS FOR EXTERNAL BUS (continued)

PIN NO.	SIGNAL NAME	INPUT OR OUTPUT	DESCRIPTION
9	GND	N/A	SIGNAL GROUND
10	N/A	N/A	N/A
11	A10	OUTPUT	ADDRESS OUTPUT
12	SYSRES*	OUTPUT	SYSTEM RESET OUTPUT, LOW DURING POWER UP INITIALIZE OR RESET DEPRESSED
13	A0	OUTPUT	ADDRESS OUTPUT
14	D6	BOTH	BIDIRECTIONAL DATA BUS
15	A12	OUTPUT	ADDRESS OUTPUT
16	A13	OUTPUT	ADDRESS OUTPUT
17	A15	OUTPUT	ADDRESS OUTPUT
18	D3	BOTH	BIDIRECTIONAL DATA BUS
19	D5	BOTH	BIDIRECTIONAL DATA BUS
20	D0	BOTH	BIDIRECTIONAL DATA BUS
21	A8	OUTPUT	ADDRESS OUTPUT
22	A4	OUTPUT	ADDRESS OUTPUT
23	D2	BOTH	BIDIRECTIONAL DATA BUS
24	A1	OUTPUT	ADDRESS OUTPUT
25	A3	OUTPUT	ADDRESS OUTPUT
26	A5	OUTPUT	ADDRESS OUTPUT
27	A9	OUTPUT	ADDRESS OUTPUT
28	A7	OUTPUT	ADDRESS OUTPUT
29	A2	OUTPUT	ADDRESS OUTPUT
30	A6	OUTPUT	ADDRESS OUTPUT
31	D1	BOTH	BIDIRECTIONAL DATA BUS
32	+5V	N/A	POSITIVE 5 VOLTS (LIMITED CURRENT)
33	GND	N/A	SIGNAL GROUND
34	GND	N/A	SIGNAL GROUND
35	GND	N/A	SIGNAL GROUND
36	+12V	N/A	POSITIVE 12 VOLTS (used for RS232 Receiver bias)
37	AUX RX DATA	INPUT	AUXILIARY PORT RECEIVE DATA
38	MAIN TX CLK	INPUT	MAIN PORT TRANSMIT CLOCK
39	MAIN RX CLK	INPUT	MAIN PORT RECEIVE CLOCK
40	MAIN RX DATA	INPUT	MAIN PORT RECEIVE DATA
41	MAIN CTS	INPUT	MAIN PORT CLEAR TO SEND
42	AUX DSR	INPUT	AUXILIARY PORT DATA SET READY
43	MAIN RTS	OUTPUT	MAIN PORT REQUEST TO SEND
44	MAIN DSR	INPUT	MAIN PORT DATA SET READY
45	MAIN CLK	OUTPUT	MAIN PORT CLOCK
46	AUX TX DATA	OUTPUT	AUXILIARY PORT TRANSMIT DATA
47	MAIN RI	INPUT	MAIN PORT RING INDICATOR
48	−12V	N/A	MINUS 12 VOLTS (used for RS232 Receiver bias)
49	MAIN DTR	OUTPUT	MAIN PORT DATA TERMINAL READY
50	MAIN TX DATA	OUTPUT	MAIN PORT DATA TRANSMIT

*IMPLIES NEGATIVE (LOGICAL 0) TRUE INPUT OR OUTPUT

TABLE OF I/O PORTS*

DEVICE* NO.	MANUFACTURER	PORT ADDRESS	FUNCTION
KR3600	STANDARD MICROSYSTEMS CORP.	50H	KEYBOARD CHARACTER (R/O)
BR1941	WESTERN DIGITAL	60H	BAUD RATE GENERATOR (W/O)
8251A	INTEL	40H	AUXILIARY PORT DATA
		41H	AUXILIARY PORT STATUS
		58H	MAIN PORT DATA
		59H	MAIN PORT STATUS
8255	INTEL	68H	8255 PORT A (W/O)
		69H	8255 PORT B (R/O)
		6AH	8255 PORT C (W/O)
		6BH	8255 CONTROL PORT (W/O)
MM58174	NATIONAL SEMICONDUCTOR	31H	DAY/DATE CLOCK TENTHS DIGIT (R/O)
		32H	DAY/DATE CLOCK UNITS OF SECONDS (R/O)
		33H	DAY/DATE CLOCK TENS OF SECONDS (R/O)
		34H	DAY/DATE CLOCK UNITS OF MINUTES (R/W)
		35H	DAY/DATE CLOCK TENS OF MINUTES (R/W)
		36H	DAY/DATE CLOCK UNITS OF HOURS (R/W)
		37H	DAY/DATE CLOCK TENS OF HOURS (R/W)
		38H	DAY/DATE CLOCK UNITS OF DAYS (R/W)
		39H	DAY/DATE CLOCK TENS OF DAYS (R/W)
		3AH	DAY/DATE CLOCK DAY OF THE WEEK (R/W)
		3BH	DAY/DATE CLOCK UNITS OF MONTHS (R/W)
		3CH	DAY/DATE CLOCK TENS OF MONTHS (R/W)
		3DH	DAY/DATE CLOCK LEAP YEAR SETTING (W/O)
		3EH	DAY/DATE CLOCK START/STOP PORT (W/O)

*FOR DETAILED DEVICE INFORMATION, CONSULT MANUFACTURER'S DATA SHEETS.

AUTOLOAD FEATURE

Perhaps you wish for your computer to perform the same function upon each operating system restart. This is possible with CP/M version 2.2. The command buffer is the area in computer memory where the next command to be executed is placed. In normal CP/M systems this buffer is empty and, upon operating system restart, the system awaits your command. You may alter this if desired, so that the system will execute any program on the disk upon cold or warm reboot.

In order to implement this autoload feature, you have to change the operating system that is stored on the inner two tracks of your diskette. First, make a copy of the program on your distribution diskette that will generate the operating system. For the SuperBrain II QD, this program is called QDIICPM.COM, for SuperBrain II SD it is called SDIICPM.COM, and for the SuperBrain II Jr, it is called SBIICPM.COM. Using the PIP program, enter the following:

A > **PIP AUTOLOAD.COM = SBIICPM.COM** ⟨cr⟩

SBIICPM.COM is similar to using the SYSGEN utility, except that no SOURCE DRIVE is specified when using it. After you have made the copy, you will have to alter its command buffer for the autoload capability. The DDT system program will have to be used to do this. It is strongly *recommended that you become familiar with the DDT program before attempting to alter the* operating system. See the CP/M DYNAMIC DEBUGGING TOOL (DDT) USER'S GUIDE in this manual, for assistance.

Next enter the program 'AUTOLOAD.COM' with the use of DDT. The correct command is:

A > **DDT AUTOLOAD.COM** ⟨cr⟩

DDT will then load into the computer's memory and read in your 'AUTOLOAD' program. After you have decided on the command you want to be executed upon restart, determine its length. This is done by counting the number of characters in the command. If a file name and/or parameters are included in the command, be sure to include their length(s) in the count. Include any separating spaces. For example, if you wanted the directory display, the command is **DIR**, and its length is 3. If instead you wanted to see a directory display of disk A, the command is **DIR A:** and its length is 6.

The CP/M command buffer begins at location 987H. Use the 'S' command to alter the desired memory locations with your new command. Place the hexadecimal value of the command length in this location. The command itself begins at location 988H, and you may use up to eighty (80) characters from that point for the buffer. Notice that if you go beyond that, you will overwrite the copyright notice in the operating system. At the end of your command, place the null terminator 00H. When inserting the command itself into the memory locations, please note that you must enter hexadecimal numbers for the ASCII values of the letters in the command. When finished, use the DDT command 'D' to display the results of your action. Make any necessary corrections, and then exit to the operating system with CRTL-C. Before you do anything else, you must save the memory contents of the 'AUTOLOAD' program. Using CP/M's 'SAVE' function, enter the following line at the keyboard:

A > **SAVE 48 AUTOLOAD.COM** ⟨cr⟩

Let's review what we have done so far. First, we made a copy of the operating system, and called it 'AUTOLOAD.COM'. (Incidentally, any other name could have been used as long as the file type is '.COM'). Next, we placed a CP/M command into the CP/M command buffer, starting with the command length in hexadecimal. We ended with a null byte terminator. Then we exited to the operating system and saved the revised program in memory on the disk. Now it is time to generate the new operating system.

Please be sure that the command in the command buffer is what you want your computer to do upon each operating restart, because that is exactly what it will do. Type in the following command at the keyboard:

A > **AUTOLOAD**⟨cr⟩

From here the operation will be similar to that of the SYSGEN command. First you will be asked to enter a SOURCE DRIVE. Press the **RETURN** key here; the program itself is carrying the operating system. Next enter the DESTINATION DRIVE. Enter your choice, and press the **RETURN** key when the correct diskette has been inserted in the destination drive. If you are using a new diskette, make certain that it has been formatted with the FORMAT command. When the message FUNCTION COMPLETE is displayed upon the screen, your transfer is done, and you should press the **RETURN** key to reboot the operating system. If you specified Drive A as the destination drive, this reboot will incorporate your new modification. If not, replace the diskette in Drive A with your destination diskette, and press both RED keys simultaneously. You should now have an operating system with an autoload feature. If not, you probably incorrectly entered the command in the command buffer. Repeat the above procedure if this is the case.

WARNING: If you choose drive A as the destination drive and you made an error in altering the command buffer, this diskette will contain an unusable copy of the operating system. You will have to replace its operating system with a valid copy probably using the SYSGEN command. Therefore, it is recommended that you select drive B as your destination drive when altering the command buffer.

Here is a sample session describing the steps needed to alter the command buffer of your operating system. Please carefully read the previous section before attempting to alter this command buffer. Note that all items in bold type are to be typed in by you. Otherwise, the displays are generated by the computer. When you encounter ⟨cr⟩ , press the **RETURN** key.

A > **PIP AUTOLOAD.COM = SBIICPM.COM[V]**⟨cr⟩
A > **DDT AUTOLOAD.COM**⟨cr⟩
DDT VER 1.4
NEXT PC
3100 0100
– S987⟨cr⟩
0987 00 **06**⟨cr⟩
0988 20 **44**⟨cr⟩
0989 20 **49**⟨cr⟩
098A 20 **52**⟨cr⟩
098B 20 **20**⟨cr⟩
098C 20 **41**⟨cr⟩
098D 20 **3A**⟨cr⟩
098E 20 **00**⟨cr⟩
098F 20 **.**⟨cr⟩
-CONTROL-C
A SAVE 48 AUTOLOAD.COM ⟨cr⟩
A **AUTOLOAD** ⟨cr⟩
SYSGEN VER 1.X
SOURCE DRIVE NAME (OR RETURN TO SKIP) ⟨cr⟩
DESTINATION DRIVE NAME (OR RETURN TO REBOOT) **B**⟨cr⟩
FUNCTION COMPLETE
DESTINATION DRIVE NAME (OR RETURN TO REBOOT) ⟨cr⟩
A >
(Now replace the diskette in drive B into drive A, and depress RED keys.)

KEY CLICK

The key click feature is designed to provide a tone with each key depression. The purpose of the feedback is to allow faster data entry by informing the operator whenever a key is depressed. This feature can be easily selected during terminal operation or can be automatically selected upon system power-up.

To enable the feedback feature, simply type a Control-B (02H). This will 'toggle' the key click feature and turn it on if it is off, or vice versa. The CONFIGUR program will permit you to set the click on or off on system power-up, and hence, relieve you of any further action.

KEY REPEAT

When a key remains depressed for more than 1 second, the key value will repeat at a rate of approximately 30 per second. This will allow faster data entry for applications such as word processing, text editing, and program displays where a 'banner' is required.

TYPE-AHEAD

The input on DOS version 1.X is saved if the operator enters data faster than the computer can accept it. Up to 128 characters are stored when typed, and delivered only when needed. It is now possible to enter commands to an application program as it is being loaded from the disk and not lose any characters. Your input will appear after the program has been loaded, and the program will execute the commands as if you had just entered them. If you type more than 128 characters ahead of the computer system, the bell will ring. This indicates that the buffer is full, and further typing will be ignored by the system.

NOTE: It should be noted that some programs will not work with the type-ahead feature. An example is the DIR command, which displays the directory contents of a diskette. By definition, a directory display is interrupted if a key is depressed during the display. If the DIR command receives a key from the type-ahead feature, it doesn't know if the key was just entered, or if it came from the buffer. In either case, the display is disrupted and a character is lost. Experiment with the system to see which programs will not tolerate type-ahead.

In the event that an error is made, the type ahead buffer can be erased by depressing the **CONTROL** key and the **1** key (on the alphanumeric keyboard only, not the numeric keypad) simultaneously.

CONTROLLING THE VIDEO DISPLAY

The SuperBrain II allows the user a great degree of flexibility in controlling the video display. The user can control where the display is on the screen and the appearance of the displayed information.

Data positioning can be effected either by absolute cursor addressing or memory-mapping. Display appearance is controlled by two factors. First, the SuperBrain II has an optional character set available to the user. Alternating character sets as well as video attributes can be effected on a character by character basis. Second, there are four video attributes. These are:

* Blinking.
* Half-intensity.
* Underlining.
* Reverse Video.

Memory-mapping means that a portion of the memory is devoted to use by the screen display.

The RAM memory location F800H marks the beginning of screen area and this area extends through location FFFFH. This memory area is not available for program or data storage.

The CRT controller performs a direct memory access (DMA) cycle to obtain the screen data, relieving the CPU of most screen related functions. When the CRT controller receives certain inputs, the display is affected.

There are two main types of inputs that are meaningful to the CRT controller: escape sequences and control codes. An escape sequence is noted when the ASCII representation of ESC (27H) is received by the CRT controller and followed by other characters.

A control code is noted when the CTRL key of the keyboard is held down while another key is depressed. *The CTRL key functions somewhat like the SHIFT key does.*

ESCAPE SEQUENCES

The following is a list of escape sequences that have meaning to the CRT controller.
NOTE: " ~ " is equivalent to ASCII code 7E (Hex) or 126 (decimal).

SEQUENCE	MEANING
ESC Y row column	Absolute cursor addressing. The cursor is positioned to the row and column as shown in the screen layout chart in this section.
ESC ~ K	Erase to end of line. Data is erased from the current cursor position through the end of the current line.
ESC ~ k	Erase to end of screen. Data is erased from the current cursor position through the end of the current screen.
ESC ~ E	Display control characters. The transparent mode of operation is enabled which means that control codes not normally shown on the screen will be displayed.
ESC ~ D	Disable display of control characters.
ESC ~ B	Turns the blinking video attribute on.
ESC ~ b	Turns the blinking video attribute off.
ESC ~ H	Turns the half-intensity attribute on.
ESC ~ h	Turns the half-intensity attribute off.
ESC ~ U	Turns the underlining attribute on.
ESC ~ u	Turns the underlining attribute off.
ESC ~ R	Turns the reverse video attribute on.
ESC ~ r	Turns the reverse video attribute off.
ESC ~ A	Makes the entire screen non-reverse video.
ESC ~ a	Makes the entire screen reverse video.

ESCAPE SEQUENCES (continued)

SEQUENCE	MEANING
ESC ~ N	Normalizes. Turns all attribute indicators (B, H, U, R) off if they are on, beginning with the next character.
ESC ~ g	Displays the entirety of what is on the screen as its corresponding alternate(s) from the secondary character set. This only works if the secondary character EPROM is installed.
ESC ~ G	This reverses the effects of the ESC ~ g escape sequence preceeding.
ESC ~ S	This sequence reverses the primary and secondary assignments of the character sets when an alternate (secondary) character set is installed. If set A is primary and set B is secondary, this sequence will cause B to be primary and A to be secondary.
ESC ~ s	This reverses the effect on the ESC ~ S sequence preceeding.

NOTE: Of the escape sequences discussed, the S, G, a, and A options affect the entire screen including data on the screen entered prior to this sequence.
NOTE: The high order bit of the ASCII character is what controls switching between primary and secondary character sets. A "0" is the high order bit selects primary set. A "1" in the high order bit selects the secondary set.

CONTROL CODES

The following is a list of the control codes that have meaning to the CRT controller.

CODE	MEANING
CTRL-A	Home cursor — The cursor is positioned at row 1, column 1.
CTRL-F	Cursor forward — The cursor is moved one space to the right.
CTRL-G	Ring bell — The audio indicator is activated.
CTRL-H	Cursor back — The cursor is moved one space to the left.
CTRL-K	Cursor up — The cursor is moved up one line.
CTRL-J	Cursor down — The cursor is positioned down one line.
CTRL-I	Tabbing — The cursor is positioned to the next tab (modulo-8) position.
CTRL-L	Clear screen — Erases the data on the screen and the cursor is moved to row 1, column 1, its home position.
CTRL-R	Redisplays current CP/M command line.
CTRL-X	Clears current CP/M command line.
CTRL-@	Page off/on — video display scrolling is enabled or disabled. Valid during operator input only and not subject to user program control.
CTRL-1	Clears type ahead buffer.

VIDEO ATTRIBUTES

Attributes are set by the SuperBrain II when particular escape sequences (see previous list) are received by the Console Out routine of the CP/M BIOS (and subsequently the CRT controller). The escape sequence consists of an ESC(ape), followed by a TILDE, followed by a hexadecimal representation of the attribute desired. The hexadecimal format is 1B 7E NN where NN assumes the following value as desired.

42H - B	61H - a
62H - b	41H - A
48H - H	4EH - N
68H - h	67H - g
55H - U	47H - G
75H - u	53H - S
52H - R	73H - s
72H - r	

The following program written in MBASIC language distributed with your SuperBrain II, shows a technique for attribute manipulation.

```
100 CY = 20
110 CX = 5
120 REM Clear screen and then show some of the SuperBrain II video attributes.
130 REM
140 PRINT CHR$(12)
150 REM first line is normal
160 GOSUB 510
170 PRINT "SuperBrain II Video Attribute Demo"
180 REM
190 REM Now turn on inverse video and reprint line.
200 REM
210 CX = 7:GOSUB 510
220 PRINT CHR$(27); " R";
230 PRINT "SuperBrain II Video Attribute Demo"
240 REM
250 REM Now turn on half intensity and reprint line
260 REM
270 REM
280 CX = 9:GOSUB 510
290 PRINT CHR$(27);" H";
300 PRINT "SuperBrain II Video Attribute Demo"
310 REM
320 REM Turn inverse back off and turn underlining on
330 REM
340 CX = 11:GOSUB 510
350 PRINT CHR$(27); " r"; CHR$(27);" U";
360 PRINT "SuperBrain II Video Attribute Demo"
380 REM
390 REM Turn half intensity off but leave underlining on
420 REM
430 CX = 13:GOSUB 510
450 PRINT CHR$(27);" h";
470 PRINT "SuperBrain II Video Attribute Demo"
471 REM
472 REM Now normalize the video attributes
```

```
473 REM
474 PRINT CHR$(27):" N"
480 PRINT
490 PRINT
500 END
510 Print CHR$(11)
520 PRINT CHR(27);"Y"; CHR$(CX + 31);CHR$ = (CY + 31);
530 RETURN
```

CURSOR POSITIONING FOR DISPLAY CONTROL

Cursor positioning is easily accomplished using the ESC Y row column escape sequence. The proper row, column coordinates can be determined by referencing the SuperBrain II screen layout in this section.

The example program that follows, written in MBASIC, shows one method of accomplishing screen control.

MEMORY MAP/SCREEN INITIALIZATION

This BASIC program fragment will clear the screen and set the "HOME" position to be memory address &HF800. The user can then "POKE" characters into the next 1,920 locations of screen memory.

NOTE: Line number 1110 leaves the cursor at the top of the screen. The cursor can, at this time, be moved where the user wishes with standard escape sequence cursor positioning commands.

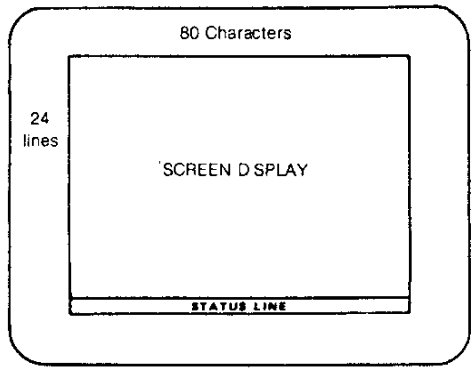
```
1090  PRINT CHR$(12);
1100  FOR I = 1 to 23:PRINT " " :Next I
1110  PRINT " "; CHR$(1);
1120  RETURN
```

The next example program, also written in MBASIC, shows an example of cursor positioning.

```
100   REM Clear the Screen
110   PRINT CHR$(12)
120   REM Position the cursor at row 20 column 30
130   CX = 20
140   CY = 30
150   GOSUB 2000
160   PRINT "* -POSITION 20, 30"
170   REM Position the cursor at row 5 column 20
180   CX = 5
190   CY = 20
200   GOSUB 2000
210   PRINT "* -POSITION 5, 20"
220   REM Home cursor and then end
230   PRINT CHR$(1);
240   END
2000  REM Cursor Positioning Subroutine
2010  REM
2020  REM This subroutine clears the MBASIC line output character counter
2030  REM and then positions the cursor at the locations specified by the
2040  REM variables CX and CY where CX is the line number and CY is the
```

```
2050    REM column number. These variables must be set by the program before
2060    REM entering the subroutine
2070    REM
2080    REM NOTE: Home position on the screen is row 1 column 1
2090    REM
2100    PRINT CHR$(11)
2110    PRINT CHR$(27);"Y";CHR$(CX + 31);CHR$(CY + 31);
2120    RETURN
```

SUPERBRAIN SCREEN LAYOUT



This Screen Format of the SuperBrain display area provides an easy method of locating and addressing specific screen positions.

Using the ESC, Y, r, c command, locate both the row character (r = 1 - 24) and the column (c = 1 - 80) characters. Example:

ROW	COLUMN	COMMAND
1 (Home)	1	ESC Y sp sp
2	5	ESC y ! $
20	50	ESC Y 3 Q

An application programmer may find it helpful to maintain a table of row and column numbers with their respective addressing characters as shown or this Screen Format. This will provide quick and easy access to specific screen positions.

INTERPRETING THE ASCII CODE CHART

The figure below illustrates a conventionally arranged ASCII code chart divided into three sections corresponding to control codes (column 0 to 1) upper case characters (columns 2, 3, 4, and 5), and lower case characters (columns 4 and 5).

b_7 b_6 b_5 →					0_0	0_0	0_1	0_1	1_0	1_0	1_1	1_1
Bits ↓	b_4	b_3	b_2	b_1	column → / row ↓	0	1	2	3	4	5	6	7
	0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
	0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
	0	0	1	0	2	STX	DC2	"	2	B	R	b	r
	0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
	0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
	0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
	0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
	0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
	1	0	0	0	8	BS	CAN	(	8	H	X	h	x
	1	0	0	1	9	HT	EM	)	9	I	Y	i	y
	1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
	1	0	1	1	11	VT	ESC	+	;	K	[	k	{
	1	1	0	0	12	FF	FS	,	<	L	\	l	|
	1	1	0	1	13	CR	GS	—	=	M	]	m	}
	1	1	1	0	14	SO	RS	.	>	N	^	n	~
	1	1	1	1	15	SI	US	/	?	O	—	o	DEL

CONTROL CODE CHART

The following is a list of the hexadecimal equivalents of the control codes. The CONFIGUR program accepts only hexadecimal values when reassigning the keypad, so these are listed as a programmer convenience. Use caution when reassigning the values on the keypad, and recall that you may enter 'R' to restore the pad to its original configuration if you desire.

Ctrl-A	01H	Ctrl-J	0AH	Ctrl-S	13H
Ctrl-B	02H	Ctrl-K	0BH	Ctrl-T	14H
Ctrl-C	03H	Ctrl-L	0CH	Ctrl-U	15H
Ctrl-D	04H	Ctrl-M	0DH	Ctrl-V	16H
Ctrl-E	05H	Ctrl-N	0EH	Ctrl-W	17H
Ctrl-F	06H	Ctrl-O	0FH	Ctrl-X	18H
Ctrl-G	07H	Ctrl-P	10H	Ctrl-Y	19H
Ctrl-H	08H	Ctrl-Q	11H	Ctrl-Z	1AH
Ctrl-I	09H	Ctrl-R	12H		

After all corrections have been entered, pressing the 'RETURN' key will save your new parameters on the disk. This must be done at the main menu of selections. Then press both RED keys when instructed to force a 'cold boot' of the Operating System and properly load your new changed parameters.

Control codes are not displayable unless in the transparent mode. Some of these codes affect the state of the terminal when they are received by the display electronics. For example, the code SOH causes the cursor to go to the home position, and code DC2 turns on the printer port. Codes which have no defined function in the SuperBrain II software are ignored if received. The set of 64 upper case alphanumeric characters is sometimes referred to as "compressed ASCII".

CONTROL CODE CHART (continued)

If the terminal is set for upper case operation only (CAPS LOCK), lower case alpha characters from the keyboard are automatically translated and displayed as their upper equivalents (columns 4 and 5). If the DEL code is received, it is ignored. Lower case characters received from the input RS-232C port are displayed as lower case.

The seven bit binary code for each character is divided into two parts in this chart. A four-bit number represents the four least significant bits (B1, B2, B3, B4) and a three-bit number represents the three most significant bits (B5, B6, B7). The chart above also is divided into 8 columns and 16 rows. This offers two ways of indicating a particular character's code. The character code is indicated as either a seven-bit binary number or as a column/row number in decimal notation. For example, the character M is represented by the binary number 1001101 or the alternative 4/13 notation. Similarly, the control code VT is represented by the code 0001011 or the alternative 0/11 notation.

For the SuperBrain II, the high order bit is used to determine switching between the primary and secondary character sets. This eighth (or high order) bit is not shown in this chart but exists and can be manipulated from user programs.

WORDSTAR CONSIDERATIONS FOR SUPERBRAIN II

This is to set up a version of WordStar for the SuperBrain II that uses the SuperBrain II in a memory mapped mode. The following variable names are in appendix D of the WordStar manual ("Terminal Patch Area"). The following items need to be set as indicated:

```
0264    UCRPOS    JMP     0304H     ; User cursor positioning
                                    ;      routine for memory map
                                    ;      operation.

02A4    INISUB    JMP     02E0H     ; Jump to the SuperBrain II
                                    ;      initialization routine.

02B0    MEMAPV    DB      0FFH      ; Turn memory map mode on
02B1    MEMADR    DB      0F800H    ; Address of video screen RAM.

02E0    MORPAT    CALL    02E8H     ; Initialize the SuperBrain "
02E3              DEC     A         ;      video memory map.
02E4              CALL    0239H
02E7              RET
02E8              XRA     A
02E9              LXI     H,0E434H
02EC              MVI     B,18H
02EE              MOV     M,A
02EF              INX     H
02F0              DEC     B
02F1              JNZ     02EEH
02F4              LXI     H,0000
02F7              SHLD    0E400H
02FA              SHLD    0E414H
02FD              SHLD    0E416H
0300              SHLD    0E412H
0303              RET
0304              XCHG
0305              JMP     0300H
```

If the user has the reverse video character set EPROM installed in the secondary character set EPROM position. WordStar can also highlight certain items by setting the following value:

```
02B3    HIBIV     DB      0FFH      ; Highlight using the high bit
```

SERVICING PROCEDURES

Your SuperBrain II Video Terminal is warranted to the original purchaser for 90 days from date of shipment. This warranty covers the adjustment or replacement, F.O.B. Intertec's plant in Columbia, South Carolina, of any part or parts which in Intertec's judgment shall disclose to have been originally defective. A complete statement of your warranty rights is contained on the inside back cover of this manual.

To qualify for receipt of future technical documentation updates, please complete the Warranty Registration Form (contained in this section) and return it to Intertec Data Systems within 10 days of receipt of this equipment. Be sure to include the serial number of the specific terminal you are registering. The serial number of your terminal can be found on the right hand side of the rear I/O panel (looking from the rear). A Customer Comment Card is also enclosed for your convenience if you desire to make comments regarding the overall operation and/or adaptability of the SuperBrain II to your particular application.

IF SERVICE IS EVER REQUIRED:

If you should ever encounter difficulties with the use or operation of this terminal, contact the supplier from whom the unit was purchased for instructions regarding the proper servicing techniques. Service procedures differ from dealer to dealer, but most Intertec authorized service dealers can provide local, on-site servicing of this equipment on a per-call or maintenance contract basis. Plus, a wide variety of service programs are available directly from the factory, including extended warranty, a module exchange program, and on-site maintenance from a wide variety of locations within the U.S.

Appendix J-1

Contact our Customer Services Department at the factory for rates and availability if you desire to participate in one of these programs. **If you are not covered under one of the programs described above and service cannot be made available through your local supplier, contact Intertec's Customer Services Department at (803) 798-9100. Be prepared to give the following information when you call:**

1. The serial number of the defective equipment. If you are returning individual modules to the factory for repair, it will be necessary to have the serial number of the individual modules also. The serial number of the entire terminal may be found on the right hand side of the rear I/O panel (looking from the rear). Module serial numbers are listed on white stickers placed in conspicuous locations on each major module or subassembly of the terminal. **NOTE:** Individual modules **cannot** be returned to the factory for repair unless you originally purchased your unit from the factory. If your unit was purchased through a Dealer or OEM vendor, and you desire factory repair, then the entire terminal must be returned.

2. The name and location of the Dealer and/or Agent from whom the unit was purchased.

3. A complete description of the alleged failure (including the nature and cause of the failure if readily available).

The Customer Services Department will issue you a Return Material Authorization Number (RMA Number) which will be valid for a period of 30 days. This RMA Number will be your official authorization to return equipment to IDSC for repair only. The Customer Services Department will also give you an estimate, if requested, of the time it should take to process and repair your equipment. Turnaround time on repairs varies depending on workloads and availability of parts, but normally your equipment will be repaired and returned to you within 10 working days of its receipt. If your repair is urgent, you may authorize a special $50 Emergency Repair fee and have your equipment repaired and returned within no more than 48 hours of its receipt at our Service Center. Ask the Customer Services Department for more information about this program.

SERVICING PROCEDURES (continued)

IMPORTANT: Any equipment returned to Intertec without an RMA Number will result in the equipment being refused and possible cancellation of your SuperBrain II warranty. Also if your RMA Number expires, you must request a new number. Equipment arriving at Intertec bearing an expired RMA Number will also be refused.

After securing an RMA Number from the Customer Services Department, return the specified modules and/or complete terminals to Intertec, freight prepaid, at the address below. **NOTE: The RMA Number must be plainly marked and visible on your shipping label to prevent the equipment from being refused at Intertec's Receiving Department.**

ATTN: SUPERBRAIN SERVICE CENTER
Intertec Data Systems Corporation
2300 Broad River Road
Columbia, South Carolina 29210

To aid our technicians in troubleshooting and correcting your reported malfunction, please complete an Intertec Equipment Malfunction Report (contained in this section) and enclose it with the equipment you intend to return to the factory.

Be sure a declared value equal to the price of the unit is shown on the Bill of Lading, Express Receipt or Air Freight Bill, whichever is applicable. Risk of loss or damage to equipment during the time it is in transit either to or from Intertec's facilities is your sole responsibility. A declared value must be placed on your Bill of Lading to insure substantiation of your freight claim if shipping damage or loss is incurred.

All equipment returned to an Intertec Service Center must be freight prepaid. Equipment not prepaid on arrival at Intertec's Receiving Department cannot be accepted. Upon repair of equipment under warranty, it will be returned to you freight prepaid, via UPS or equivalent ground transportation. All repaired equipment not covered by warranty will be returned, F.O.B. the factory in Columbia, South Carolina, via UPS or equivalent ground transportation unless you specify otherwise.

INSTRUCTIONS FOR HANDLING LOST OR DAMAGED EQUIPMENT

The goods described on your Packing Slip were delivered to the Transportation Company at Intertec's premises in complete and good condition. If any of the goods called for on this Packing Slip are short or damaged, you must file a claim WITH THE TRANSPORTATION COMPANY FOR THE AMOUNT OF THE DAMAGE AND/OR LOSS.

IF LOSS OR DAMAGE IS EVIDENT AT TIME OF DELIVERY:

If any of the goods called for on your Packing Slip are short or damaged at the time of delivery, ACCEPT THEM, **but insist that the Freight Agent make a damaged or short notation on your Freight Bill or Express Receipt and sign it.**

IF DAMAGE OR LOSS IS CONCEALED AND DISCOVERED AT A LATER DATE:

If any concealed loss or damage is discovered, notify your local Freight Agent or Express Agent AT ONCE and request him to make an inspection. This is absolutely necessary. Unless you do this, the Transportation Company will not consider your claim for loss or damage valid. If the agent refuses to make an inspection, you should draw up an affidavit to the effect that you notified him on a certain date and that he failed to make the necessary inspection.

SERVICING PROCEDURES (continued)

After you have ascertained the extent of the loss or damage, **ORDER THE REPLACEMENT PARTS OR COMPLETE NEW UNITS FROM THE FACTORY.** We will ship them to you **and bill you for the cost.** This new invoice will then be a part of your claim for reimbursement from the Transportation Company. This, together with other papers, will properly support your claim.

IMPORTANT: The claims adjustment procedure for UPS shipments varies somewhat from the procedure listed above for regular motor and air freight shipments. *If your equipment was shipped via UPS and sustained either damage or loss, the UPS representative in your area* **must** *initiate the claim by inspecting the goods and assigning a freight claim number to the damaged equipment.* The representative will attach a "Call Tag" to the outside of the equipment box which will be your authorization to return the merchandise to our factory for claim adjustment. Upon receipt of this damaged equipment, we will perform the necessary repairs, process the appropriate paperwork with UPS and return the equipment to you. Please allow time for processing of any type claim. Normal time for proper processing of a UPS claim is 15-30 working days.

Remember, it is extremely important that you **do not give the Transportation Company a clear receipt if damage or shortages are evident upon delivery.** It is equally important that you call for an inspection if the loss or damage is discovered later. **DO NOT, UNDER ANY CIRCUMSTANCES, ORDER THE TRANSPORTATION COMPANY TO RETURN SHIPMENT TO OUR FACTORY OR REFUSE SHIPMENT UNLESS WE HAVE AUTHORIZED SUCH RETURN.**

Appendix J-1

ADDITIONAL TECHNICAL DOCUMENTATION

Detailed technical documentation (i.e., schematics) describing the operation of the SuperBrain II Video Terminal and the electrical interconnection of its various modules is available at nominal cost directly from Intertec Data Systems Corporation. However, due to the confidentiality of this technical information, it will be necessary to sign and return the Documentation Non-Disclosure Agreement (appearing on the next page) denoting your concurrence with its terms and conditions.

The handling and processing costs of SuperBrain II technical documentation is $50. Due to the large amount of requests being processed and the relatively small handling costs involved, *we* **must** *request that you* **enclose payment** *($50) upon return of your Non-Disclosure Agreement.* Normally the documents will be mailed to you within 15 to 30 days after receipt of your payment and a signed copy of the Agreement. (IMPORTANT: The technical documentation will be mailed to the address listed at the top of the Non-Disclosure Agreement.) For prompt processing of your documentation request, please forward your signed agreement and payment to:

Customer Services Department
Intertec Data Systems Corporation
2300 Broad River Road
Columbia, South Carolina 29210

NOTE: Formal technical documentation for the SuperBrain II will be sent to you normally within 10-15 days of receipt of your payment and signed Non-Disclosure Agreement.

IMPORTANT: *Payment* **must** *accompany your Non-Disclosure Agreement. Agreements sent to us without payment will be discarded without notice.*

INTERTEC DATA SYSTEMS

SUPERBRAIN II DOCUMENTATION NON-DISCLOSURE AGREEMENT

IDS-350B

Corporate Headquarters: 2300 Broad River Road, Columbia, South Carolina 29210 • 803/798-9100 • TWX: 810-666-2115

THIS AGREEMENT MADE BETWEEN INTERTEC DATA SYSTEMS CORPORATION AND THE ORGANIZATION AND/OR PERSONS LISTED AT THE RIGHT AND BECOMES EFFECTIVE ON THE DATE SPECIFIED BELOW.

(PLEASE PRINT CLEARLY. DOCUMENTS WILL BE MAILED TO THE ADDRESS AT RIGHT)

YOUR COMPANY NAME _____

ADDRESS _____

CITY & STATE _____

TELEPHONE _____

YOUR NAME _____

For and in consideration of receiving confidential documentation on the SuperBrain II™ line of terminals manufactured by INTERTEC DATA SYSTEMS CORPORATION (hereinafter called INTERTEC) at the date hereof, the undersigned hereby agrees with INTERTEC as follows:

(1) The undersigned acknowleges that formulae, programs, manufacturing processes, devices, techniques, plans, methods, drawings, blueprints, reproductions, data tables, calculations and components were designed and developed by INTERTEC at great expense and over lengthy periods of time, and the same are secret and confidential, are unique and constitute the exclusive property and trade secrets of INTERTEC, and that any use of such property and trade secrets by the undersigned other than for the sole benefit of INTERTEC would be wrongful, tortiuous and would cause irreparable injury to INTERTEC.

(2) The undersigned shall not at any time, without the express written consent of the Board of Directors of INTERTEC, publish, disclose, use or divulge to any person, firm or corporation, directly or indirectly, or use for his own benefit or the benefit of any person, firm, or use other than to effect repair of INTERTEC manufacturing equipment, and property above described, trade secrets or confidential information of INTERTEC, its subsidiaries and its affiliates learned or obtained by its subsidiaries and its affiliates learned or obtained by him from INTERTEC, including, but not limited to the information and things set forth in paragraph 1 hereinabove.

(3) This agreement shall be binding upon the undersigned, his personal representatives, successors and assigns, and shall run to the benefit of INTERTEC, its successors and assigns.

(4) Upon termination of the association of the undersigned with INTERTEC or its subsidiaries, the undersigned shall promptly deliver to INTERTEC all drawings, blueprints, reproductions, manuals, letters, notes, notebooks, reports, data, tables, calculations or copies thereof, components, programs, and any and all other secret and confidential property of INTERTEC, its subsidiaries and affiliates, including, but not limited to, all of the property set forth in paragraph 1 hereinabove which are in the possession or under the control of the undersigned.

(5) The undersigned hereby acknowledges and agrees that in the event of any violation hereof, INTERTEC shall be authorized and entitled to obtain from any court of competent jurisdiction preliminary and permanent injunctive relief as well as equitable accounting of all profits or benefits arising out of such violation which rights or remedies shall be cumulative and in addition to any rights or remedies to which INTERTEC may be entitled and that the undersigned shall further be directly liable for any and all reasonable attorney's fees incurred by INTERTEC to enforce this Agreement against the undersigned in a court of law.

(6) The foregoing understanding shall apply to any subsequent meeting and/or communications between INTERTEC and the above mentioned organization relating to the same subject manner, unless modified in writing as to any such subsequent meetings and/or communications.

We would appreciate your signing and returning to us, prior to the release of INTERTEC product documentation, the original copy of this agreement denoting your concurrence with the foregoing provisions.

AGREED TO: _____

(YOUR NAME OR COMPANY - PLEASE PRINT)

YOUR SIGNATURE: _____

In addition to the terms listed above, I further certify that I am duly authorized to sign this document on behalf of the organization and/or persons requesting that this imformation be supplied by INTERTEC.

YOUR NAME: _____

YOUR TITLE: _____

TODAY'S DATE: _____

INTERTEC DATA SYSTEMS CORPORATION

SIGNATURE: _____

FOR OFFICE USE ONLY

DATE RCV'D _____ PROCESSED BY: _____

OTHER RELEASES	DATE	INVOICE NO.

INTERTEC DATA SYSTEMS
Corporate Headquarters: 2300 Broad River Road, Columbia, South Carolina 29210 • 803/798-9100 • TWX: 810-666-2115

BE SURE TO INCLUDE YOUR SERIAL NUMBER HERE.
SERIAL NO. _____

SUPERBRAIN II LIMITED WARRANTY REGISTRATION FORM

IMPORTANT: This form should be completed within ten days of receipt of your SuperBrain II Video Computer System and returned to Intertec at the following address:

Intertec Data Systems Corporation
2300 Broad River Road
Columbia, South Carolina 29210

Attn: Warranty Registration Department

All warranty liability is limited to that expressed in most recent edition of the SuperBrain II Video Computer User's Manual as published by Intertec Data Systems Corporation.

****

Date Received: _____ Purchased from: _____

Company: _____ _____

Name: _____ Address _____

Title: _____ City: _____

Address _____ Telephone: ( ) _____

City: _____ Sales Agent: _____

Country: _____ Order Placed On: _____

Telephone: ( ) _____ Price Paid: _____

****

Where did you first hear about the SuperBrain? From a ☐ Magazine ☐ Dealer ☐ Friend

_____ _____

Why did you decide to purchase the SuperBrain? ☐ Features ☐ Price ☐Appearance

_____

_____

Was the Dealer and/or Sales Agent knowlegeable about the SuperBrain? ☐YES ☐NO

Please explain.

_____

_____

_____

Questions on the reverse side must be completed to validate your warranty

Were you introduced to any other Intertec products? ☐ YES ☐NO (if yes, please indicate other products which were mentioned.)_____

_____

_____

_____

Are you aware of other Intertec products? ☐ YES ☐ NO (If yes, which ones?)

_____

_____

_____

What other microcumputer related products will you be purchasing in the next 12 months?

☐ Video Terminals ☐ Printers (matrix) ☐ Printers (character) ☐ Disk Systems ☐ Other

_____

_____

What is your application for the SuperBrain? ☐ Business ☐ Scientific ☐ Educational ☐ Other

_____

_____

_____

_____

What are your comments in general concerning the overall operation of the SuperBrain?

☐ Outstanding ☐ Excellent ☐ Good ☐ Average ☐ Unsatisfactory

_____

_____

_____

Would you like to be placed on our mailing lists? ☐ YES ☐ NO

May we use your name as a favorable reference for other customers in your area desiring to purchase a SuperBrain? ☐ YES ☐ NO

Thank you for purchasing the SuperBrain II Video Computer System. If we may be of further assistance to you, please contact our Customer Service Department at the address on the reverse side of this form.

INTERTEC DATA SYSTEMS

Corporate Headquarters: 2300 Broad River Road, Columbia, South Carolina 29210 • 803/798-9100 • TWX: 810-666-2115

EQUIPMENT MALFUNCTION REPORT

IDS - 505A

THIS EQUIPMENT PURCHASED FROM: _____

Dealer Name: _____ Address _____

City & State _____ Telephone Area ( ) _____

Dear Customer:

We are trying to manufacture the most reliable product possible. You would do us a great courtesy by completing this form should you experience any failures. Enclose this form with the equipment you intend to return to the dealer or factory for service. (Additional copies of this form available upon request.)

1. Type Unit _____ Serial No. _____

   Module (if applicable) _____

2. Component failed (if available, include Name and Number) _____

3. Description of failure (include cause of failure if readily available) _____

   _____

   _____

   _____

4. Approximate hours/days of operation to failure _____

5. Failure occurred during:

   ☐ Initial Inspection ☐ Customer Installation ☐ Field Use

6. Personal Comment:

   _____

   _____

   _____

Your Name _____ Address _____

City & State _____ Zip _____ Phone( ) _____

Date _____ Signed _____

Return this form and equipment to your local dealer or to the factory at the address below.

ATTN: SUPERBRAIN SERVICE CENTER
Intertec Data Systems Corporation
2300 Broad River Road
Columbia, South Carolina 29210

INTERTEC DATA SYSTEMS

CUSTOMER COMMENT CARD

Corporate Headquarters: 2300 Broad River Road, Columbia, South Carolina 29210 • 803/798-9100 • TWX: 810-666-2115

Our past and present customers are directly responsible for the evolution of the SuperBrain as you see it presented in this manual. Before Intertec began research and development on the SuperBrain, an extensive user survey was conducted to ascertain optimum video computer price/performance ratios to enable us to capture a major portion of the video computer market. In order that we continue with our commitment to excellence in engineering, production and marketing, we would appreciate your comments below regarding your overall opinion of the SuperBrain. All comments are given careful consideration in future product design and become the property of Intertec Data Corporation.

(1) What are your comments concerning the overall appearance of the SuperBrain? (You may want to comment on color, size and construction.)

(2) What are your comments (in general) concerning the overall operation of the unit?

(3) What features about the unit do you like best?

(4) What features about the unit do you like least?

Please see additional questions on the reverse side

(5) Briefly describe your application for the SuperBrain.

_____

_____

_____

_____

(6) What other microcomputer systems do you feel are comparable to the SuperBrain in both price and performance?

_____

_____

_____

_____

(7) What changes and/or modifications to the SuperBrain could be made to render it more suited to your application?

_____

_____

_____

_____

(8) Your candid comments regarding the operation of and application for the SuperBrain are greatly appreciated. Address your comments and/or suggestions to:

PRODUCT SERVICES MANAGER
Intertec Data Systems
2300 Broad River Road
Columbia, South Carolina 29210

(9) If you desire to be contacted by our service, marketing or technical staff regarding these comments, please give us your complete name, address and phone number below. (This information is optional.)

Company Name_____

Address _____

City, State & Zip_____

Contact: _____

Phone: AREA (_____) _____ EXT _____

I would like to be contacted by your: ☐ Marketing ☐ Technical ☐ Service Department

INTERTEC DATA SYSTEMS
Corporate Headquarters: 2300 Broad River Road, Columbia, South Carolina 29210 • 803/798-9100 • TWX: 810-666-2115

DOCUMENT REVIEW FORM

In order to insure that you are provided with a document that will satisfy all of your information requirements as well as one that is error free and easy to use, we would like to ask you to supply us with any comments, suggestions, or errors you have found. The space below is provided for this input. Return the completed form to:

ATTN: TECHNICAL SERVICES MANAGER
Intertec Data Systems Corporation
2300 Broad River Road
Columbia, South Carolina 29210