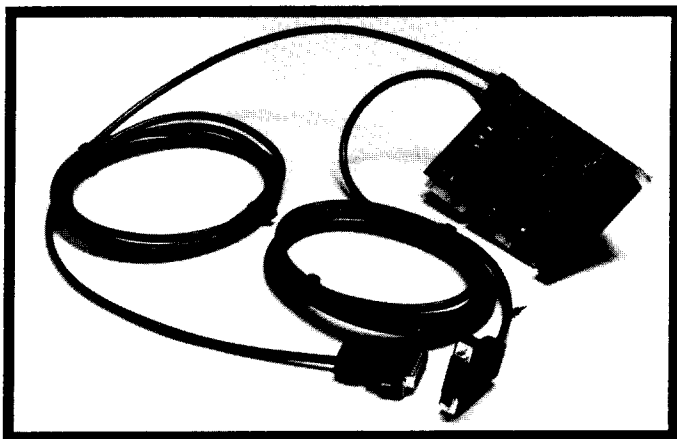


BBS550



User Manual

GTEK[®], INC.

Products for the BBS Industry

Introduction

Before installing your BlackBoard-8/650, you must configure the starting address and interrupt mode for the card. The BlackBoard-8/650's factory default configuration shipped is Base Address 100h and all 8 channels are set to share IRQ 3.

If this default configuration is suitable for your application, you may proceed to Chapter 3. Otherwise, read Chapter 2 for setup information.

—Note—

Configuring your BBS550

Selecting a Starting address:

Each port (16550 UART) on the BBS550 occupies 8 bytes of I/O. Since there are 8 16550 UARTS on the BBS550, each card occupies 64 bytes of I/O space on your computer. Each port on your BBS550 must have an address associated with it. Your BBS software needs to know the address for each port in order to send and receive data to and from the UART.

Your BBS software allows you to specify the I/O address and interrupt for each port. You must first determine where you have an available range of I/O space (64 bytes or more) in your computer. I/O space on the PC/XT machines occupies 0–3FFh. Some of the I/O space is already used by the PC as shown in the following I/O Map. Remember that PC/XT/AT's use 10 bit I/O addressing allowing for I/O in the range of 0–3FFh. Addresses at or above 400h are redundant unless the adapter card decodes A10 through A15 when determining its I/O address.

| Hex Range | Usage | Hex Range | Usage |
|-----------|--|-----------|------------------------|
| 000–00F | 8237 Direct Memory Access Controller #1 | 278–27F | Parallel printer |
| 020–021 | 8259 Programmable Interrupt Controller #1 | 2B0–2BF | EGA Display Port |
| 040–043 | 8253 Timer | 2C0–2CF | EGA Display Port (alt) |
| 060–063 | 8255 PPI (XT) | 2D0–2DF | EGA Display Port (alt) |
| 060–064 | 8742 Controller (AT keyboard) | 2E0–2E7 | GPIOB (AT) |
| 070–071 | CMOS Ram & NMI Mask Register (AT) | 2E8–2EF | Serial Port (COM4) |
| 080–08F | DMA Page Registers | 2F8–2FF | Serial Port (COM2) |
| 0A0–0A1 | 8259 PIC #2 (AT) | 300–30F | Prototype Card |
| 0A0–0AF | NMI Mask Register (XT) | 310–31F | Prototype Card |
| 0C0–0DF | 8237 DMA #2 (AT–Word Mapped) | 320–32F | Hard Disk (XT) |
| 0F0–0FF | 80287 Numeric CoProcessor (AT) | 378–37F | Parallel Printer |
| 100–107 | PS/2 type programmable option select registers | 380–38F | SDLC |
| 1F0–1FF | Hard Disk (AT) | 3A0–3AF | SDLC |
| 200–20F | Game/Control Port | 3B0–3BB | MDA |
| 210–21F | Expansion Unit (XT) | 3BC–3BF | Parallel Printer |
| 238–23B | Bus Mouse | 3C0–3CF | EGA |
| 23C–23F | Alternate Bus Mouse | 3D0–3DF | CGA |
| | | 3E8–3EF | Serial Port (COM3) |
| | | 3F0–3F7 | Floppy Disk |
| | | 3F8–3FF | Serial Port (COM1) |

If you are not sure about which address range is available on your PC, run the program "IOMAP.EXE" which is supplied on your BBS550 Support Software disk. This program will give you a visual "snapshot" of the I/O space in the 100–3FF range. You will then be able to determine which I/O addresses are in use by another device.

The following address and interrupt modes are available on the standard BBS550. Other custom modes are available. Contact GTEK for more details.

Addressing Modes

| JP1 0 | JP1 1 | JP1 2 | Port 0 | Port 1 | Port 2 | Port 3 | Port 4 | Port 5 | Port 6 | Port 7 | Sta- tus | Mode |
|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-------------|-----------------------|
| 0 | 0 | 0 | 100 | 108 | 110 | 118 | 120 | 128 | 130 | 138 | 140 | BBS Mode #1 |
| 0 | 0 | — | 200 | 600 | A00 | E00 | 1200 | 1600 | 1A00 | 1E00 | 207 | Galacticom mode #1 |
| 0 | — | 0 | 2C0 | 2C8 | 2D0 | 2D8 | 2E0 | 2E8 | 2F0 | 2F8 | 2FF | GTEK/H mode |
| 0 | — | — | 210 | 610 | A10 | E10 | 1200 | 1600 | 1A00 | 1E00 | 217 | Galacticom mode #2 |
| — | 0 | 0 | 180 | 148 | 150 | 158 | 160 | 168 | 170 | 178 | 141 | BBS Mode #2 |
| — | — | 0 | 2C0 | 2C8 | 2D0 | 2D8 | 3E8 | 2E8 | 3F8 | 2F8 | 2FF | COMM 1234 |

0=Jumper installed, —=NO Jumper installed.

Note when you use the COMM1234 mode above and select one of the first 2 Discrete IRQs from the Interrupt Modes table below, you obtain COM1 on port 6, COM2 on port 7, COM3 on port 4 and COM4 on port 5.

A Word About Interrupts

Not all BBS software uses interrupts for its serial communication. If your software does not use interrupts for serial data, set jumpers as seen above. If your software requires interrupts for serial communication, please read on...

In addition to knowing where the UARTs are, your software needs to know which ports are associated with each interrupt. This is so that when the PC receives an interrupt request on a certain IRQ line, it knows from where the interrupt came.

Some software requires that each port on your BBS550 has a dedicated interrupt. Other BBS software (TBBS for example) allows you to assign all ports to only one interrupt. If your software allows interrupt sharing, you should probably use it. Interrupt sharing conserves interrupts and allows them to be used for other devices, eg. CD Roms, Hard Disk Drives, Parallel Ports, etc.

First, you must determine how many interrupts you will need for your BBS software. (Ask your software Vendor about this.) Then figure out which interrupts are available to you in your PC. As with I/O address space, certain interrupts are already used by your PC and may not be used by your BBS550. See the following chart and then see the table following for interrupt selections.

Common Hardware Interrupts used by an AT class computer:

| Name | Description |
|------|---------------------------------|
| NMI | Parity (not available on bus) |
| 0 | Timer (not available on bus) |
| 1 | Keyboard (not available on bus) |
| 2 | Cascade |
| 3 | COM or SDLC |
| 4 | COM or SDLC |
| 5 | LPT (XT=Hard Disk) |
| 6 | Floppy Disk |
| 7 | LPT |
| 8 | Real Time Clock |
| 9 | Re-Directed to IRQ2 |
| 10 | Unassigned |
| 11 | Unassigned |
| 12 | Unassigned |
| 13 | 80x87 Coprocessor |
| 14 | Hard Disk |
| 15 | Unassigned |

Interrupt Modes

Shared IRQs

| JP1 3 | JP1 4 | JP1 5 | JP1 6 | JP1 7 | Mode |
|----------|----------|----------|----------|----------|---|
| 0 | — | — | — | — | Shared Irq3 on all 8 channels, cascadable |
| — | 0 | — | — | — | Shared Irq4 on all 8 channels, cascadable |
| — | — | 0 | — | — | Shared Irq5 on all 8 channels |
| — | — | — | 0 | — | Shared Irq7 on all 8 channels |
| — | — | — | 0 | 0 | Shared Irq2 on all 8 channels |

0=Jumper installed, —=NO Jumper installed.

Discrete IRQs

| Jumper (JP1-#) | | | | | Port (Channel-#) | | | | | | | Description | |
|----------------|---|---|---|---|------------------|----|----|----|----|----|---|-------------|---|
| 3 | 4 | 5 | 6 | 7 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | 7 |
| 0 | 0 | — | — | — | 4 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | Irq's alternated and Com1,2,3,4 Compatible |
| 0 | 0 | — | — | 0 | 7 | 7 | 7 | 7 | 4 | 3 | 4 | 3 | Irq's COM1,2,3,4 Compatible, rest Shared on 7 |
| 0 | 0 | 0 | 0 | 0 | 5 | 2 | 10 | 11 | 12 | 15 | 4 | 3 | Discrete and Com1,2 Compatible |
| 0 | 0 | 0 | 0 | — | 5 | 7 | 10 | 11 | 12 | 15 | 4 | 3 | Discrete and Com1,2 Compatible |
| 0 | 0 | 0 | — | — | 10 | 11 | 12 | 15 | 4 | 3 | 4 | 3 | Discrete and Com1,2,3,4 Compatible |

0=Jumper installed, —=NO Jumper installed.

No IRQs

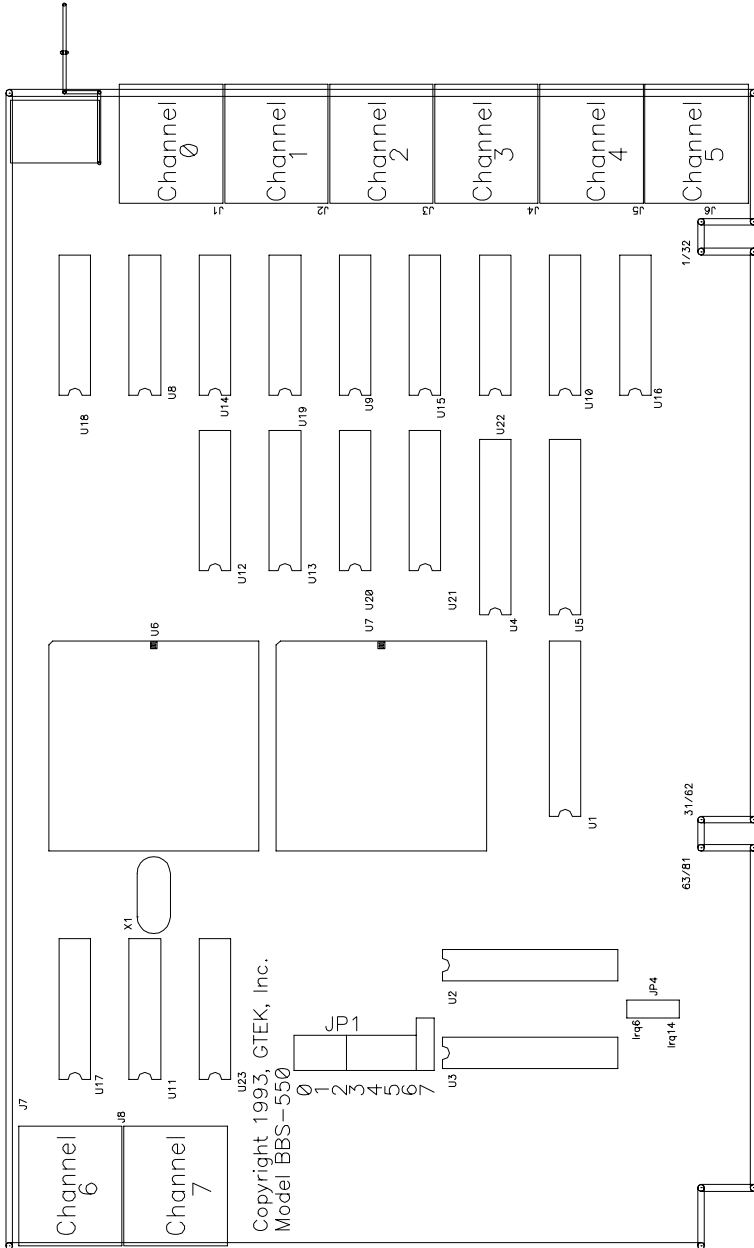
| 3 | 4 | 5 | 6 | 7 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|-----------------------|
| — | — | — | — | — | — | — | — | — | — | — | — | — | Does not generate Int |

0=Jumper installed, —=NO Jumper installed.

To Cascade Boards:

Use IRQ3, 4, or 5 as a shared interrupt on the primary board. Set the second and succeeding boards with jumpers on J5 and J6 only. Don't forget to select an addressing mode with J0, J1 and J2. Connect a wire from JP4 (center pin) on the second and succeeding boards to connect to the first board on JP7 (center pin).

—NOTES—



Physical Installation

After you have selected the base address and interrupt mode for your BBS550, you may proceed with the physical installation of the card. You may wish to make a note of you current jumper settings for future use.

CAUTION:

Be sure that the power is off and the power cord is removed from the PC before installing or proceeding with the installation.

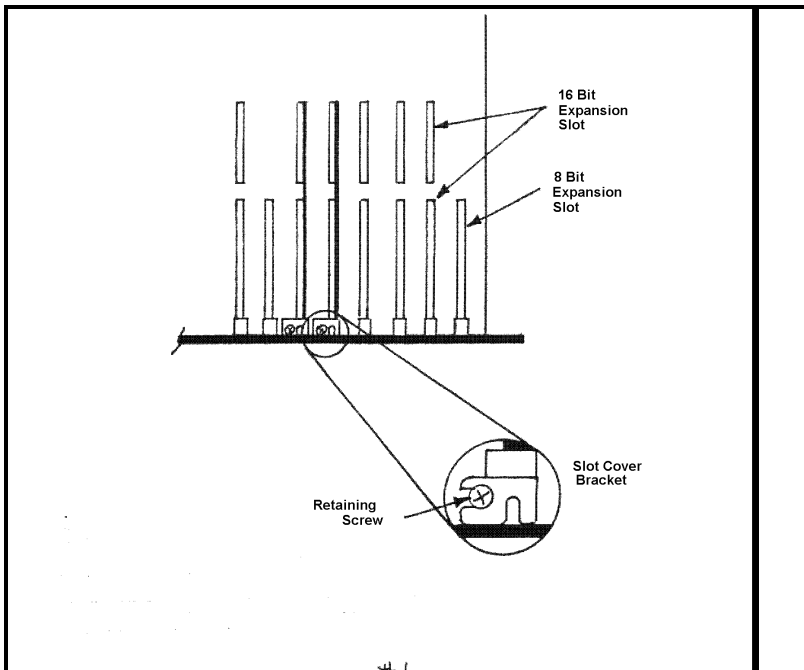
You may wish to consult with your computer's owner manual about installation of expansion cards. If you are not familiar with the process of installing expansion cards in your computer or if you feel uncomfortable with this installation, refer the installation to qualified personnel. Failure to follow these instructions may result in damage to your computer, damage to the BBS550 or both.

Step 1—Carefully remove the cover of your PC.

Case styles vary, so follow the instructions in your computer manual for removing the cover of your PC to expose the expansion slots.

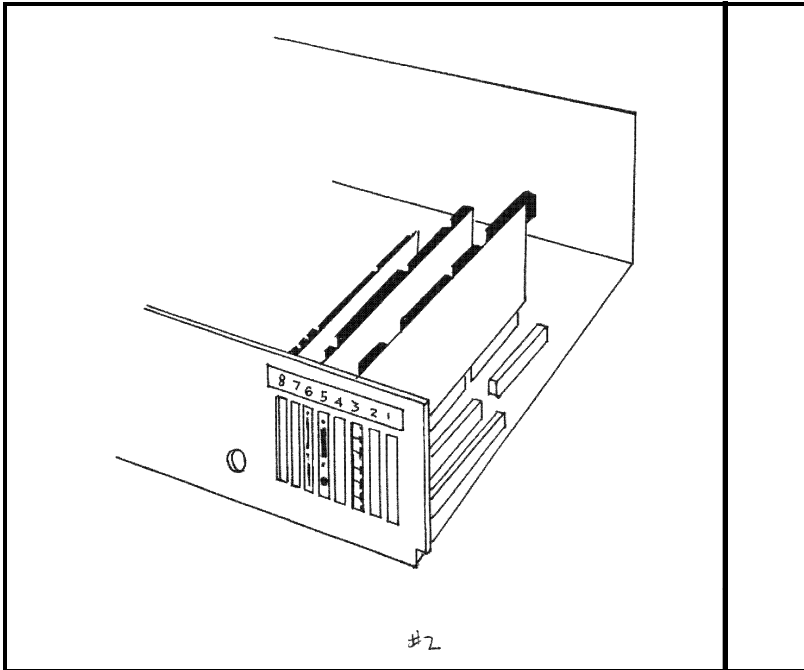
Step 2—Choose an available 8 or 16 bit expansion slot.

Eight bit slots will have only one card edge connector, and 16 bit slots will have 2 card edge connectors. In order to access the higher (above IRQ7) interrupts, you will have to install your BBS550 in a 16 bit slot. You will need to remove the screw and bracket which covers the slot hole. Retain the screw for the BBS550 bracket.



3.1 Top View of Computer

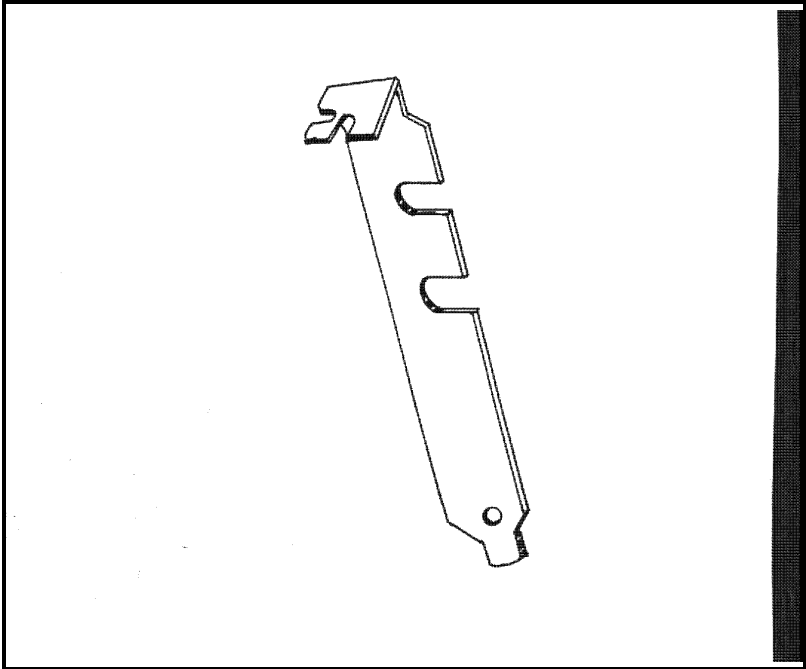
Step 3—Carefully insert the BBS550 into the available slot and secure it in place with the screw you removed from step 2.



3.2 BBS550 inserted into slot.

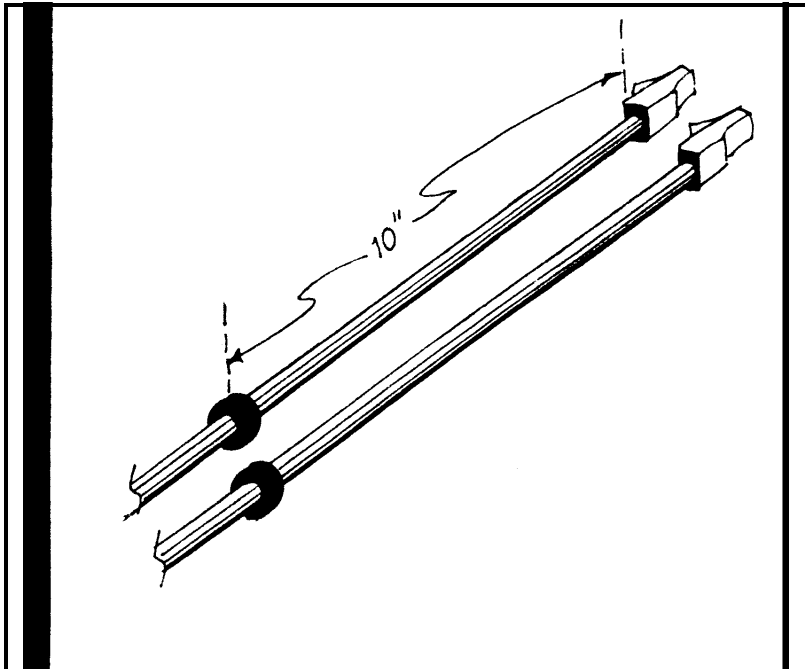
Step 4—Insert cable retaining bracket.

If you will be using the two ports on the rear of the BBS550 (Ports 6 & 7), you may wish to use the cable retaining bracket supplied with the unit. The cable retaining bracket has 2 cutouts which are made to accomodate the 2 cables which plug into ports 6 & 7.



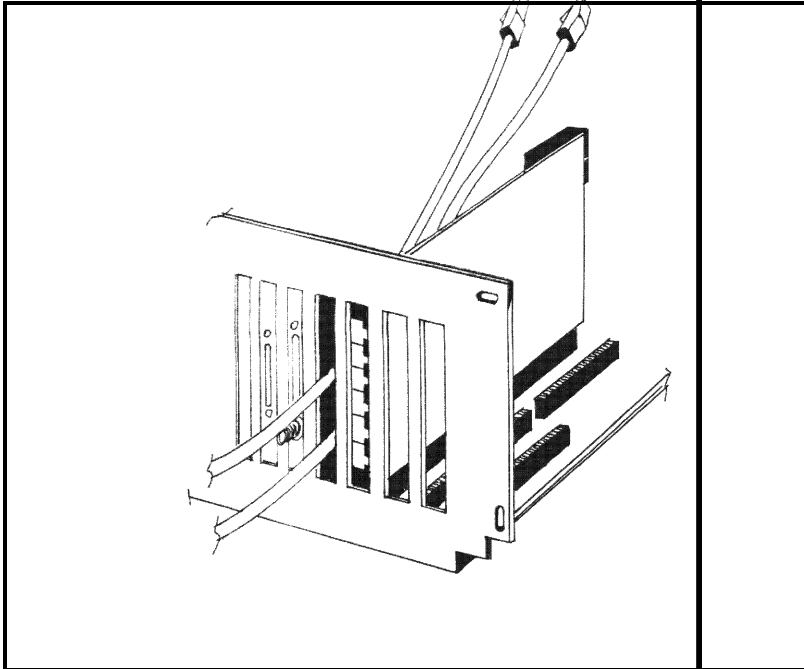
3.3 Cable retaining bracket.

The 2 cables for ports 6 & 7 can be identified by the rubber grommets which are installed approximately 10 inches from the RJ-45 plug.



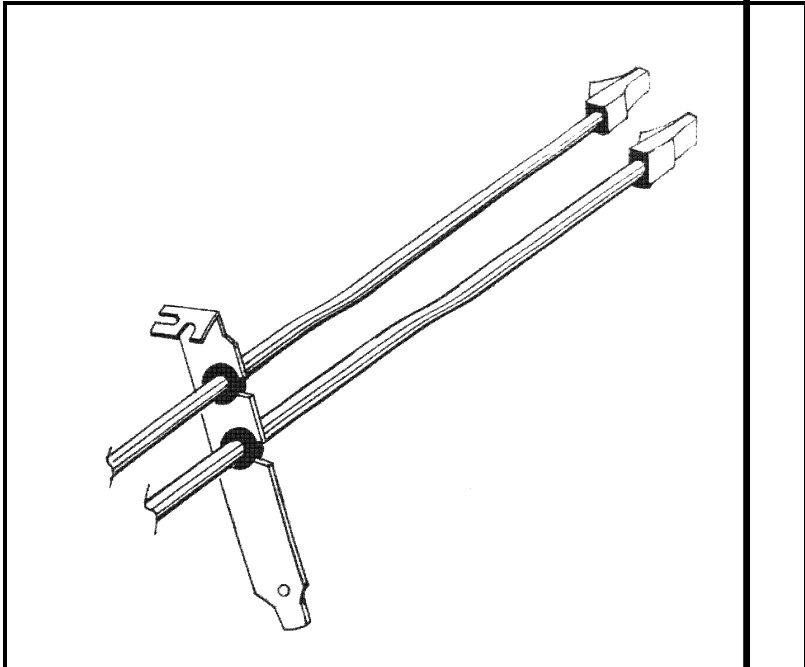
3.4 RJ-45 cables with rubber grommets (2).

To install the cable retaining bracket, first remove an existing cover bracket and retain the screw. Locate the cables for ports 6 & 7 and then carefully route the cables through the slot where you removed the existing cover.



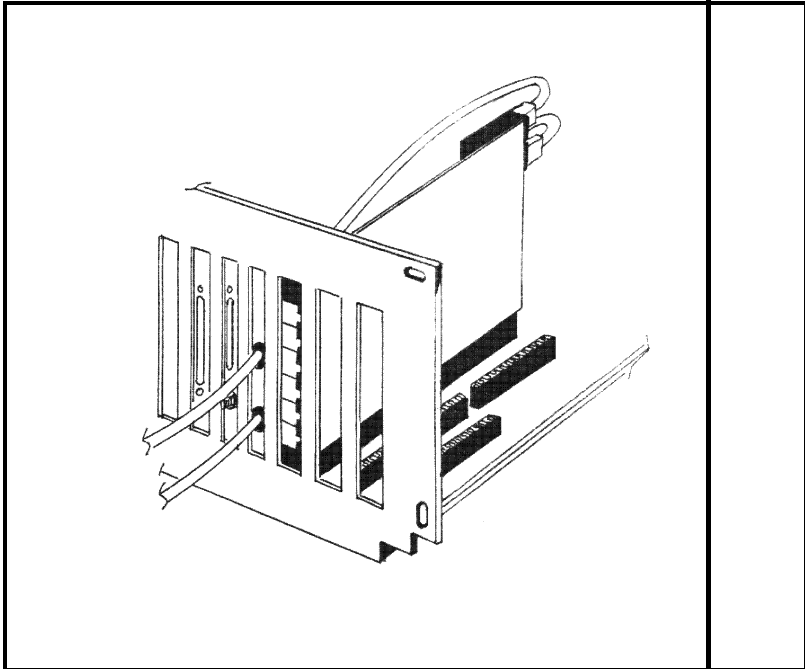
3.5 RJ-45 cables routed through opening.

Insert the rubber grommets into the slots on the retaining bracket and secure it with the screw.



3.6 Grommets installed into cable retaining bracket.

You may then plug these cables into the two RJ-45 connectors on the rear of the BBS550. Channel 6 is on top and Channel 7 is next.



3.7 BBS550 installed into computer.

—NOTES—

4—SOFTWARE LICENSE AGREEMENT

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Products requiring Limited Warranty service during the warranty period should be delivered to GTEK with proof of purchase. If the delivery is by mail, you agree to insure the product or assume the risk of loss or damage in transit. You also agree to prepay the shipping charges to GTEK.

All Express And Implied Warranties For This Product Including, But Not Limited To, The Warranties Of Merchantability And Fitness For A Particular Purpose, Are Limited In Duration To The Above 1 Year Period. Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.

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The limited warranty applies to hardware products only.

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2. if GTEK, Inc. or the dealer is unable to deliver a replacement diskette(s) which is free of defects in materials or workmanship, you may terminate this Agreement by returning the program and your money will be refunded.

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5.4 GENERAL

You may not substitute, assign or transfer the license or the program except as expressly provided in this Agreement. Any attempt otherwise to sublicense, assign or transfer any of the rights, duties or obligations hereunder is void.

This Agreement will be governed by the laws of the State of Mississippi.

Should you have any questions concerning this Agreement, you may contact GTEK, Inc. by writing to:

GTEK, Inc. Sales and Service
P. O. Box 2310
Bay St. Louis, MS 39521-2310

—Notes—

6—SERVICE

For warranty service or non warranty service, contact GTEK, INC. at (601) 467-8048 to obtain an RMA (Return of Material Authorization number). We will need the serial number and date of purchase. Send the BBS550, freight prepaid to:

GTEK, INC.
RMA #####
399 Highway 90
Bay St. Louis, MS. 39520

Be sure to include the RMA number on and in the package so we will know what to do with it. Out of warranty service charges are determined on an hourly labor plus materials basis.

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

Information to user: The user is cautioned that changes or modifications not expressly approved by GTEK, Inc. could void the user's authority to operate the equipment.

—NOTE—

7—Uart Programming

PROGRAMMING THE 16550 UART:

In this section, references to the uart I/O addresses are abbreviated to “ba” which stands for “Base Address”. In the case of Com1:, it is at 3F8h. In the case of COM2: it is at 2F8h. Other common settings for GTEK I/O cards are 200h, 2C0h, 280h, etc. When addressing these uarts, you can get to certain registers at the “base address” plus an offset from that base address. If the card is at 200h, then the base address of the first uart is 200h. The transmit and receive buffer are at that address. The Interrupt Enable Register (IER) is at the next address or as we will call it, “Base Address plus 1”. We will abbreviate this as ba+1. Interrupt ID Register (IIR) is at “Base Address plus 2”, or ba+2.

Registers Accessible to the Programmer:

| | | |
|------------------|------|--------------------------|
| Transmit Buffer | ba+0 | (write) |
| Receive Buffer | ba+0 | (read) |
| Divisor Latch | ba+0 | (read/write LSB, dlab=1) |
| Divisor Latch | ba+1 | (read/write MSB, dlab=1) |
| Interrupt Enable | ba+1 | (dlab=0, read/write) |
| Interrupt ID | ba+2 | (dlab=0, read/write) |
| Line Control | ba+3 | (dlab=0, read/write) |
| Modem Control | ba+4 | (dlab=0, read/write) |
| Line Status | ba+5 | (dlab=0, read/write) |
| Modem Status | ba+6 | (dlab=0, read/write) |
| Scratch | ba+7 | (dlab=0 read/write) |

(Note that you can't really get to the scratch register on a GTEK board because of the hardware logic involved.)

Transmit buffer at ba+0 (write only, DLAB=0):

Bits 0–7 equal your output data bits 0–7.

Receive buffer at ba+0 (read only, DLAB=0):

Bits 0–7 equal your input data bits 0–7.

Divisor latch at ba+0 (write/read, DLAB=1):

Bits 0–7 equal your byte for the LSB of the baud rate word during a write. During a Read, Bits 0–7 equal the present state of the LSB of the baud rate word.

Divisor latch at ba+1 (write/read, DLAB=1):

Bits 0–7 equal your byte for the MSB of the baud rate word during a write. During a Read, Bits 0–7 equal the present state of the MSB of the baud rate word.

To program the baud rate, write the LSB and MSB of the Baud Rate Word to ba+0 and ba+1 while bit 7 of the Line Control Register is high. To determine the bytes to write to the Divisor Latches, use this Algorithm:

$$\text{BRW} = \frac{1,843,200}{(\text{desired_baud_rate} * 16)}$$

Example: Note 1.8432 is crystal frequency. Crystal may be changed to 4 x 1.8432 = 7.3728 and baud rates will be 4X the original frequency for a particular value.

To determine the Baud Rate Word for 9600 baud:

$$\text{Baud_rate_word} = 1,843,200 \div (9600 \times 16)$$

$$\text{Baud_rate_word} = 1,843,200 \div 153,600$$

$$\text{Baud_rate_word} = 12$$

$$\text{or Baud_rate_word} = \text{x000C hex (MSB=00, LSB=0C)}$$

To determine BRW for 300 baud:

$$\text{BRW} = 1,843,200 \div (300 \times 16)$$

$$\text{BRW} = 1,843,200 \div 4800$$

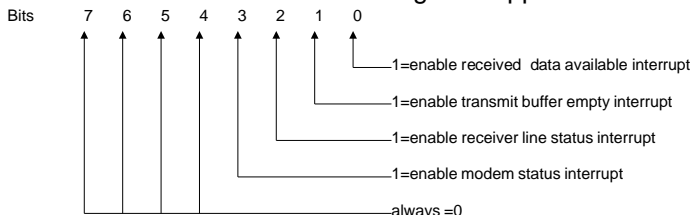
$$\text{BRW} = 384$$

$$\text{or BRW} = \text{x0180 hex (MSB=01, LSB=80)}$$

It looks like the highest baud rate is 115,200 baud (BRW= 0001) and the lowest is 2 baud (BRW= E100). Remember that due to hardware speed limitations, you may not be able to use 115,200 baud or 2 baud. Typically a 6 MHz computer might be able to use 57,600 baud, while an 8 or 12 MHz computer might be able to use 115,200. The 16550 makes it more likely to work on any particular computer, due to the extra buffering. Using the 4X crystal yeilds 430,800 baud, etc...

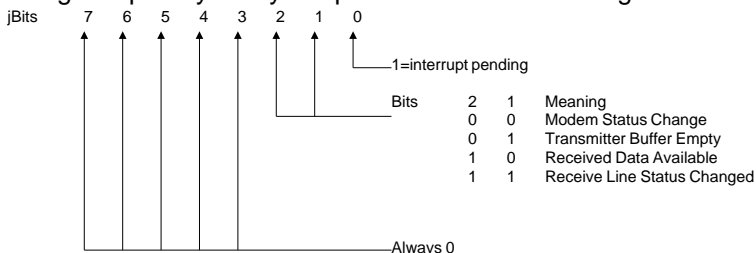
Interrupt Enable Register $ba+1$ (write/read, DLAB = 0):

Reading the IER will give you the current state of the bits. Writing to the IER will cause certain things to happen:



Interrupt Identification Register at $ba+2$ (read):

Reading the IIR will give you the status of the interrupts, if one occurred. This is prioritized, so that if more than 1 interrupt occurred, you are vectored to the interrupt service routine with the highest priority. They are prioritized in the following manner:



PriorityService

- 1 Receiver Line Status (highest priority)
- 2 Received Data Ready
- 3 Transmit Buffer Empty
- 4 Modem Status Change (lowest priority)

The Modem Status Change (lowest priority- 00) indication is reset by reading the Modem Status Register. This interrupt can be caused by the Clear To Send, Data Set Ready, Ring Indicator, or Received Line Signal Detect (CD) signals.

The Transmitter Buffer Empty indication (01). Read the IIR or write to the Transmitter buffer to Reset this Interrupt. This interrupt is caused by the Transmit Buffer becoming Empty.

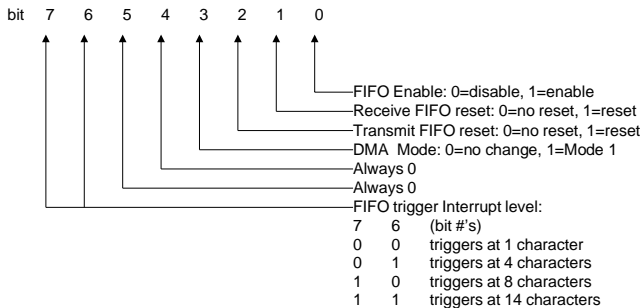
The Received Data Available indication (10). Read the Receive Buffer Register to Reset this Interrupt. It's caused by the Receive Buffer Register becoming Full.

The Receiver Line Status changed indication (highest priority 11). Read the Line Status Register to reset this Interrupt. It's caused by an Overrun, Parity, or Framing Errors, or the Break Interrupt.

On an interrupt from the uart, the highest priority interrupt has precedence. All other pending interrupts are held until the action that clears the current interrupt is performed.

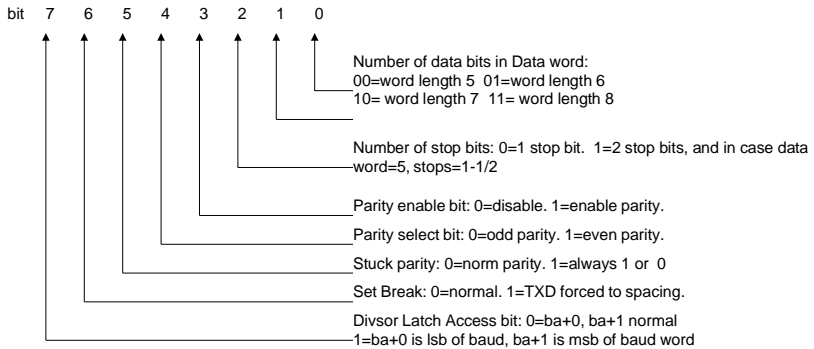
Fifo Control Register $ba+2$ (Write):

Writing this register controls fifo functions:



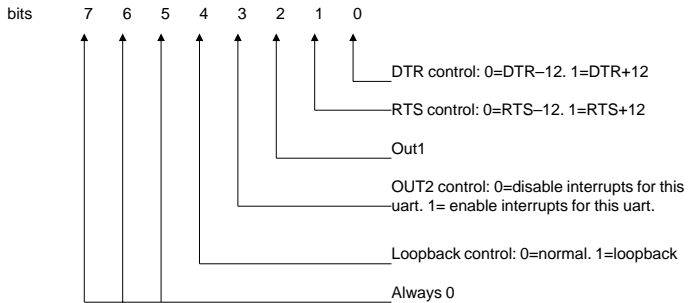
Line Control Register $ba+3$ (read/write):

Reading this register gives you the current settings of the uart as specified below. Writing to it will change the current settings.



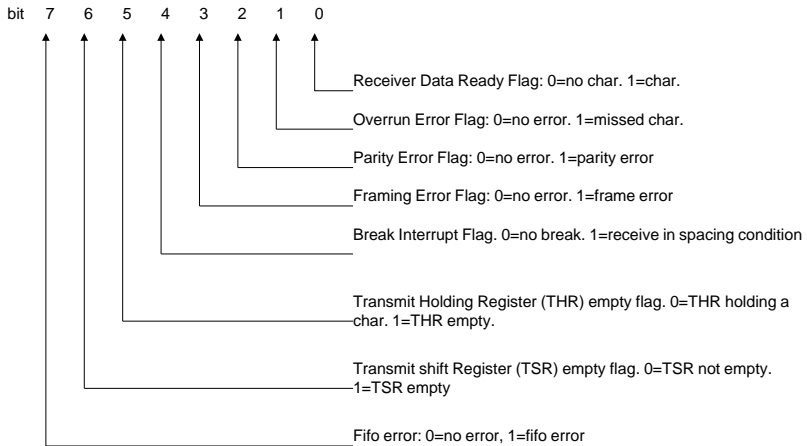
Modem Control Register $ba+4$ (write/read):

Reading this register gives you the current settings. Writing this register controls the desired function.

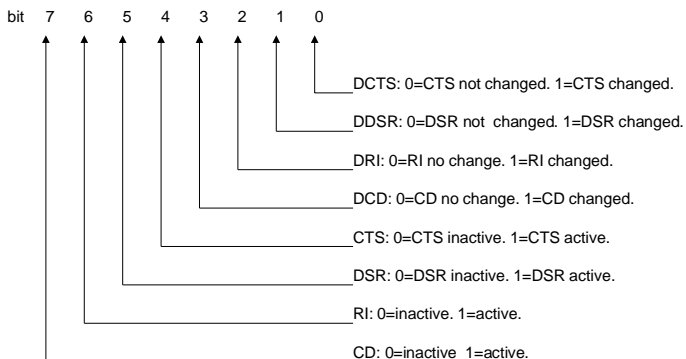


Line Status Register ba+5 (read/write):

Reading this register will give you the current line status. You read this register in the interrupt mode to find which item caused the interrupt. The interrupt is the highest priority interrupt. You must enable interrupts for these registers to work properly.

**Modem Status Register ba+6 (read/write):**

This Register indicates the current state of the external devices (modems, programmers, emulators, terminals).



Suggestion: If you need more information on programming the 16550, then we suggest that you invest in the *IBM TECHNICAL REFERENCE PERSONAL COMPUTER AT* manual. It has more detailed information about programming the uart, and the BIOS routines make a good example.

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