# TECHNICAL USER MANUAL

# MICRO B

## SERIES

## DM20, MCB 2

BEEHIVE INTERNATIONAL

# TECHNICAL USER MANUAL

# MICRO B

## VIDEO DISPLAY TERMINALS

### MICRO BEE 2, DM20

### NOVEMBER 1979

ALL SPECIFICATIONS CONTAINED IN THIS MANUAL ARE SUBJECT TO CHANGE AT ANY TIME WITHOUT NOTICE.



**BEEHIVE INTERNATIONAL**

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# BEEHIVE INTERNATIONAL WARRANTY INFORMATION

## LIMITED WARRANTY

Beehive's Equipment is warranted against defects in material and workmanship for a period of ninety (90) days from date of shipment to Beehive's direct customer. Beehive will repair or, at its option, replace Equipment which proves to be defective during the Warranty Period, provided such Equipment is returned to Beehive's factory as hereinafter provided.

No defective Equipment may be returned to Beehive without an Advance Return Authorization from Beehive's Field Service Department (801-364-4606). The Return Authorization number must be referenced on both the shipping container and the packing list.

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b. Failure or malfunctions which occur as a result of improper maintenance, operation (including hostile operating environment) or lack of care.

c. Components (if any) which are specified in the Reference or Operating Manual as being excluded from warranty.

d. Malfunctions which occur as a result of customer supplied interfacing.

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THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT WILL SELLER BE LIABLE FOR CONSEQUENTIAL DAMAGES.

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*****

In some cases Beehive's direct customer has, by written contract, waived all warranties, express and implied, in exchange for an additional discount.

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# SECTION I
# INTRODUCTION

This manual provides a general description and operating instructions for Beehive International's Micro Bee 2/DM20, with a detachable keyboard. Included are sufficient diagrams, tables and descriptive text to provide an understanding of the operational characteristics of the equipment. Three general sections are included:

- Section I provides a brief description of the Micro Bee terminal and a specifications listing on Table 1-1.
- Section II describes the installation and initial checkout of the terminal.
- Section III describes operational characteristics and functions of the terminal. Basic operator insturctions are provided first, followed by a detailed operating description.

Beehive International's Micro Bee (see Figure 1-1) is an 8085A microprocessor-controlled buffered video display terminal offering the latest advances in technology and human engineering. Its numerous features are tailored to address both interactive and batch mode markets. Specific product enhancements formerly found only in more sophisticated and expensive terminals are designed into the Micro Bee, giving it superior cost/performance value.

Among the Micro Bee features is the Memory Lock, which allows the operator or host computer to lock a position of the display while retaining the capability to enter or receive data in the unlocked portion of the display memory. The invisible Memory Address Pointer is used to read and write to and from the display memory independent of visible screen functions. Standard visual attributes include normal, reverse, blink, underline, and half-intensity video levels. These are further enhanced by the addition of logical attributes which include protected data fields, numeric only fields, alpha only fields, constant fields and modified data field transmission.

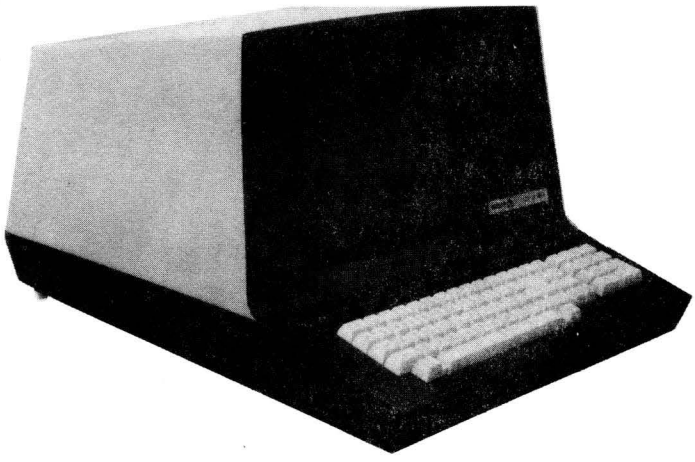
Line 25 of the Micro Bee display is a "status" line which the system firmware uses to indicate modes of operation, error messages, communications protocol information, and to convey terminal status messages. The self-diagnostic results are also selectively displayed for the operator or field technician using this reserved display area.

The most predominant video characteristic is found in the terminal display memory organization. The display format is based upon 24 lines of data with 96 characters in each line. Eighty of the character positions are displayable, which leaves sixteen nondisplayable character cells available for field attributes. Finally, the line drawing graphics capability allows for the creation of forms on the display, using the vertical and horizontal line feature.

The Micro Bee keyboard is designed with particular attention being given to combining TTY and typewriter layouts. The shape and positioning of the "Return" key, as well as the additional field termination control keys associated with the numeric pad, complete the user-oriented design when they are included with autorepeat, two-key rollover, and the highly reliable reed switch features. The half-size keys located above the standard keyboard layout include programmed function keys, editing, cursor and system mode/control keys.

The Micro Bee is designed to address the most demanding operational mode requirements found in the communications market. Data transmission can be selectively defined as Conversational, Line, Message, or Page. Operational characteristics are enhanced by the addition of Local and Line Monitor modes. The Forms mode allows the operator to prepare a form with specific visual and logical attributes on the display screen and then transmit it to a host computer or auxiliary device.

The expanded characteristics of the Micro Bee include a bidirectional buffered serial auxiliary port, X-Y addressing, read cursor address, read terminal status, time-of-day clock, and 128 ASCII characters with descenders on lower case characters.



Micro Bee 2

Micro Bee/Model DM20

**Figure 1-1 Micro Bee Video Display Terminals**

## Table 1-1 Specifications

**DISPLAY FORMAT**
24 lines x 80 characters

**STATUS LINE**
25th line of display

**CRT SIZE**
12" measured diagonally

**CHARACTER SIZE**
Approximately 0.2" high x 0.1" wide

**CHARACTER TYPE (Alphanumeric)**
128 displayable ASCII characters, each formed within an 8 x 8 dot matrix. Descenders on lower case characters.

**CHARACTER TYPE (Line Drawing)**
Eleven graphic symbols for drawing forms and contiguous lines.

**CHARACTER GENERATION**
MOS ROM

**REFRESH RATE**
50 Hz – 60 Hz (programmable)

**CHARACTER DISPLAY**
Light characters on a dark background or dark characters on a light background (switch selectable).

**VISUAL ATTRIBUTES**
Normal, reverse, blink, underline, and half intensity security fields

**LOGICAL ATTRIBUTES**
Protected, numeric only, modified data transmission, alpha/alphanumeric, must fill, total fill, constant fields.

**TABULATION**
Fixed tab stops occur each eight character positions

**CURSOR**
Non-destructive blinking block

**MEMORY LOCK**
The display area above the line the cursor is currently on is frozen on the screen.

**LINE LOCK**
The host CPU may selectively designate reserved display lines.

**MEMORY ADDRESS POINTER**
An invisible cursor that is used to read and write to and from the display memory independent of visible screen functions

**CURSOR CONTROL**
Up, down, left, right, home, carriage return, line feed

**CURSOR SENSE**
Cursor position is transmitted to the host upon request

**CURSOR ADDRESSING**
Direct X–Y cursor positioning by line and column

**MEMORY POINTER DATA SENSE**
ASCII value of the character located at the memory address pointer

**READ TERMINAL STATUS**
A 30-byte status message reflecting switch setting, diagnostic results, communication protocol, etc.

**SCROLL**
When display is filled, screen data scrolls upward. Wraparound with top down overwrite is also selectable.

**EDITING OPERATIONS**
Insert/Delete character or line plus tab, back tab, backspace and character overwrite. The clear entry (CE) operation will erase the field the cursor is in and position it at the beginning of the same field while in a protected mode of operation.

**ERASE FUNCTIONS**
Erase to end of page
Erase to end of field
Erase to end of line
Clear variable data
Clear all data

**COMMUNICATION INTERFACE**
Serial RS232C or 20 ma CLA

**TRANSMISSION RATE**
Switch selectable 110 to 9600 baud (EIA)
Switch selectable 110 to 9600 baud (CL)
Switch selectable to 19200 baud under X-ON/X-OFF protocol.

**PARITY**
Switch selectable, odd, even, mark or space

**COMMUNICATION MODE**
Selectable for X-ON/X-OFF protocol
Full duplex
Half duplex
Echoplex
Asynchronous only

**OPERATIONAL MODES**
Conversational: Character by character transmission
Line: Line at a time transmission
Page: Full or partial page transmission
Forms: Allows for operator building of formatted display
Local: Off line display data entry
Line Monitor: Displays all ESC codes and control code sequences

**TERMINATION CHARACTER**
Switch selectable CR, EOT, CR-LF, and ETX

**TIME-OF-DAY CLOCK**
A real time clock that may be set by the host CPU or operator

**CPU MESSAGE DEPOSIT**
An 80 character message buffer holds host CPU data and prints "MSG WAIT" on status line for operator recovery

**READ CURSOR CHARACTER**
Character at cursor position is transmitted to host upon request.

**BELL**
Audible alarm upon receipt of Control G or as the cursor passes through the 72nd character location when data is being entered from keyboard. The continuous alarm on/off feature is included.

**KEYBOARD**
A 61-key ANSI compatible, TTY/Typewriter compatible layout featuring autorepeat, two key rollover, alpha lock and lower case inhibit. Also includes a 14-key numeric pad with associated field termination control keys. The sixteen programmed function keys, cursor control keys, and system mode control keys are included. Detachable on Model DM20.

**AUXILIARY INTERFACE**
A serial bidirectional interface that has a character buffer on both the send and receive lines. Transparent printing, communications control, as well as independent baud rates are standard.

**SELF TEST**
Either through host CPU control, operator initiated, or upon power-up.

**INPUT VOLTAGE AND FREQUENCY**
115Vac ± 10% 50/60 Hz
230Vac ± 10% 50/60 Hz

**ENVIRONMENTAL SPECIFICATIONS**
Altitude: Sea level to 10,000 feet
Temperature: 0°C to 40°C
Humidity: 0 to 80% (noncondensing)

**TERMINAL SIZE**
19" W x 13" H x 22.5" D
on Micro Bee 2
19" W x 13" H x 24.5" D
on Micro Bee/Model DM20

**TERMINAL WEIGHT**
43 lbs. (approximate)

**TERMINAL FINISH**
Textured

**OPTION**
20 ma current loop

# SECTION II

# INSTALLATION

## 2.1 INTRODUCTION

This section contains information on unpacking, receiving inspection, connection of the communications interface, physical placement of the terminal and preliminary functional control settings for specific user requirements.

## 2.2 UNPACKING

The following items are furnished with each Micro Bee 2 terminal:

a. The display terminal with keyboard

b. Technical User Manual

There are no tie-downs or packing materials inside the unit that need to be removed.

## 2.3 INSPECTION FOR IN-SHIPMENT DAMAGE

Upon receipt, carefully check components for any signs of shipping damage. All shipping containers have been specially designed to protect their contents and special care has been taken to prevent damage under normal shipping conditions. Mishandling should be evident upon inspection of the shipping container. If damage is found after visual inspection, take care not to destroy the evidence. If necessary, document the damage with photographs and contact the transport carrier as soon as possible.

## 2.4 IDENTIFICATION

An identification plate located on the rear of the terminal provides the model number, part number, serial number, weight, voltage and current requirements, and frequency/power classifications.

## 2.5 INSTALLATION

### 2.5.1 Placement for Operation

The terminal is fully self-contained and easily relocated to alternate operating positions without removing or altering any wiring. Select a convenient, level surface and place the terminal where the power cable and data I/O cables are not in the way of the operator. Route the cables in such a manner that they are not inadvertently pulled or disturbed by minor changes in terminal position or by the operator. Position the terminal so that operator use is as convenient as possible.

**CAUTION: Do not place the terminal on any surface that blocks cooling air from the back of the cabinet. The terminal is provided with an internal fan for cooling. Air enters through a fan grill protected hole in the back and leaves through spacing at the bottom sides between the cover and terminal frame. To maintain efficient air circulation, keep at least three-and-one-half (3½) inches of clearance at the rear and on the sides of the terminal (see Figure 2-1).**

### 2.5.2 Power Connection

The terminal is shipped with a three-conductor power cord which grounds the instrument through the offset pin. The safety feature of this ground should always be preserved by grounding the terminal to the outlet box or other earth ground. If it is necessary to use an adapter, ground the pigtail.

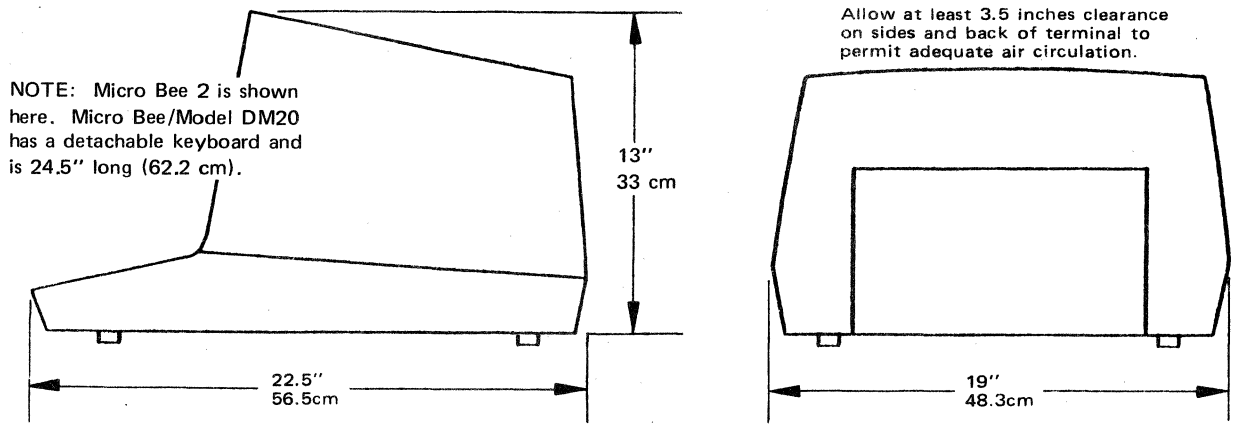



**Figure 2-1 Mounting Requirements**

### 2.5.3 Current Loop Interface (Optional)

The current loop interface is a 20mA constant current device which allows the terminal to be used up to 2000 feet (608m) from the computer. Baud rates of 9600 or less must be used. If shielded, twisted pairs are used, the terminal may be located up to 6000 feet (1.8km) away if utilized at slower baud rates.

Data transmission without the current loop interface is normally limited to 50 feet. The current loop converts the TTL logic signals into current signals at one end of the loop, transmits the pattern, reconverts the pattern to TTL logic signals at the other end, and delivers it to the computer or terminal. The current loop connections are contained within the RS232C I/O connector and do not interfere with normal RS232C signals required for asynchronous operation. Figure 2-2 illustrates four common interfacing schemes for simplex and full duplex operation using current loop.

### 2.5.4 Data Interface Connection

Signals used in communicating with the Micro Bee conform to the requirements of EIA specification RS232C. In particular, output voltage swings from −10V to + 10V, while the receivers present a minimum of 3K ohms impedance to the line. The input resistance is approximately 4K ohms. The driver circuits current limit at 10mA on both source and sink. All data source interconnections are made via the rear panel Input/Output connector (refer to Figure 2-3). A 25-pin miniature D-type ITT Cannon connector (DM-25S or equivalent) is used for connecting to the computer. Pin assignments are defined in Table 2-1.

When using a minimum AUX port interface configuration (Send, Receive and Ground), it is necessary to externally jumper together pins 6, 8, and 20 of the connector to ensure correct terminal operation. A minimum AUX port configuration requires that connector pins 20 and 6 be jumpered.

### 2.5.5 PC Board-Mounted Control Switches

Three switch blocks are mounted on the printed circuit board. Two are located at the rear of the PC board and are accessible through an external opening for repositioning. The other switch block is located near the center of the PC board and is only alterable by removing the cover. These switches are illustrated in Figure 2-4 (External Switch Block) and Figure 2-5 (Internal Switch Block).

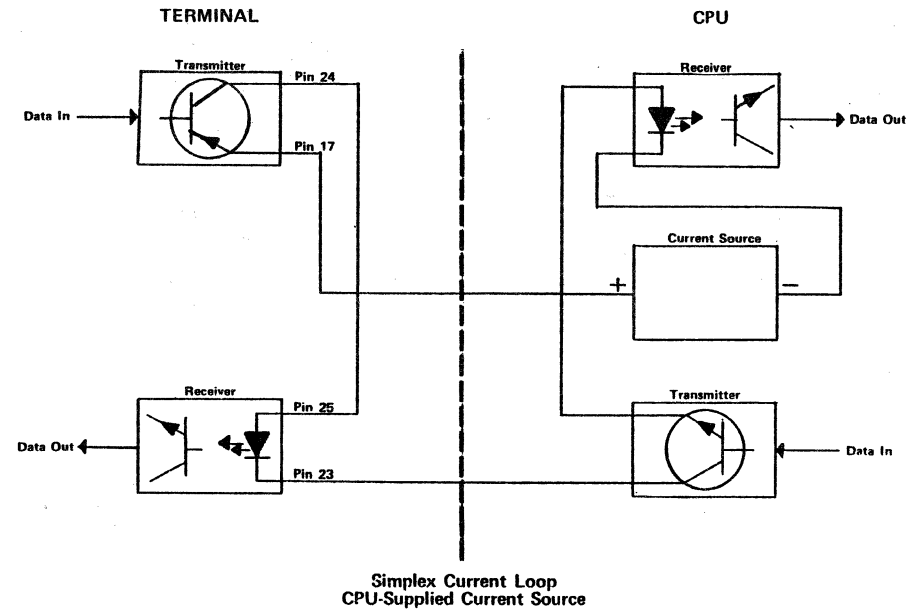
## 2.6 INITIAL TURN-ON PROCEDURE

The proper turn-on procedure for the terminal is described in 3.2.2.

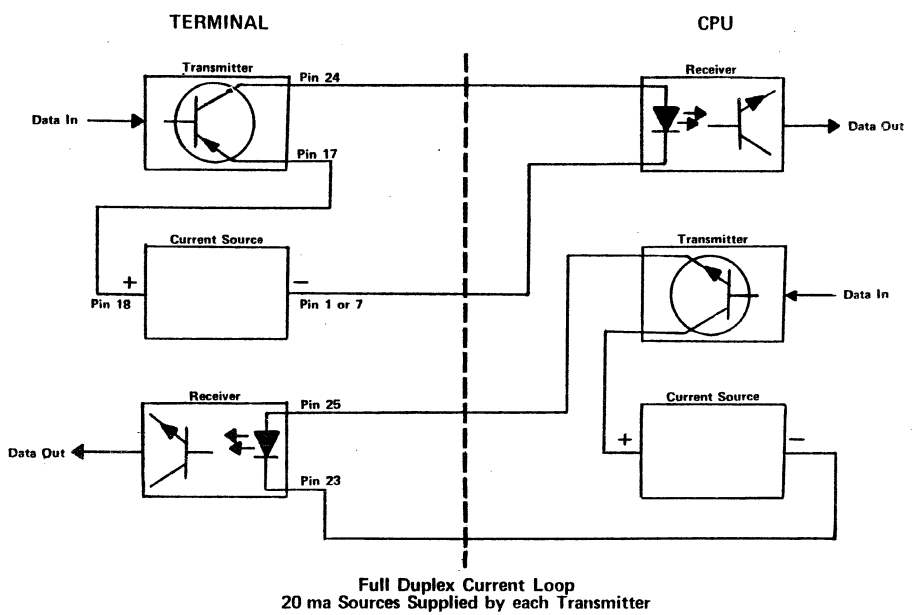
## 2.7 REAR PANEL SWITCH USE

The operating configuration of the Micro Bee 2 is defined by rear panel and internal switch positions as described below. Whenever any of these switches is changed, it is necessary to reset the terminal, using CONTROL RESET to ensure that all new switch positions are scanned by software.

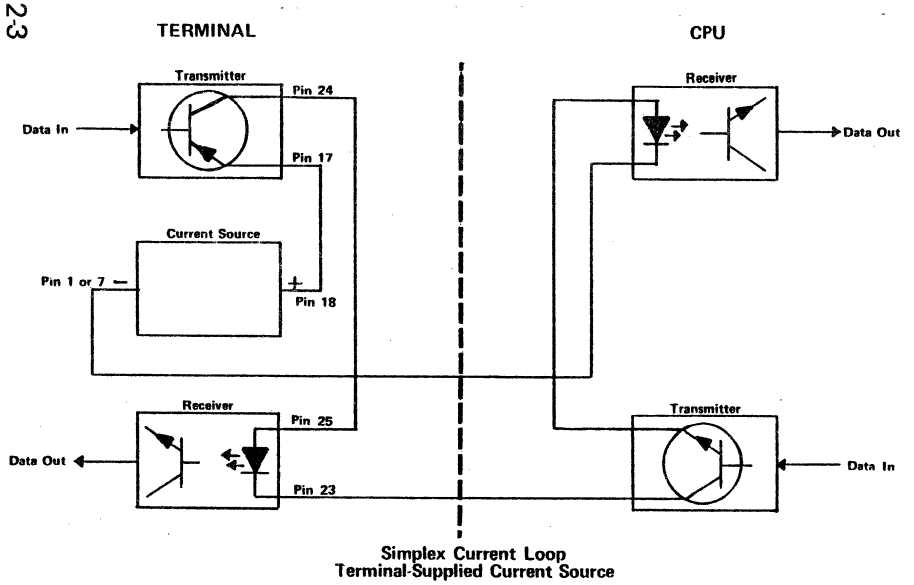
(continued on Page 2-6)



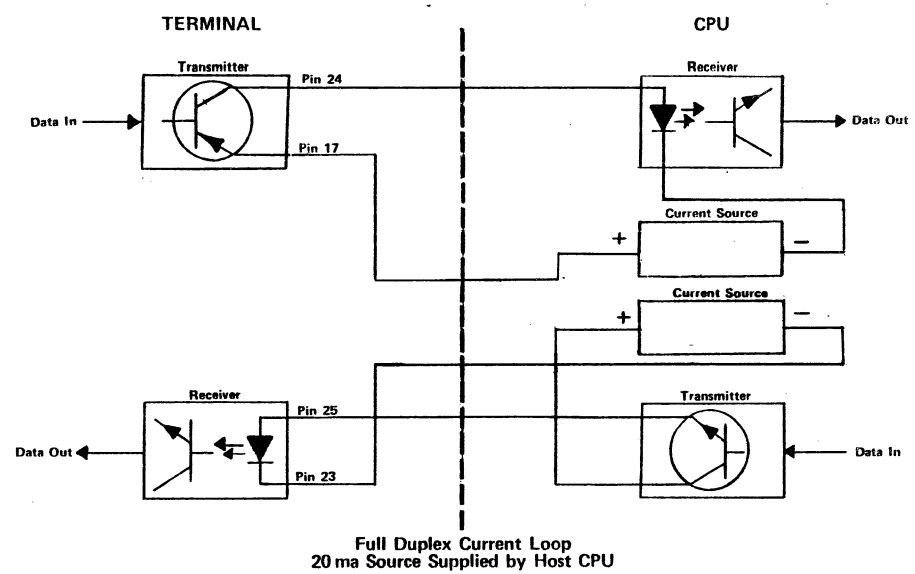

Simplex Current Loop
CPU-Supplied Current Source




Full Duplex Current Loop
20 ma Sources Supplied by each Transmitter




Simplex Current Loop
Terminal-Supplied Current Source



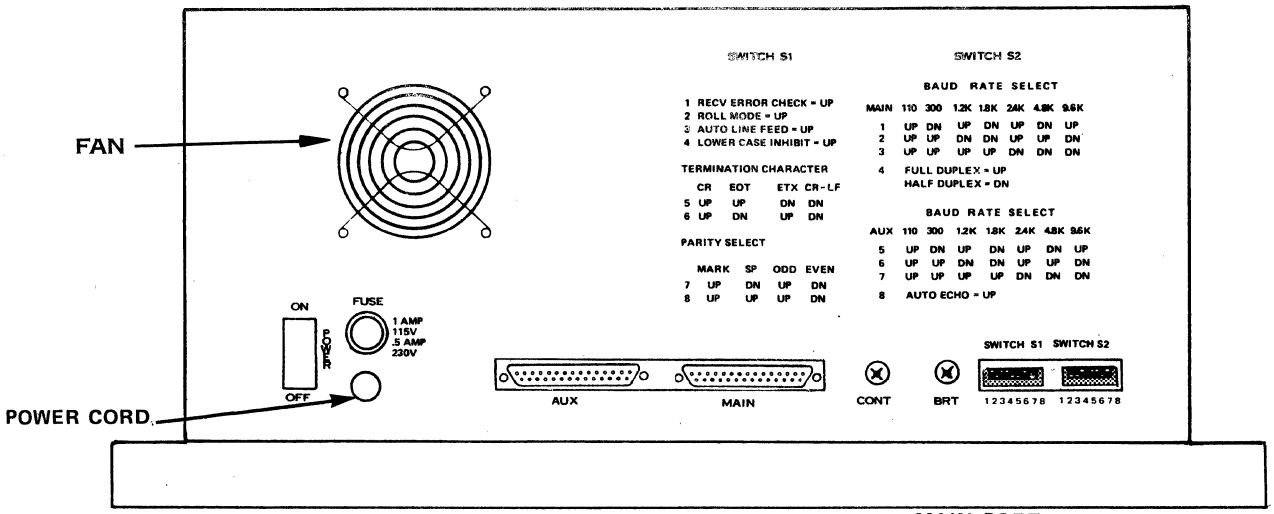

Full Duplex Current Loop
20 ma Source Supplied by Host CPU

Figure 2-2 Current Loop Cabling

## Table 2-1 I/O and Auxiliary Port Pin Assignments

| PIN NO. | RS232-C | DESCRIPTION | SIGNAL DIRECTION | ASSIGNMENTS |
|---|---|---|---|---|
| **MAIN PORT** | | | | |
| 1 | AA | Frame Ground | — | Chassis ground; electrically bonded to frame. |
| 2 | BA | Transmitted Data | MCB2 → Data Set | Transmitted data; Pin 2 is in the mark condition with no output signal. |
| 3 | BB | Received Data | MCB2 ← Data Set | Received data or terminal input. |
| 4 | CA | Request to Send | MCB2 → Data Set | When off line, RTS is held low; when on line in full duplex, it is kept high. In half duplex on line, it remains low until data transmission. It goes high during transmission and drops low upon completion. |
| 5 | CB | Clear to Send | MCB2 ← Data Set | When Clear to Send is high, the transmission is enabled. When CTS is held low, the transmitter is disabled. |
| 6 | CC | Data Set Ready | MCB2 ← Data Set | Indicates the host data set is ready. |
| 16 | | X8 XMIT Clock | MCB2 →Data Set | Provides TTL level clock. |
| 7 | AB | Signal Ground | — | Same potential as chassis ground (pin 1). |
| 8 | CF | Carrier Detect | MCB2 ← Data Set | Indicates the host data set is ready. |
| 20 | CD | Data Terminal Ready | MCB2 → Data Set | This pin is high when terminal is On. |
| **AUXILIARY PORT** | | | | |
| 1 | AA | Frame Ground | — | Chassis ground; electrically bonded to frame. |
| 2 | BA | Transmitted Data | MCB2 ← Auxiliary Device | Data input to terminal. |
| 3 | BB | Received Data | MCB2 → Auxiliary Device | Data output to auxiliary device. |
| 4 | CA | Request to Send | MCB2 ← Auxiliary Device | Ignored by MCB 2; does not evoke terminal response. |
| 5 | CB | Clear to Send | MCB2 → Auxiliary Device | When high, indicates Auxiliary port enabled and ready to receive data. |
| 6 | CC | Data Set Ready | MCB2 →Data Set | Remains on at all times. |
| 7 | AB | Signal Ground | — | Same potential as pin 1. |
| 8 | CF | Carrier Detect | MCB2 → Auxiliary Device | Same as CC (pin 6). High at all times. |
| 11 | | AUX Device Ready | DM20 AUX Device | When high,transmission to AUX is enabled. When low, transmission to AUX is disabled. |
| 19 | | | | Same as Pin 11. |
| 20† | CD | Data Terminal Ready | MCB2 Auxiliary Device | High indicates Auxiliary device ready to receive data. Low indicates Auxiliary device busy and unable to receive data. |

† Note: When the auxiliary equipment being used does not provide this signal, external jumpering must be provided on the Auxiliary port between pins 6 and 20.




**FUSE**
Prevents damage to circuitry during voltage/current overload

**AUXILIARY PORT**
This connector provides an interface for peripheral device, such as disks, printers, tape drives, etc.

**MAIN PORT**
This port provides data source interface for the terminal, RS232C or current loop interface.

**Figure 2-3 Micro Bee 2 Rear Panel**

**SWITCH S1**

1 RECV ERROR CHECK = UP
2 ROLL MODE = UP
3 AUTO LINE FEED = UP
4 LOWER CASE INHIBIT = UP

TERMINATION CHARACTER

| | CR | EOT | ETX | CR-LF |
|---|---|---|---|---|
| 5 | UP | UP | DN | DN |
| 6 | UP | DN | UP | DN |

PARITY SELECT

| | MARK | SP | ODD | EVEN |
|---|---|---|---|---|
| 7 | UP | DN | UP | DN |
| 8 | UP | UP | DN | DN |

**SWITCH S2**

BAUD RATE SELECT

| MAIN | 110 | 300 | 1.2K | 1.8K | 2.4K | 4.8K | 9.6K | 19.2K* |
|---|---|---|---|---|---|---|---|---|
| 1 | UP | DN | UP | DN | UP | DN | UP | DN |
| 2 | UP | UP | DN | DN | UP | UP | DN | DN |
| 3 | UP | UP | UP | UP | DN | DN | DN | DN |

4 FULL DUPLEX = UP
HALF DUPLEX = DN

BAUD RATE SELECT

| AUX | 110 | 300 | 1.2K | 1.8K | 2.4K | 4.8K | 9.6K | 19.2K* |
|---|---|---|---|---|---|---|---|---|
| 5 | UP | DN | UP | DN | UP | DN | UP | DN |
| 6 | UP | UP | DN | DN | UP | UP | DN | DN |
| 7 | UP | UP | UP | UP | DN | DN | DN | DN |

8 AUTO ECHO = UP

*Note: Only valid under X-On/X-OFF protocol command (see Section 3.3.12). This selection is not labeled on the rear panel.

**Figure 2-4 External Switches**

| ON | SWITCH | OFF |
|---|---|---|
| Go on line after block send | 1 | Remain off line after block send |
| All single key ESC sequences are performed locally only | 2 | All single key ESC sequences are transmitted |
| Display programmed for 50 Hz | 3 | Display programmed for 60 Hz |
| X-Suppress On | 4 | X-Suppress Off |
| Not Used | 5 | Not Used |
| Visual attribute is half intensity | 6 | Visual attribute is normal |
| White character on black field | 7 | Black character on white field |
| Enables Current Loop | 8 | Disables current loop |

**Figure 2-5 Internal Switches**

(continued from Page 2-2)

### 2.7.1 Receiver Error Check (S1-1)

When Receiver Error Check is selected (S1-1up), an ASCII substitute ($S_B$) is displayed and the bell will ring if a receiver frame, overrun or parity error is detected. Only even or odd parity are checked as selected by switches S1-7 and S1-8. With this feature disabled, data are written to the display as they are received and all errors are ignored.

### 2.7.2 Roll Mode (S1-2)

When Roll Mode is enabled (S1-2 up), data scroll upward if the cursor is in the bottom line and a Line Feed code is received. As a result of the upward scroll, all data on the page move up by one line, with data previously on the top line being lost and a new blank line appearing at the bottom of the page. This simulates the line feed action of a teletypewriter.

If the ROLL is disabled, the display page does not scroll. A command which attempts to move the cursor down from the bottom line (a Line Feed) causes the cursor to appear in the top line rather than causing the data to scroll. Thus, the non-Roll mode of operation corresponds to a "wrap-around" action of the cursor in the vertical direction. Depression of the RETURN key causes the data to be erased from the cursor position to the end of the present line and the return (or return, line feed) is executed according to the setting of S1-3.

### 2.7.3 Auto Line Feed Mode(S1-3)

In Auto Line Feed mode (S1-3 up), the RETURN key transmits Carriage Return-Line Feed codes and performs a return and line feed locally. With Auto Line Feed mode off, the key transmits and performs only a carriage return.

### 2.7.4 Inhibit Lower Case (S1-4)

With the switch in the Up position, all alpha characters a-z are forced to the upper case regardless of the condition of Shift or Shift Lock. No other codes are affected. With the switch down, all keys are fully shiftable. Received data remain unaffected by this switch setting.

### 2.7.5 Termination Character (S1-5, S1-6)

The user may select the termination character which is transmitted by the ENTER key in an on-line mode and is the last character sent after a block, line transmit, or function key sequence. The choices are ETX, EOT, CR or CR-LF.

### 2.7.6 Parity (S1-7, S1-8)

The parity selection allows for an odd or even parity bit, or a mark or space parity bit to be generated following the data in the serial data word. Mark or space parity is generated by transmitting an 8-bit data word and forcing the eighth bit low or high. The switches also select the parity condition to be checked if switch S1-1 is up (receiver error check).

### 2.7.7 Main Baud Rate (S2-1, S2-2, S2-3)

The Main Baud Rate change is accomplished thru switch selection on the back panel of the terminal. The user may select the following rates: 110, 300, 1200, 1800, 2400, 4800, 9600 or 19,200 baud. The switch settings are defined in Figures 2-3 and 2-4. For host CPU selection of both main and Aux baud rates, a three-code escape sequence is used (see Figure 2-6).

**Figure 2-6 Remote Baud Rate Selection**

| | 110 | 300 | 1200 | 1800 | 2400 | 4800 | 9600 | 19200 |
|---|---|---|---|---|---|---|---|---|
| MAIN BAUD RATE ESC, 7, | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| AUX BAUD RATE ESC, 5 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

### 2.7.8 Full/Half Duplex (S2-4)

The Full/Half Duplex (FDX/HDX) switch setting (Figure 2-3) determines how data originating from the keyboard are routed within the terminal when operating on-line and in conversational mode. In half duplex mode, data entered via the terminal keyboard are sent to the I/O port and the display memory simultaneously. In full duplex mode, data entered via the terminal keyboard are sent to the I/O port only. Data must be received to be displayed. In full duplex mode, RTS (Request to Send) is raised any time the terminal is on line. In half duplex, RTS is raised only when transmission occurs.

### 2.7.9 Auxiliary Baud Rate (S2-5, S2-6,S2-7)

Auxiliary baud rate change is accomplished through switch selection on the back panel of the terminal. The user may select the following rates: 110,300, 1200,1800, 2400, 4800, 9600, or 19,200 baud.

### 2.7.10 Auto Echo (S2-8)

With the auto echo switch on, the terminal displays and operates on all data transmitted over the main EIA serial port in conversational mode. With the switch set off, no automatic echo occurs. This switch is only effective in full duplex and allows full duplex communications without need for echo from the host CPU.

## 2.8 INTERNAL SWITCH USE

### 2.8.1 Go On Line (S3-1)

With the switch on, the terminal goes On Line after a block or line transmit or page dump function via either the auxiliary port or main port. With the switch off, the terminal remains off line.

### 2.8.2 Inhibit Escape Codes (S3-2)

With the switch on, all single key escape code sequences are performed locally without transmission, regardless of half or full duplex modes. The ESC key remains unaffected and operable. With the switch off, single key escape code sequences obey the normal rules of HDX and FDX.

### 2.8.3 50/60 Hz (S3-3)

The switch is used to program the display to 50 or 60 Hz. To avoid beat interference, the display rate should match the power line frequency.

### 2.8.4 X-Suppress (S3-4)

Suppresses transmission of X-ON/X/OFF sequences during buffer overflow conditions. Alters response to received X-ON/X-OFF commands as per Section 3.3.12.

### 2.8.5 Normal/Half Intensity (S3-6)

This switch reverses the meaning of normal and half intensity visual attributes. With switch on, normal data becomes half intensity and half intensity data becomes highlighted.

### 2.8.6 Normal/Reverse (S3-7)

This switch reverses the meaning of normal and reverse video attributes. With the switch on, characters are black on white and reverse video attributes cause data to be displayed white on black. Brightnes and contrast must be adjusted for proper screen display.

### 2.8.7 Current Loop (S3-8)

This switch must be on if the current loop option is selected for use.

# SECTION III

# OPERATION

## 3.1 INTRODUCTION

This section provides both basic and detailed operating instructions for the Micro Bee 2. Section 3.2 is a simplified operating guide which explains in nontechnical language how to turn on the terminal and use it for most data communications tasks. Operating modes and other terminal features are explained and examples are given where necessary. Section 3.3 provides more detailed operating information which is necessary for the programmer or technician who must install and interface the terminal with other data communications equipment.

## 3.2 BASIC OPERATION DESCRIPTION

### 3.2.1 General

The Micro Bee 2 is not a difficult device to operate and, with sufficient practice, any typist can master this very versatile machine. The keyboard bears close resemblance to a standard typewriter and also includes features found in teletype equipment. The big difference, however, is the CRT (picture tube) display. Unlike printed paper output, video data can be easily altered and corrected by the operator before transmission to an auxiliary device, printer, or host computer.

### 3.2.2 Turn-On Procedure

Before the Micro Bee 2 is used, it must be properly installed and set up in accordance with Section II of this manual. This should be attempted only by qualified personnel.

An identification plate located on the bottom cover of the terminal specifies the electrical power requirements of the Micro Bee 2. When moving the terminal to an alternate operating position, make sure that the selected power outlet is properly grounded and supplies the correct operating voltage/frequency. Get technical assistance, if necessary, in making this determination.

The proper turn-on procedure for the terminal is as follows:

a. Set the rear panel POWER ON/OFF switch to ON (see Figure 2-3); allow a warm-up period of about a minute and ensure that the cursor and Status line have appeared on the screen. If both the cursor and Status line do not appear, check the Brightness and Contrast adjustments, as explained in b.

b. Turn the Brightness control (located on the rear panel; see Figure 2-3) until a raster is faintly visible on the screen. Write several characters on the screen with the terminal in half duplex (see Section 2.7.5), using both high and low intensity. Use the half intensity visual attribute as described under ASET in Table 3-2 for an accurate half-intensity level. Reduce the brightness until the background raster is extinguished. Adjust the Contrast control (another rear panel component) until the difference between full and half intensity characters is easily distinguished.

c. Any time power is applied to the Micro Bee, it performs a display memory test and a system operation test. Because of the CRT warm-up time, there is no visible effect on the screen. If the unit is turned off and back on, a slight display flicker occurs while the test is run. When the self test is successfully completed, "SYSTEM RDY" appears on the Status line. In the event of a test failure, "ERR CHECK" appears. Self test may also be initiated from the keyboard as described under TEST in Table 3-2, or it may be initiated by the host computer.

### 3.2.3 Rear Panel Switches

Switch blocks 1 and 2 (S1 and S2) on the rear panel enable/disable certain operating features of Micro Bee 2. There are a total of 16 miniature switches, eight on each switch block. Most rear panel switches

require no operator attention because they must be properly set when the terminal is installed. Section 2.7 describes how to change a switch and the reset procedure which must be used following each switch change.

### 3.2.4 Keyboard Controls

The Micro Bee 2 keyboard is shown in Figure 3-1. The keyboard's main function is to generate codes which the terminal uses to display information and communicate with other equipment. The keyboard produces three main types of codes:

a. Character codes - For example, striking the "a" key causes the displayable character code for the letter "a" to be produced. Depending on the mode of operation selected, the "a" will be transmitted, displayed on the screen, or both.

b. Control Character codes - These are not displayed, but cause specific functions to occur. To generate a control character code, depress **and hold down** the CONTROL key while simultaneously typing the required alphanumeric key. Example: CONTROL G rings the bell.

c. Escape sequence codes - These are also non-displayed and cause specific functions to occur. To perform an Escape operation, **depress and release the ESC key,** followed by the designated alphanumeric key. Example: ESC E clears the screen. If the CONTROL key is held down with the ESC key, the Escape sequence will take place within the terminal only and will not affect other equipment.

Table 3-1 is an ASCII chart which the operator may use in determining what keyboard sequence to use in performing a given Control or Escape function. Note that the chart has three columns: Control Characters, Displayable Characters, and Escape Sequences. Using the chart is best explained by giving examples: If the operator wants a Line Feed (LF) to occur, the sequence CONTROL J is used; to initiate the self test, the sequence ESC f is used.

Table 3-2 is a listing of all keyboard keys on the Micro Bee 2. Each is described in sufficient detail to enable the operator to use it effectively. A technical approach to this information which is considerably more detailed and complete is included in Section 3.3.

### 3.2.5 Communication Modes

The Micro Bee terminal is capable of operating Off Line (Local) or On Line. Two operational modes of communication are provided when the unit is On Line: Full Duplex (FDX) and Half Duplex (HDX). "LOCAL" or "ONLINE" is displayed in Field A of the Status line (see Section 3.3.19), depending on the mode selected.

Local - Data communication takes place between the keyboard and display memory only. No data transmission occurs unless the SEND or ASEND functions are used for block transmission. See Table 3-2.

(continued on Page 3-6)

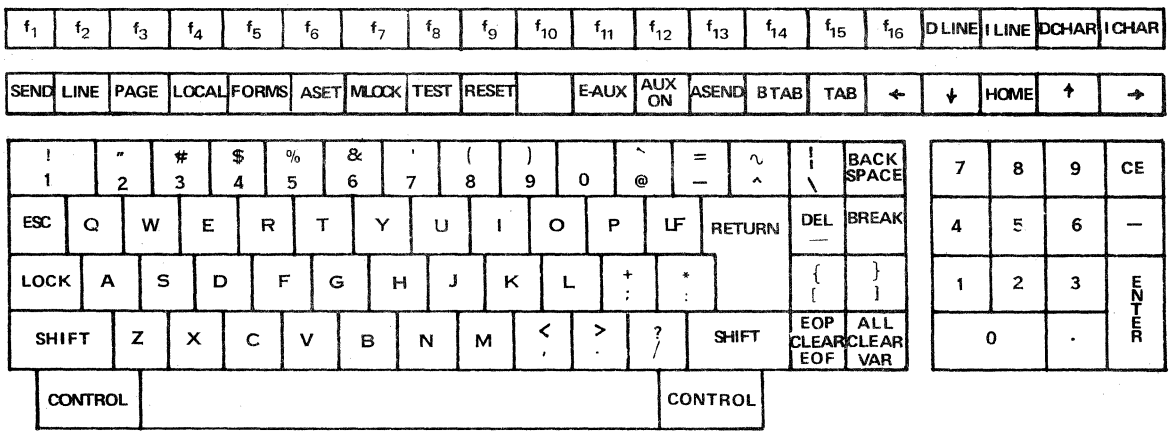



**Figure 3-1 Micro Bee 2 Keyboard**

## Table 3-1A ASCII Code Chart

| BIT 7 6 / 4 3 2 1 5 | CONTROL CHARACTERS | | DISPLAYABLE CHARACTER | | | | | | ESCAPE SEQUENCE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $0_0$ | $0_1$ | $0_1$ $_0$ | $0_1$ $_1$ | $1_0$ $_0$ | $1_0$ $_1$ | $1_1$ $_0$ | $1_1$ $_1$ | $0_1$ $_0$ | $0_1$ $_1$ | $1_0$ $_0$ | $1_0$ $_1$ | $1_1$ $_0$ | $1_1$ $_1$ |
| 0000 | NUL @ | DLE P | SP | ø | @ | P | ` | p | SET CLOCK SP | AUX SEND ø | INSERT CHARACTER OFF @ | LINE DELETE CHARACTER P | PAGE DELETE CHAR ` | F1 p |
| 0001 | SOH A | DCI Q X–ON | ! | 1 | A | Q | a | q | PAGE MODE ! | DISPLAY MESSAGE ON 1 | ↑ A | LINE INSERT ON Q | PAGE INSERT ON a | F2 q |
| 0010 | STX B | DC2 R | " | 2 | B | R | b | r | BOOT LD RUN " | DISPLAY MESSAGE OFF 2 | ↓ B | GRAPHIC MODE ON R | KEYBOARD ENABLE b | F3 r |
| 0011 | ETX C | DC-3 S X–OFF | # | 3 | C | S | c | s | LINE MODE # | AUX PAGE SEND 3 | → C | GRAPHIC MODE OFF S | KEYBOARD DISABLE c | F4 s |
| 0100 | EOT D | DC-4 T | $ | 4 | D | T | d | t | $ | AUX LINE SEND 4 | ← D | MODIFIED MODE ON T | ATTRIBUTE SET d | F5 t |
| 0101 | ENQ E | NAK U | % | 5 | E | U | e | u | START CONSTANT FIELD % | AUX BAUD RATE SET 5 | CLEAR E | MODIFIED MODE OFF U | ATTRIBUTE DELETE e | F6 u |
| 0110 | ACK F | SYN V | & | 6 | F | V | f | v | FORMS BUILD & | WRITE C ONTROL MODE 6 | CURSOR ADDRESS F | RESET V | SELF TEST f | F7 v |
| 0111 | BEL G | ETB W XMIT | ' | 7 | G | W | g | w | SEND ENTER CODE ' | MAIN BAUD RATE SET 7 | READ CURSOR CHARACTER G | FORMS MODE ON W | MEMORY LOCK ON g | F8 w |
| 1000 | BS H | CAN X | ( | 8 | H | X | h | x | AUX ON ( | CONTINOUS ALARM ON 8 | HOME H | FORMS/ FORMS BLD OFF X | MEMORY LOCK OFF h | F9 x |
| 1001 | HT I | EM Y | ) | 9 | I | Y | i | y | AUX OFF ) | CONTINOUS ALARM OFF 9 | PAGE SEND I | CURSOR ADDRESS Y | LINE SEND i | F10 y |
| 1010 | LF J | SUB Z | * | : | J | Z | j | z | LINE MONITOR OFF * | LINE MONITOR ON : | CLEAR EOP J | CURSOR DISPLAY ON/OFF Z | ENABLE AUX PORT j | F11 z |
| 1011 | VT K | ESC [ | + | ; | K | [ | k | { | START FIELD SPECIAL + | CPU MESSAGE DEPOSIT ; | CLEAR EOL K | START UN-PROTECTED FIELD [ | DISABLE AUX PORT k | F12 { |
| 1100 | FF L | FS \ | , | < | L | \ | l | \| | CLEAR ENTRY (CE) , | LINE LOCK < | INSERT LINE L | CURSOR SENSE \ | START BLINK l | F13 ; |
| 1101 | CR M | GS ] | – | = | M | ] | m | } | — | LINE UNLOCK = | DELETE LINE M | START PROTECTED FIELD ] | NORMAL VIDEO m | F14 } |
| 1110 | SO N | RS ^ | . | > | N | ^ | n | ~ | . | BACK TAB > | OFF LINE (LOCAL) N | SET MEM POINTER ^ | ON LINE n | F15 ~ |
| 1111 | SI O | US _ | / | ? | O | _ | o | RUB OUT | AUX PAGE DUMP / | UNLOCK ALL LINES ? | READ TERMINAL STATUS O | READ DATA AT MEMORY POINTER _ | PAGE DUMP o | F16 DEL |

I/O FUNCTIONS ONLY

## Table 3-1B Escape Sequence Reference Chart

| | | | | | |
|---|---|---|---|---|---|
| Attribute Delete | ESC e | | | Forms Build | ESC & |
| Attribute Set | ESC d | | | Forms Off/Forms Build Off | ESC X |
| Aux Baud Rate Set | ESC 5 | | | Forms On | ESC W |
| Aux Line Send | ESC 4 | | | Graphic Mode Off | ESC S |
| Aux Off | ESC ) | | | Graphic Mode On | ESC R |
| Aux On | ESC ( | | | Home | ESC H |
| Aux Page Dump | ESC / | | | Insert Character Off | ESC @ |
| Aux Page Send | ESC 3 | | | Insert Line | ESC L |
| Aux Port Disable | ESC k | | | Keyboard Disable | ESC c |
| Aux Port Enable | ESC j | | | Keyboard Enable | ESC b |
| Aux Send | ESC Ø | | | Line Delete Character | ESC P |
| Back Tab | ESC > | | | Line Insert On | ESC Q |
| Boot Load Run | ESC " | | | Line Lock | ESC < |
| Clear to End of Line | ESC K | | | Line Mode | ESC # |
| Clear to End of Page | ESC J | | | Line Send | ESC i |
| Clear Entry | ESC ; | | | Line Unlock | ESC = |
| Clear Screen | ESC E | | | Main Baud Rate Set | ESC 7 |
| Continuous Alarm Off | ESC 9 | | | Memory Lock Off | ESC h |
| Continuous Alarm On | ESC 8 | | | Memory Lock On | ESC g |
| CPU Message Deposit | ESC ; | | | Modified Mode Off | ESC U |
| Cursor Address | ESC Y | | | Modified Mode On | ESC T |
| Cursor Address | ESC F | | | Monitor Mode Off | ESC * |
| Cursor Display On/Off | ESC Z | | | Monitor Mode On | ESC : |
| Cursor Down | ESC B | | | Normal Video | ESC m |
| Cursor Left | ESC D | | | Off Line | ESC N |
| Cursor Right | ESC C | | | On Line | ESC n |
| Cursor Sense | ESC \ | | | Page Delete Character | ESC ' |
| Cursor Up | ESC A | | | Page Dump | ESC o |
| Delete Line | ESC M | | | Page Insert On | ESC a |
| Display Message Off | ESC 2 | | | Page Mode | ESC ! |
| Display Message On | ESC 1 | | | Page Send | ESC I |
| F1 | ESC p | F9 | ESC x | Read Cursor Character | ESC G |
| F2 | ESC q | F10 | ESC y | Read Data at Memory Pointer | ESC – |
| F3 | ESC r | F11 | ESC z | Read Terminal Status | ESC O |
| F4 | ESC s | F12 | ESC { | Reset | ESC V |
| F5 | ESC t | F13 | ESC ¦ | Self Test | ESC f |
| F6 | ESC u | F14 | ESC } | Send Enter Code | ESC ' |
| F7 | ESC v | F15 | ESC ~ | Set Clock | ESC SP |
| F8 | ESC w | F16 | ESC DEL | Set Memory Pointer | ESC ^ |

## Table 3-2 Keyboard Functions

| KEY | FUNCTION |
|---|---|
| CE | The CE (Clear Entry) key only works when the terminal is in Forms mode. Depressing this key moves the cursor to the beginning of the current unprotected field and erases to the end of the field. Forms mode is described later in this table and in Section 3.3.9. |
| (-) (Minus) | The Minus key generates the same code as in the typewriter array. |
| ENTER | The ENTER key generates the termination character selected by the rear panel switches. If CR (Carriage Return) or CR LF (Carriage Return-Line Feed) are selected, the terminal performs these functions when the ENTER key is depressed. If EOT (End of Transmission) or ETX (End of Text) are selected, the terminal transmits these codes but no visible display functions occur. |
| (.) (Decimal Point) | The decimal point key generates the same code as the period on the typewriter array. This key is included on the numeric pad as a convenience feature. |
| 0-9 keys (Numeric pad) | These are stand-alone numeric entry data keys. Numeric pad keys are not affected by the SHIFT, LOCK, or CONTROL keys. |
| BACK SPACE | This key is equivalent to the ← key, except that the ASCII back space code is transmitted when on line. CONTROL H is the ASCII back space (BS) code. |
| BREAK | The CONTROL BREAK sequence may be used to interrupt transmission from the host CPU. Actuation of the BREAK key alone causes no operation. |
| ALL CLEAR VAR | When this key is used with the CONTROL key, the entire screen contents are erased and the cursor is positioned to Home. The interlocking of the two keys is a safety feature to prevent accidental erasure. |
| EOP CLEAR EOF | When interlocked with the CONTROL key, this key causes erasure of all displayed data from the current cursor position to the end of memory. When actuated alone, data from the current cursor position to the end of the line is erased. |
| DEL/_ (Delete/ underline) | Depression of this key causes an underline to be displayed (if struck over existing data, it replaces the data with an underline). With the SHIFT key depressed, it causes a delete code to be transmitted but not displayed. |
| RETURN (Carriage Return) | This key causes the cursor to move to first position of the current line while not in Auto Line Feed mode (Switch S1-3 down). If Auto Line Feed is on, the cursor advances to the beginning of the following line. |
| LOCK | The LOCK key is more accurately described as a "caps lock" because it affects the alpha characters (A-Z) only. It is a toggle key also. This means striking the key once causes it to assume a detent position (the key remains depressed) and upper case characters only may be produced. Striking the key again releases it from the detent position, enabling lower case characters to be produced. |
| SHIFT | Nonalpha displayable keys such as !/1 are manipulated with the SHIFT keys. When entering an alpha character with the LOCK on and a SHIFT depressed, a double shift occurs which results in a lower case character being displayed. |
| SPACE BAR | The space bar is not labeled because its location and operation are very similar to the equivalent typewriter key. Its basic function is to move the cursor right one character position. After the cursor reaches the last character position of the currently-occupied line, it moves to the next line down. When the cursor reaches the last character position on the bottom display line, further movement causes it to return to Home and begin its left-to-right excursion again on the first line of display. If Roll mode has been selected (see Section 2.7.2) and the cursor is in the last position of the bottom display line, further cursor movement results in the entire display contents being shifted vertically one line. The top line of display is lost from view (and display memory) and the cursor occupies the first position of the bottom line. |
| ESC | Depression of ESC, followed by an alphanumeric or symbol key, causes the terminal to perform an Escape function as described in part c of 3.2.4 and as listed on the ASCII Code chart, Table 3-1. |
| Alphanumeric Keys (A-Z, punctuation, and shiftable numeric keys | The remaining keys, which are arranged and like the familiar standard typewriter keyboard, function as such. When used in conjunction with SHIFT/LOCK keys, the associated letter, number, symbol or punctuation mark is displayed and/or transmitted. |
| CONTROL | Depression of either CONTROL key followed by an alphanumeric or symbol key causes the terminal to perform a Control function as described in part b of 3.2.4 and as listed on the ASCII Code chart, Table 3-1. |
| SEND | The SEND key initiates a block transmission out the Main port when the terminal is in a Local mode. In the Page mode "PAGE" is displayed in Field B of the Status line and the following events occur when the SEND key is struck: 1) "Ex" is displayed at the current cursor position; 2) the send program backsearches through the screen until it encounters another Ex symbol or the Home position (top left corner of the display); 3) each character of each line is then transmitted (with spaces to to the end of line suppressed) and the line is followed by a CR LF or a CR only in the case of a completely full 80 character line. When the send program reaches the original position, it halts. The operator must move the cursor to the end of the next data block if another block send of subsequent material is desired. During data transmission, the Status line indicates MAIN SEND in Field E and the keyboard is disabled. In Line mode, "LINE" is displayed in Field B of the Status line. Only the cursor-occupied line (minus trailing spaces) is sent. No Ex character is written on the screen and the cursor appears in the first position of the following line after transmission. |

## Table 3-2 Key Functions (continued)

| KEY | FUNCTION |
|---|---|
| LINE and PAGE | When the LINE key is depressed, the terminal enters the Line mode and "LINE" appears in Field B of the Status line. Actuation of the SEND key causes data transmission on a Line basis as described under SEND in this table. When the PAGE key is depressed, the terminal enters the Page mode and "PAGE" appears in Field B of the Status line. Actuation of the SEND key causes data transmission to occur on a Page basis, as described under SEND in this table. |
| LOCAL | Depression of the LOCAL key alternately toggles the terminal from Local to On Line modes. The host computer (CPU) can place the terminal on line with an ESC n sequence and in Local mode with an ESC N. "LOCAL" or "ON LINE" appears in Field A of the Status line, depending on the mode selected. |
| FORMS | This key puts the terminal in Forms mode or when interlocked with the CONTROL key, the Forms Build mode is entered. "FORMS" or "FORMS BLD" appears in Field G of the Status line, depending on which mode is selected.<br>The Forms mode is usually used when the operator must deal with a preconstructed form which is transmitted to the terminal by the CPU for the operator to complete. Such a form usually contains protected data which in the Forms mode the operator is unable to alter. Other areas of the form are unprotected fields which are reserved for operator entry of such information as name, address, telephone number, zip code, etc. The Forms mode is often automatically entered when a form is presented to the operator for completion. The cursor is positioned to the beginning of the first unprotected field. The exit requirements of that field must be met before the operator may proceed to the next field. If an error is made while completing an unprotected field, the operator is notified of this by a message which appears in the Status line in reversed blinking video. The error must be corrected before the opeator can continue on to the next field. The completed form may then be transmitted by the operator using the SEND key.<br>The Forms Build mode is used to generate forms locally for eventual transmission to the host computer. This mode is not commonly used by most operators. Forms and Forms Build are explained in detail in Section 3.3.9. |
| ASET | The ASET key when depressed causes the next entry to be interpreted as a visual attribute according to Table 3.4. Other keys are ignored. Example: ASET Q causes the screen to become Half Intensity Reversed Video from the cursor position to the end of the screen (or until another attribute is set). See Section 3.3.10. |
| MLOCK | This toggle key alternately enables/disables the Memory Lock function. When enabled (on depression of key or receipt of ESC g), the display area above the cursor-occupied line is locked from operator access, but the area below this line functions normally. Any depression again of the MLOCK key or receipt of ESC h disables the Memory Lock function and the entire display screen is returned to normal oepration. MEM LOCK on the Status line indicates this mode is being used. See Section 3.3.11. |
| TEST | The CONTROL TEST keyboard sequence causes the system self test to be run. Successful completion of the test results in "SYSTEM RDY" being displayed on the Status line. In the event of a test failure, "ERR CK" appears, followed by an indication of which test portion failed. See part c of 3.2.2. |
| RESET | The CONTROL RESET sequence causes the terminal to revert to the initial "power on" condition, except that the screen contents remain undisturbed. |
| Blank Key | The blank key located in the bottom, half-size function key row is not used. |
| E-AUX | This key is analogous to the LOCAL key because it alternately enables/disables full communications between the keyboard, screen and auxiliary device. When E-AUX is on, "AUX RDY/BSY" appears in Field D of the Status line. See Section 3.3.8. |
| AUX ON | The AUX ON key is a toggle function also which logically connects/disconnects the Main I/O port and Auxiliary I/O port. In this way, the CPU may communicate directly with the Auxiliary device. If the terminal is on line, incoming data from the CPU is displayed on the screen. "AUX ON" is present in Field D of the Status line when this mode is selected. See 3.3.8 for more information.<br>NOTE: Do not use combinations of On Line, Aux On and Aux Enable. Unwanted data paths resulting in multiple characters and other problems may occur. |
| ASEND | The ASEND key is the equivalent of the SEND key except that transmission is out the Aux port to the Auxiliary device. |
| BTAB | Depressing the BTAB key causes the cursor to move to the previous tab location to the left. When the cursor reaches the first tab position on a line, it then moves to the last tab position of the previous line. The cursor remains at the Home position when back-tabbed there and does not wrap around to the last line. |
| TAB | The TAB key moves the cursor to the next tabulation position. Fixed tab locations occur each eight character positions, e.g., position 0, 8, 16, etc. Tabs cannot be set by the operator.<br>Selection of Roll or non-Roll mode also affects TAB key operation. In non-Roll, TAB key actuation advances the cursor to the next available tabulation stop. When the cursor is at the last tab stop of line 24, the next TAB key actuation returns the cursor to HOME. In Roll mode, the cursor is also positioned from tab stop to tab stop when the TAB key is pressed. However, when the cursor is in the last position of line 24, it will cause the screen to scroll and move the cursor the first position of the next line. |
| LF | Depression of this key causes the cursor to move down one line while occupying the same character position. |
| ← (Cursor Left) | Depression of this key or ESC D moves the cursor to the left. If the cursor is at the first character position on a line, the cursor moves to the last character on the line above and upon reaching Home, moves to the last position on the last line. |

Table 3-2 Key Functions (concluded)

| KEY | FUNCTION |
|---|---|
| ↓ (Cursor Down) | Depression of this key or ESC B moves the cursor to the same character position on the next line down. If on the last line, the cursor moves to the same character position on the first line. |
| HOME | Depression of this key or ESC H moves the cursor to the first character position on the first line. |
| ↑ (Cursor Up) | Depression of this key or ESC A moves the cursor to the same character position in the next line above. Upon reaching the top line, the cursor moves to the same character location in the bottom line. |
| → (Cursor Right) | Depression of this key or ESC C moves the cursor to the next character position. When the cursor reaches the last character position on the line, it moves to the first position on the next line down. When the cursor reaches the last position on the last line, it moves to the Home position. |
| F1 - F16 (Special Function keys) | The operation of the special function keys is determined by the user. Depression of any of these keys causes transmission of the codes indicated on Table 3-1. The CPU responds to these codes as determined by local programming. Seek local technical advice when necessary in determining what functions (if any) have been assigned to these keys. |
| DLINE | The DLINE key causes the cursor-occupied line to be deleted and the remaining lines below to move up one line. |
| I LINE | Depressing the ILINE key causes data from the cursor-occupied line on down to be moved one line lower. The cursor is positioned to the beginning of the blank line which is created and data may then be entered in that line as desired by the operator. |
| DCHAR | The DCHAR key causes the character at the current cursor position to be deleted. The remaining data from the cursor position to the end of the line moves one character position left for each deleted character. Spaces for each deleted character are added at the end of the line. The CONTROL DCHAR sequence causes characters to be deleted on a Page basis, with all data past the cursor to the end of the display moving left. As before, spaces are inserted at the end of display for each deleted character. |
| ICHAR | Depression of this key initiates the Insert Character mode. All data on the current line move one character position right of the cursor as new characters are inserted at the cursor location. Data at the end of the line are lost. The CONTROL ICHAR sequence initiates the Page Insert mode. As characters are entered at the cursor location, all data to the right of the cursor are moved one position to the right for each character entered. Characters are deleted as they reach the end of the page. |

(continued from Page 3-2)

On Line - Data are entered into memory, displayed and transmitted to the CPU. Transmission of the data to the CPU takes place in either full duplex or half duplex.

a. Full duplex - Data sent from the keyboard through the I/O port go to the CPU only and are not displayed. Only data received from the CPU are displayed by the teminal.

b. Half duplex - Keyboard entered data are displayed and transmitted to the CPU simultaneously.

### 3.2.6 Transmission Modes

When the Micro Bee 2 is On Line, transmission occurs in a character-by-character fashion as the keys are depressed. This is called a "conversational" mode and is used by the terminal to communicate with both the CPU and auxiliary devices. When the terminal is in the Local mode, the screen contents may be transmitted in block send fashion a line or a page at a time. The SEND key initiates such transmissions out the Main I/O and the ASEND performs a similar job for the auxiliary port. See Table 3-2.

### 3.2.7 Additional Operating Features

Many of the following Micro Bee 2 capabilities are not readily apparent when looking at the keyboard. Some are implemented using Control and Escape functions and others occur as an end result of the terminal operating program.

Subcharacter Display—When using the Micro Bee 2 in communication with a CPU in full duplex and a receiver error occurs on either a transmitted or received message, the $S_B$ character is displayed and a simultaneous audible alarm occurs.

Audible Alarm – The CONTROL G sequence (BELL character) causes momentary action of the audible alarm. It is also a result of the cursor passing the 72nd character position with the alarm sounding to warn the operator of the approaching line end. The momentary alarm also occurs when an illegal

keyboard entry is attempted or a receiver error is detected. The CPU may gain the attention of the operator using the **continuous** alarm feature (ESC 8). The operator can end a continuous alarm by striking any keyboard key.

Clock – A 24-hour clock which can be used to indicate elapsed time or time of day can be made to appear in the Status line by using the procedure outlined in Section 3.3.16.

Graphics – The construction of line drawings and forms may be accomplished using the terminal's Graphics mode. Eleven characters are available to make graphs, charts, etc., which can be transmitted to the CPU for storage and recall at a later date. See Section 3.3.10.

Read Terminal Status – The ESC O sequence may be used by the operator to promote a 27-character Status line message which summarizes the current terminal operating configuration (baud rates, duplex setting, rear panel switch positions, etc.). The message appears in the Status line and is interpreted using Section 3.3.19 and Tables 3-10 and 3-11.

Line Lock – The CPU may designate display lines as reserved for its exclusive use. The operator has no control over this, but "LINE LOCK" appears on the Status line when such has occurred. The operator may enter data in any unprotected area of display that remains.

## 3.3 DETAILED OPERATION DESCRIPTION

### 3.3.1 General

This section provides detailed functional information on the Micro Bee 2. It is assumed that the reader has some background in digital communications and is familiar with some of the terminology involved. To understand all terminal capabilities thoroughly, the user must read this section because it covers terminal functions which are interdependent and behave differently in different modes. While none of the following material is difficult, the user must be acquainted with it to realize maximum efficiency from the Micro Bee 2.

### 3.3.2 Keyboard Operation

#### Control Functions

To perform a Control operation, depress the CONTROL key and **hold this key down** while simultaneously typing the alphanumeric key. The CONTROL key is used to modify the meaning (and code) of certain other keys. When held down during action of any displayable character key (columns 2-7 of ASCII Code Chart), bits 6 and 7 of the code are forced to zero so that the codes from rows 0 and 1 of the chart can be produced from the keyboard. It is also used as a safeguard for functions like Clear, Break, Reset and others so that the accidental striking of these keys does not destroy screen contents or disrupt communications. CONTROL does not affect the 16 special function keys or the numeric pad.

#### Escape Functions

To perform an Escape operation, depress and release the ESC key, followed by the designated alphanumeric key. Be careful that any commas or dashes appearing in the explanation of an Escape or Control operation are actually part of the intended sequence before entering them as part of the sequence. Often the punctuation is included in the text only to help clarify the explanation of a multiple entry keyboard operation. The ASCII Code chart is the best place to verify Control or Escape sequences.

The Escape key is used as the first code in a multiple code sequence. It must be pressed and released before the second key is struck

On Line: ASCII ESC is transmitted.

The CONTROL ESC sequence allows local action of escape code sequences. The codes will not be transmitted even if On Line. This sequence overrides full duplex and all other switch settings. For example, setting the clock as described in 3.3.16 and using the CONTROL key in conjunction with this operation would result in a clock displayed on the terminal screen with no clock information being being transmitted out the I/O.

On Line: Nothing is sent for the entire sequence:

#### SHIFT and LOCK

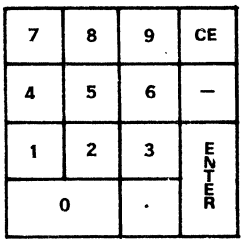
The SHIFT and LOCK keys are used to generate upper case codes and are operated the same as the equivalent typewriter keys, except as follows:

The LOCK key (also called the Alpha Lock key) affects alpha characters (A-Z, upper and lower case) only, so the SHIFT key must be used to manipulate the other displayable keys such as !/1. When enter-

ing an alpha character with the LOCK on and the SHIFT depressed, a double shift occurs which results in lower case characters being displayed. The SHIFT keys do not affect special function keys or numeric pad keys.

### 3.3.3 Numeric Pad Functions

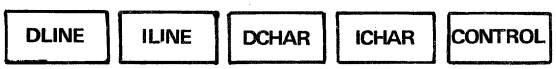
The numeric pad keys shown below, when depressed, cause the associated character to be displayed and/or transmitted. The numeric pad includes a CE, Minus, and ENTER key. This group is a stand-alone numeric data entry key pad, not affected by the SHIFT, LOCK, or CONTROL keys.




The ENTER key generates the termination character designated by the rear panel switches (see Section 2.7.5). If a CR or CR-LF is the selected termination character and the ENTER key is struck while in Local or half duplex, the terminal activates the code locally and transmits it is in On Line. There is no visible screen response to EOT or ETX, but these codes are transmitted. The Minus key in the numeric pad generates the same code as the typewriter Minus key. The CE (Clear Entry) feature is operational **only while in the FORMS mode** and positions the cursor to the beginning of the current unprotected field, erasing to the end of the field. If On Line whether in the Forms mode or not, the CE key generates ESC , (comma).

### 3.3.4 Edit Functions

The edit function keys are shown below.




**Delete Line (DLINE)**

Keyboard action of the Delete Line key (DLINE) causes the current cursor line to be deleted. The remaining display lines are each moved up one line and a blank line is inserted at the end of the display. The cursor is positioned to the beginning of the line it currently occupies. If DLINE is used on a line where an attribute is set, the attribute is also deleted, even if the attribute affects multiple lines.

Forms Mode: Illegal; rings bell.

Keyboard Operation: DLINE or ESC M.

I/O Operation: Receipt of ESC M.

Transmitted Code: ESC M.

**Insert Line (ILINE)**

Keyboard action of the Insert Line key (ILINE) causes all data to be moved down one line, starting from and including the cursor-occupied line. A blank line is inserted at the original cursor line position and the cursor is positioned to the beginning of the new blank line. Any data in the last display line (line 24) are lost.

Forms Mode: Illegal; rings bell.

Keyboard Operation: ILINE or ESC L.

I/O Operation: Receipt of ESC L.

Transmitted Code: ESC L.

**Delete Character – On a Line Basis (DCHAR)**

Keyboard action of the Delete Character (DCHAR) key causes the current cursor character to be deleted. All data to the end of the line is moved left one position and a space is inserted at the end of the line.

Forms Mode: Character deletion is on a field basis.

Keyboard Operation: DCHAR or ESC P.

I/O Operation: Receipt of ESC P.

Transmitted Code: ESC P.

**Delete Character – On a Page Basis (CONTROL DCHAR)**

Keyboard action of the Delete Character key in conjunction with the Control key (CONTROL DCHAR) causes character deletion on a page basis. All data to the end of the page is moved and wrapped around to the left with a space inserted at the end of the display.

Forms Mode: Illegal; rings bell.

Keyboard Operation: CONTROL DCHAR or ESC `.

I/O Operation: Receipt of ESC `.

Transmitted Code: ESC `.

**Insert Character – On a Line Basis (ICHAR)**

Keyboard action of the Insert Character key (I CHAR) initiates the Insert Character mode and the message "LINE INSRT" appears in Field F of the Status line. All data in the current line are moved to the right, from and including the character at the cursor, as new characters are entered. The cursor moves to the right as each character is inserted, indicating the location of the next inserted character. Data are lost at the end of the line. Striking the ICHAR key a second time resets the Insert Character mode.

Forms Mode: Character insertion is on a field basis.

Keyboard Operation: ICHAR or ESC Q sets mode on.
ICHAR or ESC @ sets mode off.

I/O Operation: Receipt of ESC Q sets mode on
Receipt of ESC @ sets mode off.

Transmitted Code: ESC Q when mode on
ESC @ when mode off

**Insert Character – On a Page Basis (CONTROL ICHAR)**

Keyboard action of the Insert Character key in conjunction with the CONTROL key intiates the Page Insert mode. "PAGE INSRT" appears in Field F of the Status line and all data to the end of the page is moved and wrapped around to the right as characters are inserted at the cursor position. Characters are lost at the end of the display. Striking the ICHAR key resets this mode.

Forms Mode: Illegal; rings bell.

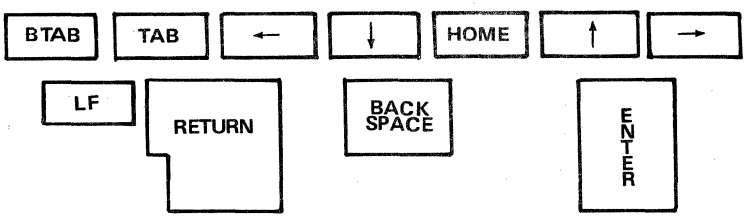
Keyboard Operation: CONTROL ICHAR or ESC a sets mode on;
ICHAR or ESC @ sets mode off.

I/O Operation: Receipt of ESC a sets mode on;
Receipt of ESC @ sets mode off

Transmitted Code: ESC a when mode on
ESC @ when mode off

### 3.3.5 Cursor Movement

The cursor movement keys are shown in below.




**Home (HOME)**

Action of the HOME key moves the cursor directly to the Home position, Line 1 column 1.

Forms Mode: The cursor moves to the first location of the first unprotected field on the screen.

Memory Lock/Line Lock: When portions of the memory are locked, the cursor moves to the first unlocked location available (moving from the top of the screen down).

Keyboard Operation: HOME or ESC H.

I/O Operation: ESC H.

Transmitted Code: ESC H.

**Cursor Left (←)**

Action of the ← key advances the cursor one position to the left. On reaching column 1 of a line, it wraps to column 80 of the previous line. On reaching Home, it wraps to column 80 of line 24.

Forms Mode: The cursor moves within an unprotected field and to an immediately adjacent field, provided exit parameters of the currently occupied field are met.

Memory Lock/Line Lock: On reaching an area of "Memory Lock", the cursor wraps to column 80 of line 24. On reaching a locked line, the cursor wraps from column 1 to column 80 of the first unlocked line above. If no further unlocked lines remain before reaching Home, the cursor wraps to column 80 of line 24.

Keyboard Operation: ← or ESC D.

I/O Operation: Receipt of ESC D.

Transmitted Code: ESC D.

**Cursor Right (→)**

Action of the → key advances the cursor one position right. On reaching line end, it wraps to column 1 of the next line below. On reaching column 80 of line 24, it wraps to Home.

Forms Mode: The cursor moves within an unprotected field.

Memory Lock/Line Lock: On reaching an area of "Memory Lock" while wrapping from column 80 of line 24, the cursor advances to the first available unlocked location of the screen. On reaching a locked line the cursor advances to column 1 of the first unlocked line available, wrapping through Home, if required.

Keyboard Operation: → or ESC C.

I/O Operation: Receipt of ESC C.

Transmitted Code: ESC C.

**Cursor Up (↑)**

Action of the ↑ key advances the cursor up one line; on reaching the Home line, it wraps through to line 24.

Forms Mode: The cursor moves within a field that extends through multiple lines.

Memory Lock/Line Lock: On reaching an area of "Memory Lock", the cursor advances and wraps to line 24. On reaching a lock line, it advances to the first free unlocked line, wrapping through line 1, if necessary.

Keyboard Operation: ↑ or ESC A.

I/O Operation: Receipt of ESC A.

Transmitted Code: ESC A

**Cursor Down (↓)**

Action of the ↓ key advances the cursor down one line. On reaching line 24, it wraps back to line 0.

Forms Mode: The cursor moves within a field that extends through multiple lines.

Memory Lock/Line Lock: On reaching a "Memory Locked" area, the cursor advances to the first unlocked line. On reaching a locked line, the cursor advances to the next unlocked line, wrapping through line 1, if necessary.

Keyboard Operation: ↓ or ESC B.

I/O Operation: ESC B.

Transmitted Code: ESC B.

**Line Feed (LF)**

Action of the Line Feed key causes the cursor to advance to the next line. On reaching line 24, if the terminal is in the Roll mode (switch S1-2 up), action of the Line Feed key causes scrolling to occur. Line 1 is lost and the data moves to create a new line 24. If the terminal is in the non-Roll mode (switch S1-2 down), the cursor wraps to line 1 of the display.

Forms Mode: The cursor moves within a field extending through multiple lines.

Memory Lock/Line Lock: In non-Roll mode, encountering a locked area advances the cursor to the first unlocked line available, wrapping, if necessary. In Roll mode, memory-locked areas are not encountered because of scrolling; however, on reaching a locked line, the cursor skips that line, forcing a scroll of all unlocked lines, if necessary.

Keyboard Operation: LF or CONTROL J.

I/O Operation: Receipt of CONTROL J (LF)

Transmitted Code: CONTROL J (LF)

**Carriage Return (RETURN)**

Action of the RETURN key causes the cursor to move to column 1 of the current line while not in the Auto Line Feed mode (switch S1-3 down). If Auto Line Feed is on, the cursor advances to column 1 of the following line.

Forms Mode: The cursor returns to the first unprotected location of the current field.

Roll Mode: If the Auto Line Feed mode is selected, the Micro Bee 2 display scrolls if the cursor is on the bottom line.

Non-Roll Mode: If the Auto Line Feed mode is on, the cursor wraps to Home if the RETURN key is struck while the cursor occupies the bottom line. **Note: In non-roll mode, action of the Return key causes erasure to the end of the current line from current cursor position.**

**Enter Key (ENTER)**

If the selected termination character is CR or CR-LF (see Section 2.7.5), action of the ENTER key causes cursor movement. See Carriage Return and Line Feed section 3.3.5 for relevant details.

**Tabulate (TAB)**

Action of the Tab key causes the cursor to advance to the right and halt at the next tab stop location. Tab stops are fixed at locations 0, 8, 16, 24, 32, 48, 56, 64, and 72 of each line. The Tab key automatically wraps at the end of each line.

Forms Mode: Action of the Tab key moves the cursor sequentially to each unprotected field start delimiter on the screen provided the exit parameters of the current field have been met. Attempts to tab when exit parameters are not met sound the alarm and the cursor does not move. Tabbing from the last field on the screen advances the cursor to the first unprotected field on the screen.

Roll Mode: In Roll mode, action of the Tab key advances the cursor sequentially until it reaches the end of the display. Tabbing beyond line 24 causes rolling to occur.

Non-Roll Mode: In Non-Roll mode, the cursor wraps to Home when it reaches line 24, column 80.

Keyboard Operation: TAB or CONTROL I (HT)

I/O Operation: Receipt of CONTROL I (HT)

Transmitted Code: CONTROL I (HT)

**Back Tab (BTAB)**

Action of the BTAB causes the cursor to back up to the previous tab loation, wrapping as necessary. On reaching Home, the cursor halts. Memory and Line Locked areas are tabbed around, not through.

Forms Mode: The BTAB key causes the cursor to reverse to the beginning of the field it currently occupies. Action of the BTAB key a second time reverses the cursor to the start of the previous field. BTAB stops on reaching the Home location in the first field.

**Back Space (BACK SPACE)**

This key is equivalent to the ← key except that th ASCII back space code is transmitted when on line. Local effects are identical to ←.

### 3.3.6 Screen Erasure

The screen erase associated keys are shown below.


**Clear Screen (CONTROL–CLEAR ALL VAR)**

Action of the Clear All Variables key in conjunction with the CONTROL key causes erasure of all data in memory, the cursor returning to the Home position. The Clear All Variables key actuated without the CONTROL key causes no action. This is a safety feature to prevent accidental erasure.

Forms Mode: The Clear Screen function causes the erasure of all unprotected data to the Null codes, the cursor returning to the first unprotected location of the first field.

Memory Lock/Line Lock: The Clear Screen function causes erasure of all unlocked areas of memory while allowing lo locked areas of data to remain. The cursor moves to the first unlocked location of the screen.

Keyboard Operation: CONTROL CLEAR ALL VAR or ESC E.

I/O Operation: Receipt of ESC E.

Transmitted Code: ESC E

**Erase to End of Line (CLEAR EOP/EOF)**

Action of this key causes erasure of displayed data from the current cursor position to the end of the line.

**NOTE:** If forms delimiters are present in memory but Forms mode is not currently selected, these delimiters are **not** altered by using the Erase to End of Line function.

Forms Mode: Erases all unprotected data to the Null codes from the current cursor position to the end of the field.

Keyboard Operation: Action of the CLEAR EOP/EOF KEY OR ESC K.

I/O Operation: Receipt of ESC K.

Transmitted Code: ESC K.

**Erase to End of Page (CONTROL–CLEAR EOP/EOF)**

Action of the CLEAR EOP/EOF key in conjunction with the CONTROL key erases all displayed data from the current cursor position to the end of memory.

**NOTE:** If forms delimiters are present in memory but Forms mode is not currently selected, these delimiters are not altered by using the Erase to End of Page function.

Forms Mode: Erases all unprotected data from the current cursor position to the end of memory.

Keyboard Operation: Action of CONTROL-CLEAR EOP/EOF or ESC J.

I/O Operation: Receipt of ESC J.

Transmitted Code: ESC J

**Clear Entry (CE)**

The CE key is operable only while in the Forms mode. Action of this key causes total erasure of the current unprotected field and the cursor to be placed in the first location of that field.

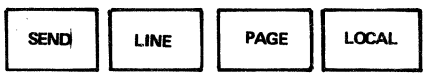
Keyboard Operation: CE or ESC ,

I/O Operation: Receipt of ESC ,

Transmitted Code: ESC ,

### 3.3.7 Communications–Main Port

The Main Port communications associated keys are shown below.




**Send**

In Local mode, the SEND key initiates a block transmission to the Main Port.

In Page mode, an ETX (EX) is displayed at the current cursor position. An STX code is transmitted and the send program searches through the screen until it encounters another ETX symbol or the Home position (top left corner of the display). Each character of each line is then transmitted (with spaces to the end of line suppressed) and the line is followed by CR-LF. A CR code only is transmitted after an 80-character line. When the Send routine reaches its original position, the termination character is transmitted (see Section 2.7.5) and the terminal remains in the Local mode. During data transmission the Status line indicates MAIN SEND in Field E and the keyboard is disabled. (Internal switch 1, when enabled, allows the terminal to go On Line after a block transmission.) All applicable RS232C control signals are active during a block transmission.

In Line mode, the line send routing starts the beginning of the present line and the whole line (minus trailing spaces) is transmitted. No ETX character is written on the screen and the cursor appears at column 1 of the following line after transmission of the termination character. If Internal switch 1 is enabled, the terminal goes On Line at the end of line transmission. Again, all applicable RS232C control signals are active during the transmission.

Forms Mode & Page Mode: Regardless of cursor position, in the Page mode, all of the unprotected fields of data are transmitted with an ASCII HT code between fields. There is no displayed ETX, and any constant field is transmitted first.

Forms + Modified Mode: If the Modified mode is on, only the fields which have been altered are transmitted with HT codes replacing unmodified fields.

Forms + Line Mode: In the Line mode, only the current field is transmitted and the cursor skips to the next field, if exit requirements of the current field have been met. All characters of the variable field are transmitted, including all spaces in the field.

On Line: The ETB code is transmitted by the SEND key in either the Page or Line mode. The Send function cannot be initiated from the keyboard when On Line unless the ETB code is echoed to the terminal by the CPU.

**NOTE:** Receipt of X-OFF code disables transmission until X-ON is received (see Section 3.3.12).

Keyboard Operation: The SEND key or ETB (CONTROL W) initiates a Page Send or a Line Send, according to the current mode selected.

I/O Operation: Receipt of an ETB code causes either a Line Send or a Page Send, according to the mode selected.

Receipt of an ESC I code forces a Page Send to be initiated, regardless of the current mode selected. The original mode is assumed when transmission is complete.

Receipt of ESC i similarly forces a Line Send to occur, the original mode again being assumed upon completion.

Transmitted Code: CONTROL W (ETB)

**Line Mode**

The LINE key changes the terminal mode from Page to Line mode. In the Line mode the SEND key initiates a line send function. The line send routine starts at the beginning of the present line and the whole line (minus trailing spaces) is transmitted. No ETX character is written on the screen and the cursor appears at column 1 of the following line after transmission of the termination character. If internal switch 1 is enabled, the terminal goes on line at the end of the line transmission. All applicable RS232C control signals are active during the transmission.

On Line: ESC # is transmitted.

Forms Mode: If the terminal is in Forms mode and a Line Send is initiated, then only the field the cursor presently occupies is sent.

Modified Mode: If the terminal is in a Modified mode and a Line Send is initiated, then only a cursor-occupied field in which the data have been modified may be sent. The exit parameters of the field must be met and the selected termination character is included.

Keyboard Operation: LINE key or ESC #.

I/O Operation: Receipt of ESC #.

Transmitted Code: ESC #.

**Page Mode**

The PAGE key returns the terminal to Page mode from Line mode. In Page mode, the SEND key initiates a block or page transmission. An STX code is transmitted and the send routine backsearches through the screen until it encounters another ETX symbol or the Home position (top left corner of the display). Each character os each line is then transmitted with spaces to the end of line suppressed. A CR-LF sequence is transmitted at the end of each line of data when spaces are suppressed. A CR code only is transmitted after an 80-character line. When the cursor reaches its original position, the selected termination character is transmitted (see Section 2.7.5) and the terminal remains in the Local mode. (Internal switch 1 when enabled allows the terminal to go On Line after a block transmission.)

Forms Mode: A constant field (if present) plus all unprotected fields is sent when the SEND key is struck, but no STX is sent. An ASCII HT is sent between fields. After sending the last field, the termination character (switch selectable) is transmitted and the terminal remains in Local mode.

Modified Mode: If the terminal is in Modified mode and a Page Send is initiated, then only modified fields are sent. In place of unmodified fields, an HT is sent.

Keyboard Operation: PAGE key or ESC !.

I/O Operation: Receipt of ESC !.

Transmitted Code: ESC !.

**Local Mode**

The LOCAL key is a toggle function; it alternately switches the terminal from On Line to Local and vice versa. In the On Line mode, all alphanumeric characters are transmitted through the main I/O port when keys are struck. All control keys (such as RETURN) send their associated control code. All function keys send their associated 4 or 5 code sequence.

In the Local mode, the keyboard is connected directly to the display and any key activated only

affects the display; no transmission occurs. The terminal must be in the Local mode before a block transmission may be initiated. The receiver is only partially disabled while in Local mode. It continues to monitor for the receipt of certain code sequences that may be performed while the terminal is in a Local mode. These sequences are:

GO ON LINE
AUX-ON
AUX-OFF
SET MEM ADD POINTER
CPU MSSGE DEPOSIT

Keyboard Operation: LOCAL or ESC n for On Line
LOCAL or ESC N for Local

I/O Operation: Receipt of ESC n for On Line
Receipt of ESC N for Local

Transmitted Code: ESC n for On Line
ESC N for Local

**Line Monitor Mode**

The Line Monitor mode allows the entry of received Control code and Escape sequences into a display memory. Remote command execution is inhibited and all codes are displayed. Control codes and Escape codes are generated on the keyboard and written to display memory without command execution.

Keyboard Operation: On with ESC : and Off with ESC *.

I/O Operation: Receipt of ESC : for On or ESC * for Off.

Transmitted Code: ESC : for On or ESC * for Off.

**Page Dump**

The Page Dump feature allows the user to send the entire screen contents (including graphics, visual and logical attributes) to the CPU for later retrieval and recomposing. To perform a Page Dump from the keyboard, the terminal must be in Local mode and not in Forms or Forms Build mode. Page Dump is initiated with an ESC o. After this sequence is entered, an ESC E (Clear Screen) is transmitted, followed by the entire screen contents including visual attributes (see Section 3.3.10) and associated codes. Codes necessary to build forms are also sent. These include the cursor address to position the cursor to the beginning of a field, the Escape sequence and logical attributes associated with that field (see Table 3-2), the field-ending cursor address, and the Escape sequence to end the field. Graphical information is similarly transmitted as a sequence of graphic on/off commands. This enables exact representation of the original screen contents at a later time.

### 3.3.8 Communications - Aux Port

**Auxiliary Send (ASEND)**

The ASEND key is the equivalent of the SEND key except that data transmission is out the Auxiliary port (not the Main port) and is routed to the Auxiliary device. All lines are followed by a CR-LF sequence regardless of line length. Transmission of data while in the Forms mode via the Auxiliary port causes all protected data to be transmitted as space codes. If a constant field is present, it is transmitted as constructed on the terminal's screen. Space suppression is performed as required, page format being maintained. The ASEND functions in both Line and Page modes are similar to SEND while obeying the Go On Line switch (Internal switch 1) after the transmission is completed. If the terminal is Aux enabled when an Auxiliary Send is activated, and ESC 0 is transmitted to the auxiliary device and no action occurs unless the code is echoed. While doing a block transmit out the Auxiliary port, AUX SEND appears in Field E of the Status line.

**Note: Transmission to the auxiliary port while in modified mode is an illegal operation.**

Line Mode: With the Micro Bee 2 in Local and Line modes, the action of an AUX SEND causes transmission a line at a time to occur. No STX is sent and an ETX does not appear on the terminal screen. A CR-LF is sent following the line.

Page Mode: When the ASEND key is actuated in the Page mode, an ETX is printed at the present cursor location. The send routine then backsearches to Home or the next previous ETX and transmission occurs from that point until another ETX is encountered.

Keyboard Operation: ASEND or ESC 0 (zero)

I/O Operation: Receipt of ESC 0 (zero)

Transmitted Code: ESC 0 (zero)

**Auxiliary On (AUX ON)**

The AUX ON key logically connects the Main I/O

port to the Auxiliary I/O port in a daisy chain configuration. Communication may be bidirectional and data transfer does not interfere with terminal keyboard and screen operations. When the terminal is in LOCAL mode, all keys operate locally without transmission to either port. Baud rate settings on the two ports need not be the same. Each port is buffered and the terminal may optionally control data flow in a way that no overrun or data loss occurs (see Section 3.3.12). If the terminal is unable to accept more data from the main port, an X-OFF code is sent to the host to stop data flow. When the buffer is sufficiently empty, an X-ON code is sent to restart the flow of data without loss. If the terminal is unable to accept more data from the Aux port, the CTS signal (pin 5, Clear to Send) is dropped to inhibit data flow until the buffers can accept more data. If the terminal is placed On Line or Aux Enabled, the screen monitors data from the port selected and the keyboard codes are routed to that port. When AUX ON is selected, it is indicated in Field D of the Status line.

Keyboard Operation: AUX ON or ESC ( for Aux On; AUX ON or ESC ) for Aux Off - (AUX ON is a toggling key)

I/O Operation: Receipt of ESC ( for Aux On; receipt of ESC ) for Aux Off.

Transmitted Code: ESC ) when Aux On
ESC ( when Aux Off

**NOTE:** Combinations of ON LINE, AUX ON, and AUX ENABLE are provided primarily for line diagnostic purposes and therefore may produce multiple characters on the screen or unwanted multiple paths for data. All three modes should not typically be used simultaneously.

### Auxiliary Enable (E-AUX)

This key has a function similar to the Local key. It puts the terminal On Line with the auxiliary I/O port and full communications are enabled between the keyboard, screen, and auxiliary device. All communications are half duplex only, regardless of main port switch settings. (Echoed characters appear double on screen.) The terminal controls incoming data by dropping and raising pin 5 (CTS) on the auxiliary port. The aux port is disabled when the E-AUX key is struck a second time. When E-AUX is on, it is reflected by the AUXRDY/BSY message in Field D of the Status line.

Keyboard Operation: E-AUX or ESC j enables AUX
E-AUX or ESC k disables Aux (E-AUX is a toggling key.)

I/O Operation: Receipt of ESC j enables Aux; Receipt of ESC k disables Aux.

Transmitted Code: ESC j or ESC k.

**NOTE:** If On Line and Aux Enabled, keyboard data goes to both ports and the screen, and each port has access to the screen. If either device echoes, multiple characters appear on the screen. The terminal may also be Aux On and Aux Enabled simultaneously. Under these conditions, data from the main receiver passes directly to the auxiliary device without appearing on the screen. Data from the keyboard appears on the screen and is passed to the auxiliary device. Data from the auxiliary device appears on the screen and is passed to the main port transmitter. Under this condition, the Status line Field D indicates AUX-ON, since it has priority over AUXRDY.

### Auxiliary Page Dump

This function is similar to Page Dump described in 3.3.7, except that data transmission occurs from the Auxiliary port to the Auxiliary device. ESC / initiates the dump. Again, the Micro Bee 2 may not be in Forms or Forms Build mode. The terminal responds to the Go-On-Line switch (Internal switch 1) following transmission.

Keyboard Operation: ESC / initiates the Auxiliary Page Dump.

I/O Operation: Receipt of ESC /.

Transmitted Code: ESC /.

## 3.3.9 Formatting Modes

Keys associated with the Forms and Forms Build modes are shown below.


### Forms Mode (FORMS)

Action of the FORMS key selects the Forms mode and the message "FORMS" is reflected in Field G of the Status line.

Selection of this mode causes previously entered attributes to be asserted, defining areas of protected and unprotected data upon the screen. At-

tempts to select Forms mode without previously entering field attributes aborts and the alarm sounds.

Field delimiting attributes are invisible and occupy no space in memory. A range of attributes allows selection of various field types designed to limit the type of data being entered by the operator (see Table 3-3 for field type definitions).

**NOTE: When data are being entered in Forms mode via the I/O, fields do not automatically overflow; a horizontal tab (HT) is required to advance the cursor between fields.**

Defining Forms—Forms may be built via the I/O or the keyboard. A special method permitting local definition of Forms data is described next under Forms Build Mode.

With no field delimiters entered, the screen is considered to be totally protected. Thus, in defining a form, it is necessary to define the unprotected data fields. Data entered directly to the screen from the keyboard or I/O without setting attributes is considered protected when the Forms mode is asserted. To define an unprotected area, enter the code sequence defining the starting delimiter for that field, i.e., ESC [ defines a regular unrestricted entry field. The cursor must be positioned to the required ending location for that field by means of cursor addressing or by any movement instruction desired, and the Start Protect delimiter entered (ESC ] for all field types). Data entered between fields again becomes protected. Unprotected fields may be located at any position on the screen and may be built in random order. Data may be entered into unprotected areas during definition and remain displayed but unprotected when Forms mode is asserted.

Operator Entry—Once a form has been defined and Forms mode initiated, the form is ready for operator entry. The action of turning on the Forms mode positions the cursor to the first unprotected character position from the Home position. Since field definitions are not displayed, the areas to be entered may be defined to the operator by containing data, visual attributes, or by entering a clear

**Table 3-3 Logical Field Attributes**

| 3-code Sequence | Field Definition (Unprotected) | Graphic Symbol |
|---|---|---|
| ESC, +, 0 | Must Enter Alphanumeric | ┌ |
| ESC, +, 1 | Must Enter Alpha only | ┐ |
| ESC, +, 2 | Must Enter Numeric only | └ |
| ESC, +, 3 | Must Enter Alphanumeric | ┘ |
| ESC, +, 4 | Total Fill Alphanumeric | ┬ |
| ESC, +, 5 | Total Fill Alpha only | ┤ |
| ESC, +, 6 | Total Fill Numeric only | ├ |
| ESC, +, 7 | Total Fill Alphanumeric | ┴ |
| ESC, +, 8 | Normal Alphanumeric | ─ |
| ESC, +, 9 | Normal Alpha only | │ |
| ESC, +, : | Normal Numeric only | + |
| ESC, [ | Normal Alphanumeric | — |
| ESC, ] | Start Protect (End of Field) used after all fields | |
| ESC, % | Start Constant field | |

**Definitions:**

Alphanumeric — All characters accepted in field entry.

Alpha Only — All characters except the digits 0-9.

Numeric Only — All characters less than A, hexadecimal.

Normal — Fields may be skipped or entered without restriction.

Must Enter — At least one valid character must be entered into field before cursor may advance to next field.

Total Fill — Field must be totally filled (specified length) before cursor may advance to the next field.

Constant — One field may be defined with identification data which is not accessible or alterable in the FORMS mode but which will be transmitted before the unprotected fields in a Page Send.

**NOTE: If more than one constant field is set up on the screen, only the last one defined is valid.**

screen code sequence, the unprotected areas becoming defined by delete codes throughout their length ( • • • • • ).

The operator may now proceed to enter data as required. If the field definitions are for normal fields, on reaching the last character of an unprotected field, the cursor automatically tabs to the first character position of the next unprotected field. Again in normal fields, action of the tab key automatically advances the cursor to the next field.

Tab stops may be set within unprotected fields by the inclusion of additional start unprotect delimiters at the requisite positions during form construction. During eventual transmission, these additional

start delimiters appear as additional Horizontal Tabs.

On reaching a field having a total fill definition, any attempt to advance from the field before every location is completed sounds the bell and displays a message indicating the error in the Status line Field G. This error message identifies the field type and the error, i.e. , MUST ENTER
ALPHA ONLY
NUMERIC ONLY
TOTAL FILL

Fields defined as Must Enter require the entry of at least one character before attempts are made to leave the field. If at least one character is not entered, an error message is produced and the alarm sounds. In this case, the error message indicates MUST ENTER.

Fields specifically defined as alpha or numeric only again refuse entry illegal codes and provide an alarm and a status message indicating the error, i.e., ALPHA ONLY, etc.

Editing is permissible within any unprotected field (see Section 3.3.4 for definition).

Having reached the completion of the entry, the operator may transmit the entered data under the following rules.

a. SEND Key Operation in Forms and Page Modes:

   Striking the SEND key causes all unprotected data to be transmitted with ASCII HT codes inserted between fields. No space suppression occurs and any delete codes present are transmitted as spaces. If a constant field is present upon the screen, it is transmitted first, regardless of its position on the screen.

   Under these conditions, activating the SEND key does not write an ETX on the screen and the cursor position is irrelevant, since all unprotected data present are transmitted. The terminal finishes by transmitting the selected termination character and finally responding to the Go-On-Line switch (Internal switch 1), if selected.

b. SEND Key Operation in Forms and Line Modes:

   Striking the SEND key causes the current field in which the cursor resides to be transmitted. If the exit requirements of that field have been met, the cursor advances to the next sequential field. Constant fields are ignored in these modes and are not transmitted. The selected termination character is transmitted at the end of the data and the terminal then references the Go-On-Line switch.

c. ASEND Key Operation in Forms and Page Modes:

   Striking the ASEND key causes transmission of the entire page of data via the auxiliary port. The constant field, if present, is transmitted as it appears on the screen. Protected data are transmitted as spaces, with trailing space suppression permitted, provided the Page format is maintained. In this way, a complete representation of the format page may be passed to a printer to enter onto a preprinted form.

d. ASEND Key Operation in Forms and Line Modes:

   Striking the ASEND key causes the transmission of the current cursor field via the auxiliary port. Constant fields are not transmitted in Line mode.

Forms Build Mode

The Forms Build mode (FBM) is entered by simultaneously activating the FORMS and CONTROL keys (or ESC &) and is reflected by the message FORMS BLD in Field G of the Status line.

The mode is specifically designed to allow the normally invisible logical field attributes to become visible and thus allow the user to generate forms locally for eventual transmission to the host device (via Page Dump).

Having entered FBM, fields may be entered in any sequence on the screen since at this time they are being held as visual data. The screen is generally considered a protected area and therefore all unprotected fields must now be specified. Entry of a start unprotected attribute (see Table 3-3 for available codes) causes display of a half-intensity blinking graphics symbol marking the first unprotected location. The cursor may now be moved to the required ending location of the field by means of the space bar, cursor movement keys or any other method. Entry of the start protect attribute (ESC ]) causes the area between the two attributes to fill with delete codes, thus visually defining

the extent of the field, the graphics character at the first location remaining visible to permit identification of the field type.

All data entered into areas not defined as unprotected is treated as protected data when the form is retransmitted by the terminal.

One exception to the field definition is the "constant field". Entry of an ESC % produces no graphic display; data may be entered for the duration of the field and terminated by ESC ]. These data are treated as a constant when the form is in use; that is, the operator may not alter it as it is truly protected, but during transmission it is sent as a prefix to all unprotected data regardless of its position on the screen. It is possible to enter multiple constant fields in a display page; however, only the last one entered is effective, as each prior constant field is relegated to being normal, protected data upon receipt of an additional constant field.

While in FBM, full editing facilities remain operable, thus permitting movement and adjustment of field sizes and data content. In this way, existing forms data may be received from the I/O in Forms Build mode, modified via the edit routines and retransmitted to the host via Page Dump.

**NOTE: Visual attributes may be used in building a form. However, a graphics character (delimiter) immediately following visual attribute appears as an ASCII character. When FBM is exited, the field will be valid, since the graphics character only marked the location of the field during the building of the form.**

Modified Mode

When using the Forms mode, a Modified mode may be set such that any unprotected fields which are changed in any way from the keyboard (written, erased, inserted, deleted, etc.) are flagged as modified. When the page is transmitted (all unprotected fields), only those that were modified are transmitted in their entirety. Fields not altered are replaced by a single horizontal tab code in the data stream to indicate their position among modified fields. Aux Page Send sends all fields as described in Section 3.3.8.

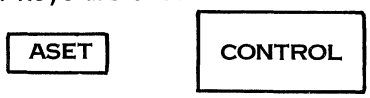
Keyboard Operation: ESC T turns modified mode on; ESC U turns it off.

I/O Operation: Receipt of ESC T turns modified mode on; receipt of ESC U turns it off.

Transmitted Code: ESC T or ESC U.

### 3.3.10 Visual Attributes

Associated keys are shown below.




Attribute Set (ASET)

The ASET key sets up the terminal so that the next key is interpreted as a visual attribute according to Table 3-4. Other keys are ignored.

Example: ASET Q causes the screen to become Half Intensity Reverse Video from the cursor position to the end of the screen (or until another visual attribute code is found). There is a limit of 16 visual attributes allowed per line. An attribute may not be set in the 80th column of the screen. However, to stop a video field at the end of a line, another attribute may be set at column 1 of the next line. In Non-Roll mode, a video attri-

**Table 3-4 Visual Attributes**

| Key (ASCII Code) | Visual Attributes |
|---|---|
| @ | Normal (Stop Visual Attribute) |
| A | Half Intensity |
| B | Blinking |
| C | Half-Blink |
| P | Reverse-Video |
| Q | Reverse-Half |
| R | Reverse-Blink |
| S | Reverse-Half-Blink |
| ` | Underline-Normal |
| a | Underline-Half |
| b | Underline-Blink |
| c | Underline-Half-Blink |
| p | Underline-Reverse |
| q | Underline-Reverse-Half |
| r | Underline-Reverse-Blink |
| s | Underline-Reverse-Half-Blink |
| $ | Security (Invisible) |
| 4 | Reverse-Security |
| 5 | Half-Reverse-Security |
| 6 | Blinking-Reverse-Security |
| 7 | Blinking-Half-Reverse-Security |

bute in column 0 cannot be followed immediately by a CR; a code such as a space code must be entered before the CR. Attributes may not be followed immediately by graphics characters.

Forms Mode: ASET is not allowed while in Forms mode. The audible alarm sounds. Attributes may be set prior to entering the Forms mode.

The ASET key in conjunction with the CONTROL key causes an attribute delete function to occur. An attribute may be overwritten with another attribute; however, the maximum total per line is 16.

Keyboard Operation: Enter mode with ASET or ESC d followed by desired attribute ASCII Code from Table 3-4
Exit mode (i.e., generate a delete attribute function) with CONTROL-ASET or ESC e. A normal attribute (@) may be entered in lieu of deletion.

I/O Operation: ESC d followed by the appropriate ASCII Code from Table 3-4 sets an attribute

## Graphics

Eleven graphic characters are available and may be displayed in normal video, half intensity, blinking or blinking half intensity. The graphic mode is turned on by entering an ESC R sequence and turned off with an ESC S sequence. To enter the Graphic mode, use the following procedure:

a. Turn on Graphic mode with an ESC R.
b. Move the cursor to where the graphic character is to start. At least one character must separate a graphics character and any preceding ASET.
c. Then key the ASCII character required for the given graphic symbol as shown on Table 3-5.
d. Repeat steps b and c as needed.
e. Exit the graphic mode with ESC S.

While in graphics mode, the 44 characters listed in Table 3-5 appear on the screen as corresponding graphics characters. All other codes are interpreted normally.

Table 3-5 Graphic Characters

| SYMBOL | NORMAL | ASCII EQUIVALENT HALF | ASCII EQUIVALENT BLINK | HALF BLINK |
|---|---|---|---|---|
|  | @ | A | B | C |
|  | D | E | F | G |
|  | H | I | J | K |
|  | L | M | N | O |
|  | P | Q | R | S |
|  | T | U | V | W |
|  | X | Y | Z | [ |
|  | \ | ] | ^ | — |
|  | ` | a | b | c |
|  | d | e | f | g |
|  | h | i | j | k |

Keyboard Operation: ESC R sets graphics mode on
ESC S turns graphics mode off

I/O Operation: ESC R sets graphics mode on
ESC S turns graphics mode off

Transmitted Codes: ESC R
ESC S

### 3.3.11 Display Locking

Associated key:

MLOCK

Portions of the display memory may be selectively locked from operator access under the control of Memory Lock or Line Lock functions.

### Memory Lock (MLOCK)

The MLOCK key causes the display memory above the cursor line to be locked from operator access or scrolling. The display area below the locked portion of the screen functions normally. The cursor position is not affected by Memory Lock. Data in the locked portion of the screen cannot be altered by the operator but remain available for CPU control and data entry using the Memory Address Pointer. Memory Lock is not operable beyond line 23. A Status Message of "MEM LOCK" appears in this mode in Field E.

**NOTE:** The operator cannot accidentally lock out a whole page. There will always be at least one line left unlocked.

Forms Mode: Illegal; rings bell.

Keyboard Operation: MLOCK or ESC g activates Memory Lock.
MLOCK or ESC h deactivates Memory Lock.
MLOCK toggles the Micro Bee 2 in and out of Memory Lock.

I/O Operation: ESC g for Memory Lock On;
ESC h for Memory Lock Off.

Transmitted Codes: ESC g and ESC h.

### Line Lock

By way of the remote command ESC < , followed by a line address, the host CPU may selectively designate display lines as reserved for exclusive CPU use. When lines are so locked, keyboard and received data and terminal functions have no effect on those lines. The terminal does not allow cursor positioning in locked lines; the cursor moves down to the next available unlocked line. Clear screen and roll functions operate normally except that locked lines are left unaffected and fixed in display position. A Status Message of "LINE LOCK" appears in Field E while in this mode.

**NOTE: The CPU cannot lock all lines on the screen.**

Forms Mode: Illegal; rings bell.

**NOTE: Entering Forms mode cancels line lock.**

Keyboard Operation: None.

I/O Operation: ESC < locks, ESC = unlocks
These Escape sequences must be followed by a third code which specifies which line is to be locked or unlocked. These codes are specified in Table 3-8.

Example: ESC < + locks line 12.
ESC ? is a CPU-entered code which unlocks all lines.

### 3.3.12 Transmit On and Transmit Off (X-ON/X-OFF)

The Micro Bee 2 is provided with a switch-selectable full duplex line protocol. Designed to allow full control of both data transmission and reception by the terminal, it enables the user to gain the maximum permissible data throughput on any full duplex system. The use of the full protocol is limited to full duplex systems because of the requirement to simultaneously transmit and receive data.

The terms X-On and X-Off as used herein mean Transmit On (CONTROL Q) and Transmit Off (CONTROL S), respectively. They are ASCII Control Codes used in data communications to interrupt transmission and reception when necessary to prevent data loss.

The protocol which is described below accomplishes X-On and X-Off automatically. This automatic, periodic suppression of the transmit function is called "X Suppress," an acronym for "Transmit Suppress," and is controlled by Internal switch No. 4.

The protocol is subdivided into two major areas:
(1) Control of data output from the terminal and
(2) Control of data received by the terminal.
Each is discussed in detail.

Internal switch 4 governs the automatic assertion of Transmit Suppress.

When switch 4 is on, X-Suppress is also on. The terminal will not transmit X-On or X-Off codes unless these control codes have been generated as valid data. The terminal responds to receipt of X-On and X-off only if it is currently transmitting.

When switch 4 is off, X-Suppress is also off. The terminal transmits X-On and X-Off codes and responds to the receipt of X-On and X-Off in all transmission modes.

### Terminal Output Control

The control of data output from the terminal via protocol exchange depends on the setting of Internal switch 4.

Switch 4 On (X-Suppress On)—Under this condition, any time the terminal is performing a block transmission (i.e., Page Send/Dump, Line Send, etc.), the receiver is enabled and is monitoring for the reception of an X-Off Control Code (CONTROL S). Upon detecting an X-Off, transmission ceases within two character times. The terminal then enters an idle state until such time as an X-On (CONTROL Q) is received. At this time, data trans-

mission recommences without data loss and is maintained until such time as transmission is completed or a subsequent X-Off is received.

In this manner, a host device having a specific input block size requirement may control the terminal's transmission without the need for manual intervention.

The following constraints apply when controlling terminal output with X-Suppress On: (1) The terminal must be operating in a full duplex environment to permit simultaneous data transmission and reception. (2) The terminal must be currently performing a block transmit when the X-Off code is received. X-Off received at any other time is ignored.

Switch 4 Off (X-Suppress Off) – With X Suppress Off, the terminal reacts exactly as in X Suppress On except that receipt of an X-Off is valid at any time. Even if the terminal is in a conversational mode, receipt of an X-Off halts the output of transmitted data. In this mode, the bell sounds for each individual key struck after the receipt of an X-Off. These characters, however, are being placed into the output buffer at this time and up to 16 may be entered sequentially. Receipt of an X-On command releases the contents of this buffer for immediate transmission. If output is halted because of receipt of an X-Off and keyboard entry continues (once 16 characters are received), the system will prevent further acceptance of keyboard characters until the output is released by receipt of an X-On.

The following constraints apply when controlling terminal output with X Suppress Off: (1) The terminal must be operating in a full duplex environment to enable simultaneous transmission and reception. (2) Receipt of an X-Off always halts data transmission, regardless of mode.

## Auxiliary Output Control

Reception of the X-On/X-Off protocol is also valid while the terminal is transmitting data from an auxiliary source in the Aux On mode. Under this condition, receipt of the X-Off code again halts the transmission of the data within two characters. However, once data output has ceased, the auxiliary device is halted only when the terminal's auxiliary buffer has become full. The auxiliary device is halted by the lowering of the auxiliary Clear-to-Send circuit. When an X-On is subsequently received, data output recommences and as soon as buffer space is available, the CTS circuit is raised to permit passing of further data from the auxiliary device.

Auxiliary output control must be accomplished under the following constraints: (1) The terminal Main port must be operating in a full duplex environment. (2) The Auxiliary device must be capable of observing the Clear to Send circuit. (3) X-On and X-Off commands received on the Main port while outputting from the auxiliary device are also passed through to the auxiliary device. (4) With the X-Suppress switch on, transmission must be in progress when the X-Off is received. With the X-Suppress off, it may be received at any time to halt output.

## Terminal Input Control

A separate X-On/X-Off protocol controlling data input to the terminal is available under switch selection (Internal switch 4).

With the switch in the On position, the protocol is disabled and the terminal is reliant upon the host computer to ascertain and compensate for any timing requirements within data streams. (Since certain functions of the terminal require time to perform, pad codes such as Null or Delete must be inserted to allow the operations to be completed. With the switch off and the protocol enabled, the host can permit the terminal to command its own data reception rate and thus take no consideration of pad times.

The terminal has a receiver buffer of 254 characters length and the function of the protocol is controlled by the state of this buffer. When data is being received at a high rate, the terminal is normally able to remove data from the buffer at sufficient speed to prevent a potential buffer overrun condition. However, if a number of codes are included in a long data stream which requires time to perform, incoming data begins to stack up on the buffer. On reaching a condition of being 80% full (205 unprocessed characters received), the terminal issues an X-Off command via the Main port to halt the host CPU. After the issuance of the first X-Off, additional

characters received cause an X-Off to be transmitted for each received character. The terminal continues to process data from the buffer and reduce the number of unprocessed characters during this time. When the buffer content has been reduced such that it is 20% full (approximately 51 unprocessed characters), the terminal issues an X-On command to the host, calling for data to recommence.

Since the terminal is effectively controlling its own reception rate, it is therefore possible to permit communications at 19200 baud while the protocol is enabled. The terminal's transmitter will maintain 19200 baud operation without difficulty.

The following are terminal input control operating considerations: (1) The terminal Main port must be operating in a full duplex environment to permit transmission of codes while receiving data. (2) The host device must be able to receive and respond to X-On/X-Off protocol commands. Further, upon receipt of an X-Off command, the CPU receives further X-Off commands for each code transmitted prior to the receipt of an X-On. Theoretically, the host may send up to approximately 50 additional characters after receipt of the initial X-Off prior to a buffer overrun occurring and data being lost at the terminal. (3) Switch No. 4 must be off to permit X-ON/X-OFF transmission.

### Auxiliary Input Control

The switch selectable protocol when enabled is also applicable to received data being passed to the auxiliary device. Thus, if the terminal is in an Aux On mode and data is being received at a high rate (for example, 19200 baud) but the auxiliary device is operating at 1200 baud, then the protocol can control this situation.

The auxiliary port has a similar but separate structure to the receiver Main Port buffer. Thus, if data is being received faster than it can be released to the auxiliary device, the buffer again stacks up and commences issuing X-Off/X-On commands as the buffer load permits. If the terminal is On Line and Aux On simultaneously, such that all received data is being both displayed and passed to the auxiliary device, the slower of the two operations commands the data rate. Thus, if a slow speed printer is connected, the terminal does not request additional data until both buffers are able to receive additional characters.

The following are the Auxiliary Input Control operating considerations: (1) Terminal Main Port must be operating in a full duplex environment. (2) While Aux On is enabled and the terminal remains Off line, normal keyboard operations are maintained. The operator may therefore continue to prepare data for eventual block transmission while the communications circuit is effectively timeshared to permit passing of data in either direction to an auxiliary device. It should be noted that when operating in an Aux On mode with both ports selected for high speed, keyboard operations causing a heavy processor load, such as Page Mode Insert, degrades the overall operating speed between the Main and Auxiliary ports. This will not cause any data loss but increases the incidence of X-Off transmissions while the processor is unable to clear the buffers as fast due to a temporary high throughput. (3) Operating speed of the auxiliary device is immaterial due to full buffering in both directions. If the speed of the auxiliary device is higher than that selected for the main port, then the data received does not cause any issuance of protocol commands. (4) Should the auxiliary device become "not ready" and drop pin 20 of the Auxiliary port low, the auxiliary buffer again fills if data reception is maintained and X-Off is transmitted until the device is again able to receive data. If the system is Aux-On and On Line simultaneously, the auxiliary device becoming "not ready" also causes data reception to the screen to halt until the device is again ready.

### 3.3.13 Special Function Keys (F1-F16)

These keys transmit a 4- or 5-code sequence according to Table 3-6. Example: F1 when depressed transmits

STX ESC p TERM

(where TERM = the termination character selected by the rear panel switches. [See 2.7.5] The choices are CR, EOT, ETX, or CR-LF.) If the terminal is in a Local mode, it obeys the Go-On-Line switch (Internal switch 1) setting after the transmission occurs (with the terminal remaining On-Line) regardless of switch settings. Under no conditions is the function key to be sent via the Auxiliary port.

Local: Associated codes are transmitted.

Line Monitor Mode: Code sequence is displayed. Example: $S_X$ $E_C$ q $C_R$ No data is written to display by the function keys except in Line Monitor mode.

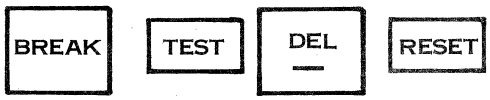
On Line: Code sequence is transmitted.

**Table 3-6 Function Key Table**

| FUNCTION KEY | CODE TRANSMITTED |
|---|---|
| F1 | STX, ESC, p, TERM |
| F2 | STX, ESC, q, TERM |
| F3 | STX, ESC, r, TERM |
| F4 | STX, ESC, s, TERM |
| F5 | STX, ESC, t, TERM |
| F6 | STX, ESC, u, TERM |
| F7 | STX, ESC, v, TERM |
| F8 | STX, ESC, w, TERM |
| F9 | STX, ESC, x, TERM |
| F10 | STX, ESC, y, TERM |
| F11 | STX, ESC, z, TERM |
| F12 | STX, ESC, { TERM |
| F13 | STX, ESC, \| TERM |
| F14 | STX, ESC, } TERM |
| F15 | STX, ESC, ~ TERM |
| F16 | STX, ESC, DEL, TERM |

### 3.3.14 Other Key Operations

Associated keys:




#### Break (CONTROL BREAK)

When the terminal is on line, this key generates a 250 (±10%) ms. break ("spacing" condition) on the transmit data line (pin 2, main I/O). The BREAK key is interlocked with the CONTROL key. This key is inoperative in the Off Line or Local mode. Actuating BREAK by itself causes no operation.

Keyboard Operation: CONTROL BREAK

I/O Operation: None

#### Delete (DEL/—)

This key normally produces the underscore character (_). When shifted, this key produces the delete (rub out) code (•).

Transmitted Codes: Underscore is sent when unshifted; delete (rub out) is sent when shifted.

#### Test (CONTROL TEST)

The TEST key in conjunction with the CONTROL key causes the system self test to be run. This is the same test that runs at power-up. The self test puts the terminal in a Local mode and destroys screen data.

On Line: Receipt of ESC f initiates the self test

Transmitted Code: None

#### Reset (CONTROL RESET)

Execution of the Reset sequence (CONTROL RESET or ESC V) causes the terminal to be set to its initial state without altering the display memory. Reset functions the same as power-on, except the display memory is not altered and the power-on diagnostic is not invoked. A reset cannot be executed from the keyboard if the keyboard is in Lock mode. The Reset sequence must be executed if any rear panel switches are changed to ensure these changes have been read into the software.

#### Hard Reset (CONTROL SHIFT V)

Depressing the right hand control and shift keys along with the V key will execute a reset as above except that it will work when the keyboard is disabled.

### 3.3.15 I/O Functions

#### Keyboard Locking

- The ESC b sequence causes the keyboard to be enabled (data can be entered from the keyboard).
- The ESC c sequence causes the keyboard to be disabled (data cannot be entered from the keyboard). A message indicating KEYBD LOCK blinks in Field E of the status line.
- **WARNING:** Keyboard lock cannot be disabled from the keyboard except by use of a hard reset.

Keyboard Operation: None

I/O Operation: Receipt of ESC b enables the keyboard and ESC c disables the keyboard.

#### Control Code Handling

When in normal operating modes, the ASCII control codes, NUL and Delete codes and ESC codes sequences that are valid terminal remote commands as listed in Table 3-1 are not written in display memory. Received control codes and ESC code sequences that are not listed in Table 3-1 are ignored. Control code display symbols are listed on Table 3-7. Line Monitor mode (see Section 3.3.7) allows display of all received codes.

The majority of the ASCII Control Codes listed on Table 3-1 (from 00 through 1F Hex) are not acted upon. The following codes are operational:

NUL (00 Hex) – Used as a pad code
BEL (07 Hex) – Sounds the audible alarm
BS (08 Hex) – Back space
HT (09 Hex) – Horizontal Tab
LF (0A Hex) – Line Feed
CR (15 Hex) – Return
DC1 (11 Hex) – X-On
DC3 (13 Hex) – X-Off
ETB XMIT (17 Hex) – Performs a block transmit if the terminal is on line.
SUB (1A Hex) – Used to indicate a received error.
ESC (1B Hex) – First part of an Escape sequence
GS (1D Hex) – Terminates CPU messages

All Control codes are displayed in Line Monitor mode. (See Table 3-7 for the displayable symbols and Section 3.3.7 for an explanation of Line Monitor mode.)

**Table 3-7 Control Code Symbols**

| | | | |
|---|---|---|---|
| A – $S_H$ | I – $H_T$ | Q – $D_1$ | Y – $E_M$ |
| B – $S_X$ | J – $L_F$ | R – $D_2$ | Z – $S_B$ |
| C – $E_X$ | K – $V_T$ | S – $D_3$ | [ – $E_C$ |
| D – $E_T$ | L – $F_F$ | T – $D_4$ | \ – $F_S$ |
| E – $E_Q$ | M – $C_R$ | U – $N_K$ | ] – $G_S$ |
| F – $P_K$ | N – $S_O$ | V – $S_Y$ | ^ – $R_S$ |
| G – 🔔 | O – $S_I$ | W – $E_B$ | _ – $U_S$ |
| H – $B_S$ | P – $D_L$ | X – $C_N$ | @ – • |

## Cursor Addressing

Cursor addressing allows the cursor to be positioned by sending a four-code sequence. The cursor may be addressed from the keyboard or from the I/O port. Cursor addressing uses absolute addressing and not relative addressing. The current cursor location has no effect on cursor addressing. The cursor is addressed by receiving the following four-character sequence:

ESC, F or Y, line address, column address

For example, to position the cursor to line 15 and character position 41, send the following sequence:

ESC, F, period, H or
ESC, Y, period, H

Table 3-8 gives the character and line location ASCII characters required to address any position on the display. If either the line or column address is out of bounds, the whole sequence is ignored.

**Table 3-8 CURSOR ADDRESS CODES**

ABSOLUTE CURSOR POSITIONING

| LINE OR COLUMN | ASCII CODE | LINE OR COLUMN | ASCII CODE | LINE OR COLUMN | ASCII CODE |
|---|---|---|---|---|---|
| 1 | SPACE | 28 | ; | 55 | V |
| 2 | ! | 29 | < | 56 | W |
| 3 | " | 30 | = | 57 | X |
| 4 | # | 31 | > | 58 | Y |
| 5 | $ | 32 | ? | 59 | Z |
| 6 | % | 33 | @ | 60 | [ |
| 7 | & | 34 | A | 61 | \ |
| 8 | ' | 35 | B | 62 | ] |
| 9 | ( | 36 | C | 63 | ^ |
| 10 | ) | 37 | D | 64 | _ |
| 11 | * | 38 | E | 65 | ` |
| 12 | + | 39 | F | 66 | a |
| 13 | , | 40 | G | 67 | b |
| 14 | - | 41 | H | 68 | c |
| 15 | . | 42 | I | 69 | d |
| 16 | / | 43 | J | 70 | e |
| 17 | 0 | 44 | K | 71 | f |
| 18 | 1 | 45 | L | 72 | g |
| 19 | 2 | 46 | M | 73 | h |
| 20 | 3 | 47 | N | 74 | i |
| 21 | 4 | 48 | O | 75 | j |
| 22 | 5 | 49 | P | 76 | k |
| 23 | 6 | 50 | Q | 77 | l |
| 24 | 7 | 51 | R | 78 | m |
| 25 | 8 | 52 | S | 79 | n |
| 26 | 9 | 53 | T | 80 | o |
| 27 | : | 54 | U | | |

## Cursor Sense

The Cursor Sense feature provides for the transmission of the current cursor location to the host processor. An ESC \ command causes the cursor position to be transmitted by line and column as shown in the cursor addressing scheme, Table 3-8.

Cursor Sense is an I/O function only and is not operable from the keyboard. When the terminal receives this command, it replies with ESC F followed by the line and column coordinates of the current cursor position. This allows the CPU or other I/O to store away the cursor address and later reposition the cursor to its original location. For example, if the cursor is on line 5 at character position 34, the response is ESC F $ A

Keyboard Operation: None

I/O Operation: Receipt of the ESC \ sequence causes the terminal to transmit the current cursor location.

## Read Cursor Character

The Read Cursor character feature provides for the transmission of the character at the current cursor location to the host processor. An ESC G command causes the character to be transmitted to the host CPU. Graphics characters are sent as ASCII characters from Table 3-5.

Keyboard Operation: Illegal, rings bell.

I/O Operation: Receipt of ESC G causes cursor character to be transmitted.

### Memory Address Pointer

The Memory Address Pointer is an I/O-controlled, invisible cursor that is used to read and write to and from the display memory, independent of visible screen functions. The Memory Address Pointer is positioned just like the cursor but only by the I/O. The sequence is: ESC, Λ, Line Address, Character Address. If an invalid row or column address is sent, the sequence is ignored (see Table 3-8).

After the Memory Address Pointer is set, the data to be written in display are entered. Attempts to write characters beyond column 80 of the current line cause automatic wrap to the beginning of the next line. On reaching column 80 of line 24, the data entered via the Memory Address Pointer automatically wraps to Home, regardless of Roll or Non-Roll mode selection. Any control or attribute characters (with the exception of a group separator [GS]) cannot be acted upon and are only displayed. The GS (CONTROL) terminator must be used when the data to be entered at the pointer are complete. To reposition the Memory Address Pointer without sending data, the sequence ESC, Λ, line, column, GS is used.

The CPU may write in locked areas of the display by using the Memory Address Pointer.

The Memory Address Pointer may be positioned and data entered while the terminal is Off Line without interference to the operator.

Keyboard Operation: None

I/O Operation: Terminal responds to codes as explained above.

### Data Read at Memory Address Pointer

Using the sequence ESC _ (Escape, underscore), data located at the Memory Address Pointer are transmitted out of the I/O port. If, for example, the Memory Address Pointer is at position 10 of a given line, the character there is transmitted. After a read, the MAP will automatically increment to the next location, thus allowing sequential reading of screen data.

Keyboard Operation: None

I/O Operation: Receipt of ESC _ causes the data at the Memory Address Pointer to be transmitted.

### Read Terminal Status

The Terminal Status message (displayed in Fields F and G of line 25 [see 3.19]) is generated in response to the code ESC 0. When this code is entered from the keyboard, no communication occurs to the I/O but the Terminal Status Message appears in line 25. When ESC 0 is received from the I/O, the terminal status along with the clock (if set) is transmitted back in response, but the message is not displayed. See Section 3.3.19 for an explanation of the Status Line and Section 3.3.16 for an explanation of the clock

Keyboard Operation: ESC 0 causes the Status Message to be displayed.

I/O Operation: Receipt of ESC 0 causes the Status Message to be transmitted.

Transmitted Code: ESC 0

### CPU Message Deposit

The procedure for the host CPU to deposit data into the Message Waiting buffer is the code sequence ESC, ;, message, GS—the last characters being the control code GS or "Group Separator" (CONTROL ]). The operator is notified of the message deposit by "MSG WAIT", which appears in Field D of the Status line in reversed blinking video. When the operator simultaneously depresses and holds down either the right or left pair of SHIFT and CONTROL keys, the message on deposit is displayed on line 25 in half-intensity reversed video, replacing the original status message. This new message remains as long as the selected SHIFT/CONTROL key pair is held down. On releasing the keys, the original Status line reappears. The CONTROL ESC 1 keyboard sequence also places CPU message in line 25. It remains there until removed by the CPU or the keyboard sequence CONTROL ESC 2. If no message is present, the Status line appears blank and nonreversed.

The function of displaying the deposited message may be controlled via the I/O by use of the ESC 1 sequence. This causes the message to remain displayed until the normal Status line is displayed on receipt of an ESC 2 sequence.

The customer therefore has the ability to force an alternate status line and gain additional system information.

The following constraints apply to data which is to be held as a waiting message:

a. A maximum of 80 characters can be stored. Overflow will overwrite in character position 80.

b. Attribute codes and control codes are not recognized. For example, sending CR-LF to the Message Waiting buffer results in "CR-LF" being displayed in the data stream as control code symbols.

c. The GS terminator (CTRL ]) must be used at all times. For example, if a 10-character message is sent to the MESSAGE WAITING buffer and it is followed by a GS, any data past that point reverts to normal display memory.

The CPU Memory Deposit Function is operable whether the terminal is in On Line or in Local mode.

**NOTE: Status line can be made to disappear by sending ESC ; GS ESC 1 (zero length message followed by display message command).**

## Self Test

A self-testing firmware is invoked at power-up. This may also be initiated by the operator or through CPU intervention with the sequence ESC f. This performs a memory test throughout the terminal's RAM, and an LRC check of the internal ROM memory. Successful completion of the test and correct terminal operation is verified by the appearance of "SYSTEM RDY" on the Status line. Failure to perform the test correctly promotes an "ERR CHECK" message in Field E of the Status line.

Keyboard Operation: CONTROL TEST or ESC f invokes the self test.

I/O Operation: Receipt of ESC f causes the Self Test to be invoked.

## Send Enter Code

This is similar to the function performed by the ENTER key. On receipt of ESC ', the terminal responds by sending the selected termination character (see 2.7.5). This Escape sequence may be received over the I/O or entered from the keyboard. The ENTER key evokes the same terminal response.

Keyboard Operation: ESC ' or ENTER key

I/O Operation: Receipt of ESC '.

Transmitted Code: Selected termination character.

## Baud Rate Setting

Baud rates for either the Main or Auxiliary port may be set over the I/O or via the keyboard to any data rate selectable by the rear panel switches. A three-part Escape sequence is used as outlined in Table 3-9 .

**Table 3-9 Remote Baud Rate Selection**

| | 110 | 300 | 1200 | 1800 | 2400 | 4800 | 9600 |
|---|---|---|---|---|---|---|---|
| MAIN BAUD RATE ESC, 7, | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| AUX BAUD RATE ESC, 5 | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

Example: To set the Main baud rate at 1800, the sequence ESC 7 3 is used.

Example: To set the Auxiliary baud rate at 4800, the sequence ESC 5 5 is used.

## Write Control Mode

Receipt of the Write Control code sequence (ESC 6) from the receiver or the keyboard causes the next received Control or Escape sequence to be written into memory without execution. The terminal then reverts to the previous operating condition prior to the receipt of the sequence.

Keyboard Operation: ESC 6 causes the mode to be entered.

I/O Operation: Receipt of ESC 6 causes the mode to be entered.

## Page Send

With the terminal On Line and upon receipt of ESC I, the terminal performs a block send to the Main port in accordance with the constraints of Page mode (as outlined in 3.3.7) without altering the Page/Line mode.

Keyboard Operation: ESC I initiates Page Send

I/O Operation: Receipt of ESC I

## Auxiliary Page Send

With the terminal On Line and upon receipt of ESC 3, the terminal performs a block Aux send

to the Aux port in accordance with the constraints of Aux Send (3.3.8) without altering the Page/Line mode.

Keyboard Operation: ESC 3 initiates Aux Page Send

I/O Operation: Receipt of ESC 3.

**Line Send**

With the terminal On Line and upon receipt of ESC i, the terminal performs a Line Send to the Main port in accordance with the constraints of Line Mode (in Section 3.3.7) without altering the Page/Line mode.

Keyboard Operation: ESC i initiates Line Send

I/O Operation: Receipt of ESC i

**Auxiliary Line Send**

With the terminal On Line and upon receipt of ESC 4, the terminal performs an Aux Line Send in accordance with the constraints of Aux Send (in Section 3.3.8) without altering the Page/Line mode.

Keyboard Operation: ESC 4 initiates Aux Line Send

I/O Operation: Receipt of ESC 4.

**Cursor On/Off**

If ESC Z is received or performed from the keyboard, the cursor becomes blanked and invisible. All cursor functions are still available, however. The cursor can be made to reappear in its correct screen location with another ESC Z.

Keyboard Operation: ESC Z is a toggle function which causes the cursor to alternately appear and disappear.

I/O Operation: Receipt of ESC Z.

### 3.3.16 Special Keyboard Functions

**Clock**

A 24-hour clock which provides time of day or indicates elapsed time can also be made to appear on the status line using the keyboard sequence ESC, space bar, hours, minutes. For example, to set the time at 06:45, the keys ESC, space bar, 0, 6, 4, and 5 are struck. The colons are inserted automatically and the seconds begin counting when the last minute digit is entered. Erasing the clock from the status line can be accomplished with the RESET sequence ESC V. If a clock-setting mistake is made, the operator must complete the erroneous entry until all clock digits are filled, then key ESC, space bar again and reenter the correct time. A correct clock setting sequence must contain any initial or trailing zeros and consist of four digits.

Keyboard Operation: ESC, space bar, hours, minutes

I/O Operation: Receipt of ESC, space bar, hours, minutes

**Display CPU Message**

The operator is notified of a CPU-deposited message by "MSG WAIT", which appears on the Status line in reversed blinking video. When the operator simultaneously depresses and holds down either the right or left pair of SHIFT and CONTROL keys, the message on deposit is displayed on line 25 in half-intensity reversed video, replacing the original status message. This new message remains as long as the selected SHIFT/CONTROL key pair is held down. On releasing the keys, the original Status line reappears. The CONTROL ESC 1 keyboard sequence also places CPU message in line 25. It remains there until removed by the CPU or the keyboard sequence CONTROL ESC 2. If no message is present, the Status line appears blank and nonreversed.

The function of displaying the deposited message may be controlled via the I/O by use of the ESC 1 sequence. This causes the message to remain displayed until the normal status line is displayed on receipt of an ESC 2 sequence.

The user, therefore, has the ability to force an alternate status line and gain additional system information.

Keyboard Operation: Depressing and holding the SHIFT and CONTROL keys down or depressing CONTROL ESC 1 promotes display of a waiting CPU message.

Releasing the SHIFT/CONTROL pair or depressing CONTROL ESC 2 removes the message.

I/O Operation: Receipt of ESC 1 displays message, if present. Receipt of ESC 2 causes Status line to reappear.

### 3.3.17 Boot Load

The Boot Load sequence, ESC ", allows loading of 8085 Machine Code programs directly into the RAM memory area. A program can be entered either from the keyboard or over the I/O port. The load address and program data are loaded using ASCII characters of 0 through 9 and A through F representing their hex value. Two sequential characters are used to form an 8-bit byte. The program load operation is terminated by either an @ or # character code. An @ character causes the programs just loaded to be executed, starting at the defined load address. A # character saves the program (allowing its later execution) and returns the terminal to normal operation

A program is loaded and executed in the following manner:

a. ESC " initiates the Boot Load.

b. The first four characters are used as the high-low load address.

c. Subsequent bytes are stored sequentially, starting at the load address.

d. All codes other than ASCII 0 through 9, A through F, @ or # will terminate the program load.

e. The program load is terminated by either an @ or a #.

f. An @ character terminates the load sequence and starts execution of the loaded program starting at the load address.

g. A # character terminates the load sequence and returns the terminal to normal operation, allowing for later execution of the program

h. If a run address other than what was initially loaded is desired, it is possible to load only the address by entering ESCAPE, "four-digit hexadecimal address, and @ (program run terminator). If a later run is desired at the same address, an ESCAPE," @ will do this. The address, however, is cleared out at reset time to prevent accidental running of nonexistent programs.

### 3.3.18 Audible Alarm

An audible tone is sounded in the terminal if the BELL (Control G) character is received. This is consistent with the bell control of teletypewriters. When data entry from the keyboard causes the cursor to pass through the 72nd position of a line, an audible alarm will sound. The bell rings when illegal keys are struck or when other error conditions exist, such as numeric entry in an Alpha Only field, attempting to lock memory when lines are locked, etc.

The **continuous** alarm feature allows the host processor to gain the attention of the terminal operator. The continuous alarm is turned on with an ESC 8 sequence from the keyboard or over the main I/O port. The alarm can be turned off by either striking any key on the keyboard or by receiving an ESC 9 sequence on the main I/O port.

### 3.3.19 Status Line

The status line occupies the 25th display line of the CRT and is displayed in half intensity reverse video. The breakdown of the status line display fields is outlined in Tables 3-10 and 3-11.

Should the user require display of an alternate status line or no status line at all, this may be accomplished by use of the CPU Message Deposit function. In order to inhibit display of status line, the sequence ESC; GS ESC 1 is employed. This causes no message to be deposited and forces the status line to be displayed in normal video with no data present. The 25th line remains inaccessible to the operator. In order to display an alternate status line, the complete CPU Message Deposit sequence is followed (See Section 3.3.15).

An additional status line for host CPU system information can be implemented through the use of the CPU Line Lock feature.

Following is an explanation of messages which may appear in Status Line fields A through H:

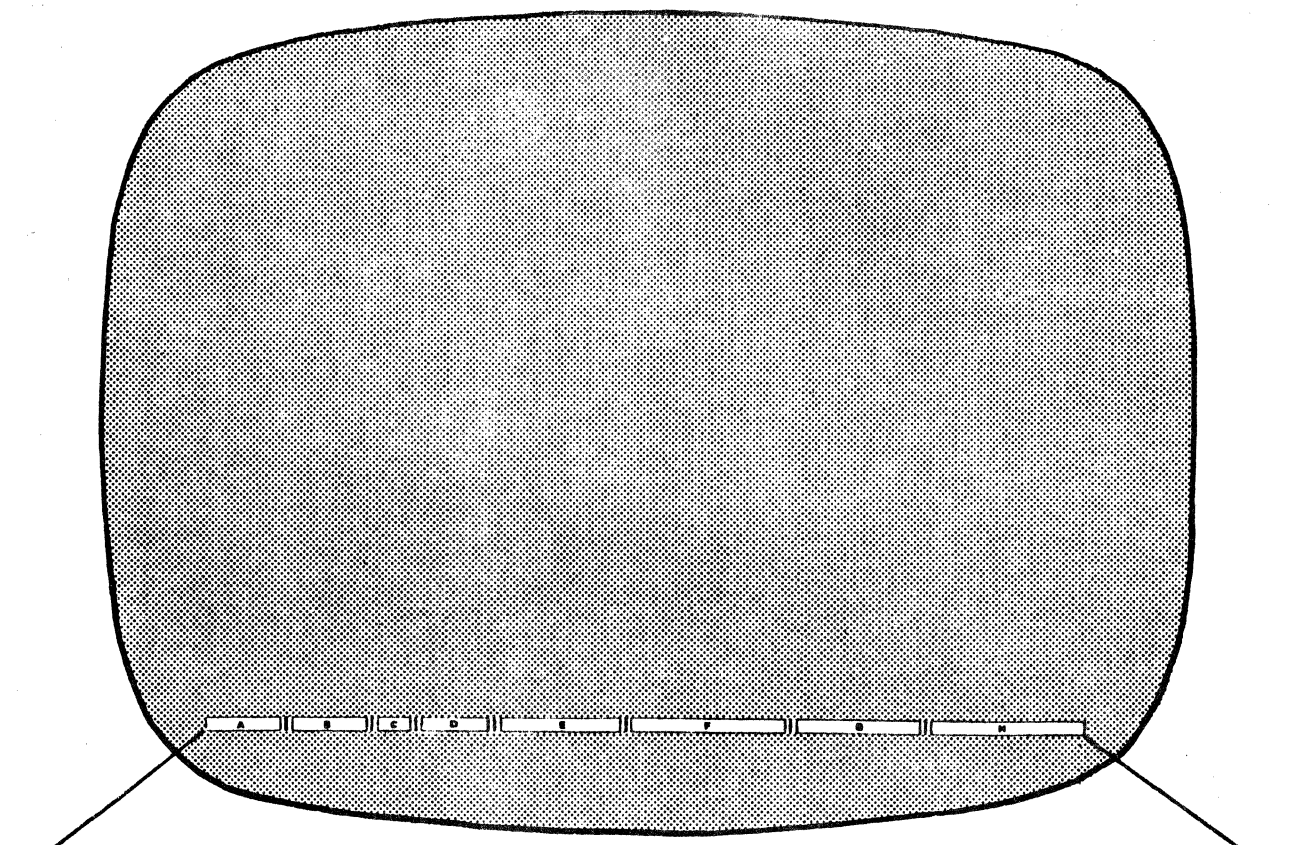
**Field A** – reflects the status of the main port either being on line or in local mode.

**Field B** – reflects the terminal being either in monitor mode or conditioned to provide a page or line send if a block send is implemented.

**Field C** – indicates the status of the data set ready

**(continued on page 3-31)**

Table 3-10 Status Line Display Fields




*Status line indicators which appear in full intensity reversed blinking video

†Status line indicators which appear in full intensity reversed video

All others appear in half intensity reversed video

The status line is an invaluable ready-reference tool which enables the operator to tell at a glance which operating modes/features are currently in use on the DM 30, and whether the terminal is operating correctly.

It is normally continuously visible unless superseded by a CPU message or other I/O function. The status line occupies a complete 80-character display line on the bottom (25th) row of the screen and consists of 8 fields displayed in full intensity reversed blinking or half-intensity reversed video.

The possible messages for each field are explained in Section 3.3.19 of this manual and are shown graphically here. Please note only one message at a time can be displayed in each field.

The all-numeric status message, when displayed, occupies Fields F and G. It may be requested by the operator or the CPU using the sequence ESC O. It is broken down character by character in Table 3 - 13 which follows on the next page.

(continued from page 3-29)
line of the main I/O port, DSR indicating true, blank indicating false.

**Field D** – indicates the status of the aux port.
Blank = Disabled
AUX ON = Aux connected to main on line
AUX BSY/RDY = Aux enabled from keyboard to aux; BSY/RDY indicates status of aux pin 20

**Field E** –Indicates main message sequences on a proprietary basis.

Priority 3 = Error Check, RAM, ROM or I/F
1 = Main Send 5 = Message Wait
2 = Aux Send 6 = Line Lock
4 = Keyboard Lock 7 = Memory Lock
8 = System Ready

**Field F** – indicates status messages of terminal operation.

1. ALPHA ONLY – Displayed if illegal entry attempted to an alpha only format field.

2. NUMERIC ONLY – Displayed if illegal entry attempted to a numeric only format field.

3. TOTAL FILL/MUST ENTER – In conjunction with above further qualifies entry error or if blank in alpha or numeric field indicator, indicates error on an alphanumeric field.

4. INSERT – Indicates insert mode selected; qualified by line or page to further identify mode.

5. MODIFIED MODE – Indicates modified mode selected while in format mode to limit data transmission.

**Field G** – indicates terminal is in either form - Forms Build or Graphics mode.

**Field H** – contains the 24-hour clock in an hours: minutes:seconds format.

A 27-character terminal status message appears in character positions 39 through 65 (Fields F and G) in response to ESC 0. This action is initiated by the CPU or operator and contains information which pertains to the current terminal operating configuration.

This message supersedes existing display and remains until any keyswitch is pressed. At that time, the 27-character message disappears and the status line returns to its former condition.

Table 3-11 is a key to aid the operator in decoding this numeric message.

**Table 3-11 Status Line Indicators**

| CHARACTER POSITION | CHARACTER DISPLAYED | FEATURE CONVEYED | MESSAGE CONVEYED |
|---|---|---|---|
| 39 | 1 - 7 | Main Baud Rate | 5 = 4800 6 = 9600 4 = 2400 3 = 1800 1 = 300 2 = 1200 0 = 110 |
| 40 | 1 - 7 | Auxiliary Baud Rate | Same as above |
| 41 | 0 - 3 | Termination Character | 0 = CRLF 1 = ETX 2 = EOT 3 = CR |
| 42 | 0 - 3 | Parity Select | 0 = Even 1 = Space 2 = Odd 3 = Mark |
| 43 | 0 - 3 | Self-diagnostics | 0 = No fault 1 = ROM fault 2 = RAM fault 3 = I/O fault |
| 44 | 0 - 1 | Receiver Error Check | 0 = Off 1 = On |
| 45 | 0 - 1 | Roll Mode | 0 = Off 1 = On |
| 46 | 0 - 1 | Auto Line Feed | 0 = Off 1 = On |
| 47 | 0 - 1 | Lower Case Inhibit | 0 = Off 1 = On |
| 48 | 0 - 1 | Duplex Mode | 0 = Half Duplex 1 = Full Duplex |
| 49 | 0 - 1 | Auto Echo | 0 = Off 1 = On |
| 50 | 0 - 1 | Screen Display | 0 = Off 1 = On |
| 51 | 0 - 1 | Main Port | 0 = On Line 1 = Local |
| 52 | 0 - 1 | Aux Port | 0 = Off 1 = On |
| 53 | 0 - 1 | Graphics Mode | 0 = Off 1 = On |
| 54 | 0 - 1 | Line Lock | 0 = Off 1 = On |
| 55 | 0 - 1 | Memory Lock | 0 = Off 1 = On |
| 56 | 0 - 1 | Keyboard Lock | 0 = Off 1 = On |
| 57 | 0 - 1 | Error Check | 0 = No error 1 = Diagnostic error detected |
| 58 | 0 - 1 | CPU Message Wait | 0 = No message waiting 1 = Message waiting |
| 59 | 0 - 1 | ESC Code Suppression | 0 = Off 1 = On |
| 60 | 0 - 1 | Main Baud Reset | 0 = Under rear panel switch command 1 = Under software command |
| 61 | 0 - 1 | Aux Baud Reset | 0 = Under rear panel switch command 1 = Under software command |
| 62 | Various | Software version | Reflects ROM revision level |
| 63 | Various | Software version | Reflects ROM revision level |
| 64 | Various | Software version | Reflects ROM revision level |
| 65 | Blank | Reserved | - |

TYPICAL TRANSMITTED MESSAGE: STX-27 - character string - clock (HH-MM-SS) - selected termination character.
The clock digits appear only when the clock is properly set.

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