

Cromemco
3102 VIDEO TERMINAL
USER'S MANUAL

**CROMEMCO, Inc.
280 Bernardo Avenue
Mountain View, CA 94043**

Part no: 023-6004

March 1980

3102 STANDARD SWITCH SETTINGS

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							

PRINTER



CONT BRT



SWITCH S1 SWITCH S2



1 2 3 4 5 6 7 8

1 2 3 4 5 6 7 8

MAIN

Cromemco
3102 VIDEO TERMINAL
USER'S MANUAL

CROMEMCO, Inc.
280 Bernardo Avenue
Mountain View, CA 94043

Part no. 023-6004

March 1980

Copyright © 1980
By CROMEMCO, Inc.
ALL RIGHTS RESERVED

This manual was produced on a Cromemco System Three computer using the Cromemco Screen Editor. The edited text was formatted using the Cromemco Word Processing System Formatter. Final camera-ready copy was printed on a Cromemco 3355A printer.

TABLE OF CONTENTS

1.	Introduction and Overview.....	5
2.	Installation.....	9
2.1	Introduction.....	9
2.2	Unpacking.....	9
2.3	Inspection for In-Shipment Damage.....	9
2.4	Identification.....	9
2.5	Installation	10
2.5.1	Placement for Operation.....	10
2.5.2	Power Connection.....	10
2.5.3	Current Loop Interface.....	11
2.5.4	Data Interface Connection.....	11
2.5.5	Control Switches.....	16
2.6	Initial Turn-On Procedure.....	16
2.7	Rear Panel Switches.....	16
2.7.1	Receiver Error Check.....	16
2.7.2	Roll Mode.....	16
2.7.3	Auto Line Feed Mode.....	17
2.7.4	Inhibit Lower Case.....	17
2.7.5	Termination Character.....	17
2.7.6	Parity.....	17
2.7.7	Main Baud Rate.....	17
2.7.8	Full/Half Duplex.....	18
2.7.9	Auxiliary Baud Rate.....	18
2.7.10	Auto Echo.....	18
2.8	Internal Switches.....	19
2.8.1	Go On Line.....	19
2.8.2	Inhibit Escape Codes.....	19
2.8.3	50/60 HZ.....	19
2.8.4	S 3-4.....	19
2.8.5	Reset.....	19
2.8.6	Normal/Half Intensity.....	19
2.8.7	Normal/Reverse Video.....	20
2.8.8	Current Loop.....	20
3.	Operation	
3.1	Power-On.....	23
3.2	Rear Panel Switches.....	24

3.3	Communications Modes.....	25
3.3.1	Local/Online.....	25
3.3.2	Software Handshaking.....	25
3.3.3	Monitor Mode.....	26
3.3.4	Page/Line Mode.....	26
3.3.5	Cursor Pad Local/Online.....	26
3.3.6	Function Key Enable/Disable.....	26
3.3.7	Block Send Enable/Disable.....	27
3.3.8	Write Control Mode.....	27
3.3.9	Boot Load Mode.....	27
3.3.10	Graphic Mode.....	27
3.4	Other Modes.....	27
3.4.1	Make Forms.....	27
3.4.2	Use Forms.....	28
3.4.3	Modified Mode.....	28
3.5	3102 Host Functions.....	28
3.5.1	Editing.....	32
3.5.2	Cursor Movement.....	33
3.5.3	Screen Erasure.....	37
3.5.4	I/O Port Control.....	40
3.5.5	Defining and Displaying Forms.....	40
3.5.6	Display Control.....	48
3.5.7	Block Transmission.....	54
3.5.8	Baud Rate Control.....	56
3.5.9	Initialization.....	57
3.5.10	Communication Control.....	58
3.5.11	Keyboard Control.....	59
3.5.12	Terminal Inquiries.....	60
3.5.13	Additional Mode Control.....	63
3.5.14	Miscellaneous Functions.....	65
3.6	3102 Keyboard.....	67
3.6.1	Keyboard Layout.....	67
3.6.2	Keyboard Functions.....	67
3.7	3102 Status Line.....	79

1. Introduction and Overview

This manual provides a detailed description of the CROMEMCO 3102 video terminal. It is intended for technically-trained individuals who need to know the operational characteristics of the terminal so they can, for example, write software that makes use of its capabilities or develop hardware that interfaces with it. It is NOT intended as an instruction manual for non-technical users of applications software such as word-processing, accounting, or data base management systems. Any instructions regarding how the terminal is to be used with any particular application package should be included in the manual for that product.

Three general sections are included:

- 1) Section 1--(this section) provides a brief overview of the 3102 and a specifications listing (Figure 1-1).
- 2) Section 2--(page 9) describes proper installation and initial checkout procedures.
- 3) Section 3--(page 23) describes the operational characteristics, the functions that can be invoked from the host system, and the keyboard functions of the 3102.

The CROMEMCO 3102 is a microprocessor-controlled "smart" terminal offering many features otherwise found only in more expensive terminals. What's more, it was designed to reflect CROMEMCO's commitment to produce "human engineered" products. Finally, the 3102 was designed for maximum compatibility with other CROMEMCO products. This third design consideration--compatibility with other CROMEMCO products--applies to planned future products as well as current products. This reflects CROMEMCO's commitment to insure that existing products will not become obsolete as new ones are developed.

Though the 3102 was designed primarily with the CROMEMCO product line in mind, its operational characteristics are sufficiently flexible to allow it to be used as a component in other systems as well. This flexibility exists because:

- 1) it is microprocessor-controlled, and
- 2) the controlling firmware provides several selectable modes of operation.

For example: with the default settings in effect, the 3102 operates in an on-line, conversational mode, and assumes that the host system cannot buffer terminal input; however, put the terminal in LOCAL mode, enable BLOCK SEND, and turn off SOFTWARE HANDSHAKING and you have a "batch"-mode terminal capable of performing simple local editing functions, displaying forms, checking the "type" (eg: numeric, alphabetic) of entered data, and transmitting large quantities of data at high speed.

Features of interest to applications programmers are the ability, from the host system, to:

- 1) lock selected portions of the screen while allowing normal operation (eg: data entry, scrolling) in the unlocked portion of the screen,
- 2) query the cursor position or read the character at the cursor position,
- 3) define reverse video, blinking, half intensity, and underlined portions of the screen, or combinations thereof,
- 4) insert and delete lines or characters, and
- 5) draw line drawings through the use of special graphics characters.

Also of interest to applications programmers are:

- 1) the 20 unassigned function keys, to which applications software is free to assign special functions,
- 2) the labeled function keys, which should be interpreted (in on-line mode) as they are labeled,
- 3) the number pad.

Of interest to systems programmers are the abilities, from the host system, to:

- 1) set the various modes of the terminal to match the requirements of the host system (eg: cause the 3102 to buffer its output),
- 2) send messages to the operator that do not overwrite text, but rather appear on a reserved (25th) "status" line,
- 3) set and read a clock that is displayed on the "status" line,
- 4) read the terminal status, and
- 5) invoke an automatic baud-rate synchronization sequence.

Also of interest to systems programmers is a special mode that displays control characters rather than carrying out the corresponding control function.

Of general interest are the capabilities to:

- 1) display 128 ASCII characters with descenders,
- 2) display 24 lines by 80 columns of data, plus a 25th status line,
- 3) write data to the screen or read data from the screen via an invisible second "cursor", and
- 4) display alternate character sets and/or map keys to different ASCII values simply by changing a couple of ROMs inside the terminal.

Also of general interest is the keyboard (see Fig. 3.2) which:

- 1) is detachable,
- 2) uses hermetically-sealed reed switches,
- 3) is laid out with both TTY and typewriter keyboards in mind,
- 4) has color coded keys and key labels, and
- 5) has auto repeat and two-key rollover.

SCREEN FORMAT

- * 24 lines, 80 columns, with reserved 25th STATUS LINE
- * 6.5" high, 8.5" wide; 12" diagonally

CHARACTER DISPLAY

- * 128 (full ASCII) displayable characters
- * 11 graphics characters for drawing lines and forms
- * Descenders on lower case letters and punctuation characters
- * All characters contained within 9 x 7 dot matrix; all alphanumeric characters contained within 9 x 5 dot matrix
- * Approximately .2" high, .1" wide
- * MOS ROM generated ==> easily changed
- * White on black background or vice-versa (switch selectable)

CURSOR CONTROL

- * Two cursors: one always invisible, one visible (as nondestructive blinking block) or invisible (host selectable)
- * Cursor addressing (either cursor)
- * Send cursor character (")
- * Cursor up, down, left, right, home, carriage return, linefeed (primary cursor only)
- * Send cursor position

DISPLAY CONTROL

- * Normal, reverse-video, blinking, underlined, half-intensity, and "invisible" fields
- * Line lock
- * Area lock

LOCAL EDITING

- * Insert/Delete character
- * Insert/Delete line
- * Clear screen
- * Clear to end of screen
- * Clear to end of line

STATUS LINE

- * Visible or invisible (selectable from host and keyboard)
- * Displays messages from host
- * Displays time-of-day (maintained by host-set internal clock)
- * Displays terminal status

DATA TRANSMISSION

- * Switch- or host-selectable baud rate (110 to 19200)
- * Main or auxiliary port
- * ONLINE or LOCAL
- * Host-selectable software handshaking protocol for block transmissions
- * X-ON/X-OFF protocol
- * Parity: even, odd, mark, or space (switch selectable)
- * Full duplex
- * Serial RS232C or 20 ma Current Loop
- * Single character, line-at-a-time, or screen-at-a-time

FORMS DEFINITION AND DATA ENTRY

- * Protected fields
- * Unprotected (data entry) fields: unrestricted, numeric, alphabetic, alphanumeric, must-enter, must-fill with type-checking and error display
- * Constant fields

KEYBOARD

- * Full ASCII keyboard with shift, delete, and alpha-lock keys
- * Conveniently-located cursor movement keys
- * 14-key number pad with <enter> key
- * 20 pre-assigned function keys
- * 20 unassigned function keys
- * Color-coded control-interlocked keys
- * Modifiable key-ASCII mapping (ROM)

TERMINAL QUERIES

- * Send terminal status (including clock)
- * Send terminal ID

SELF TEST FUNCTION

- * Automatic at power-on
- * Can be invoked by host

VOLTAGE AND FREQUENCY REQUIREMENTS

- * 115VAC or 230VAC (+/- 10%)
- * 50 or 60 Hz

ENVIRONMENTAL REQUIREMENTS

- * Altitude: 0 to 10000 feet
- * Temperature: 0 to 40 deg. C
- * Humidity: 0 to 80% (noncondensing)

PHYSICAL SPECIFICATIONS

- * Size: 18" wide, 13" high, 22.5" deep
- * Weight: 43 lbs. (approx.)
- * Colors: Cromemco brown and tan

Figure 1-1 Specificaiton

2. 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 the specific user requirements.

2.2 UNPACKING

The following items are furnished with each 3102 terminal:

- a. The Display terminal with keyboard
- b. Technical Manual

There are no tie-downs or packing materials inside the terminals 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

Identification labels located on the lower rear panel of the terminal provide the model number, serial number, and line voltage and frequency requirements.

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.

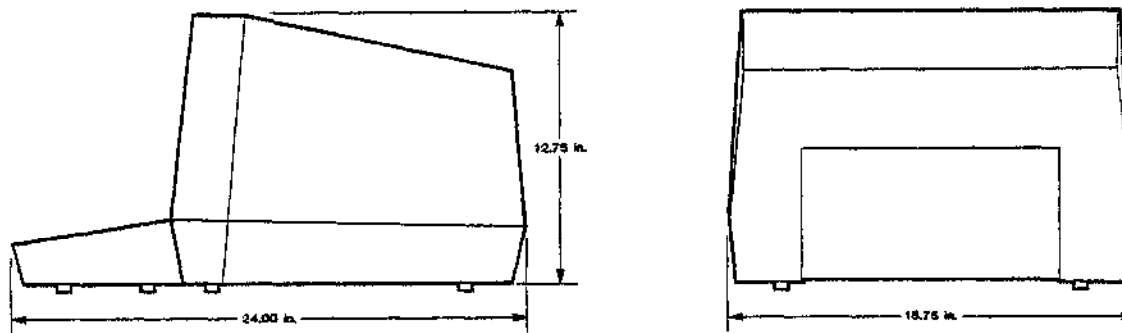
CAUTION: Do not place the terminal on any surface that blocks cooling air from the back of the cabinet. The terminal is provided with an internal fan for cooling. Air enters through a fan grill protected hole in the back and leaves through spacing at the bottom sides between the cover and terminal frame. To maintain efficient air circulation, keep at least three-and-one-half (3 1/2) 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 equipped with a three conductor grounded power cord. All exposed metallic parts of the terminal are connected to the ground lead of the cord. The safety feature afforded by this grounding should be preserved by always connecting the cord to a properly 'grounded' AC outlet. If plug adapters are necessary, be sure to properly connect the ground lug or pigtail.

2.5.3 Current Loop Interface (Optional)

The Current Loop Interface is a 20 ma 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.



Allow at least 2.5 inches clearance on sides and back of terminal to permit adequate air circulation.

Figure 2-1 3102 Placement Requirements

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 3102 conforms to the requirements of EIA specification RS232C. In particular, output voltage swings from -10 V to +10 V, while the receivers present a minimum of 3K ohms impedance to the line. The receiver circuits employed in the 3102 switch at approximately +10 V with 0.1 V of hysteresis. The input resistance is approximately 4K ohms. The driver circuits current limit at 10 ma on both source and sink. All data 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 connection to the computer. Pin assignments are defined in Figure 2-4.

2.5.5 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 2-5 (External Switch Block) and Figure 2-6 (Internal Switch Block).

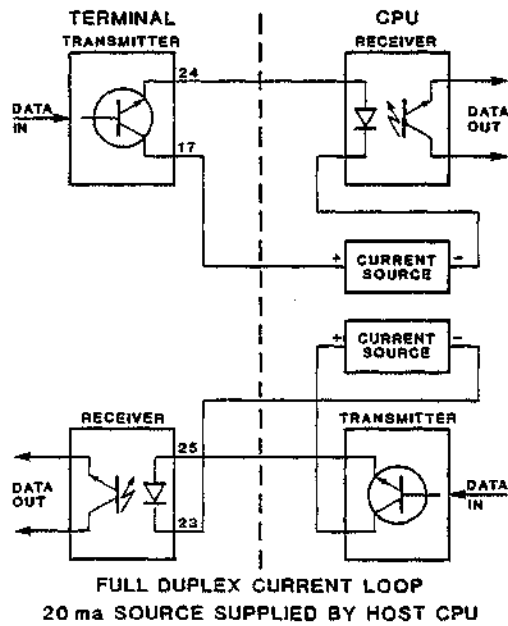
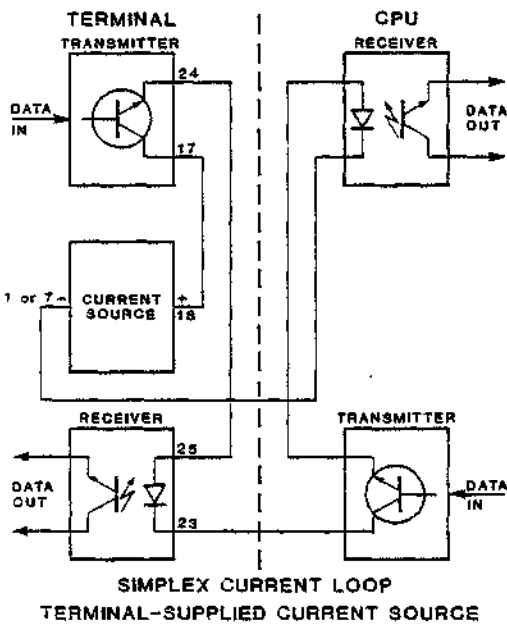
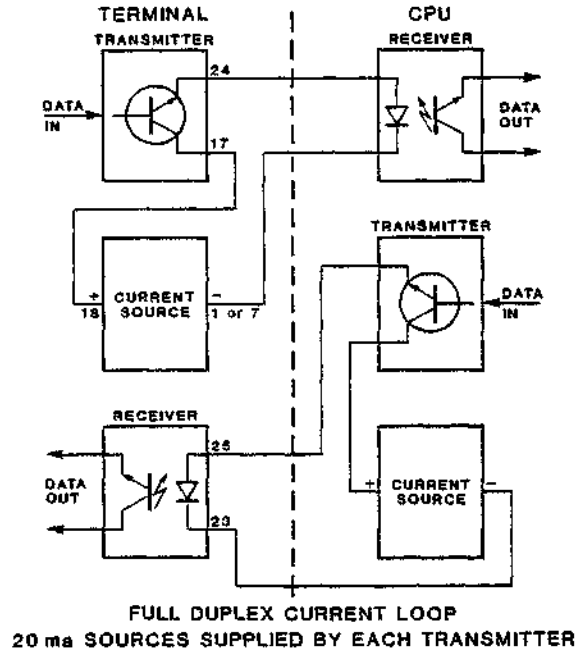
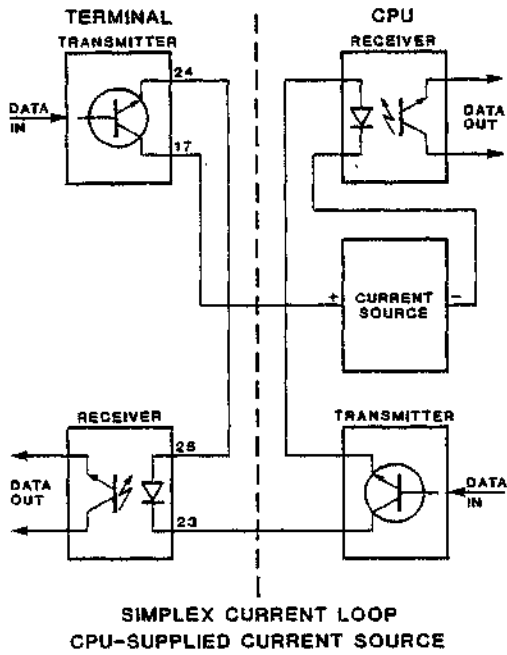


Figure 2-2 Current Loop Diagrams

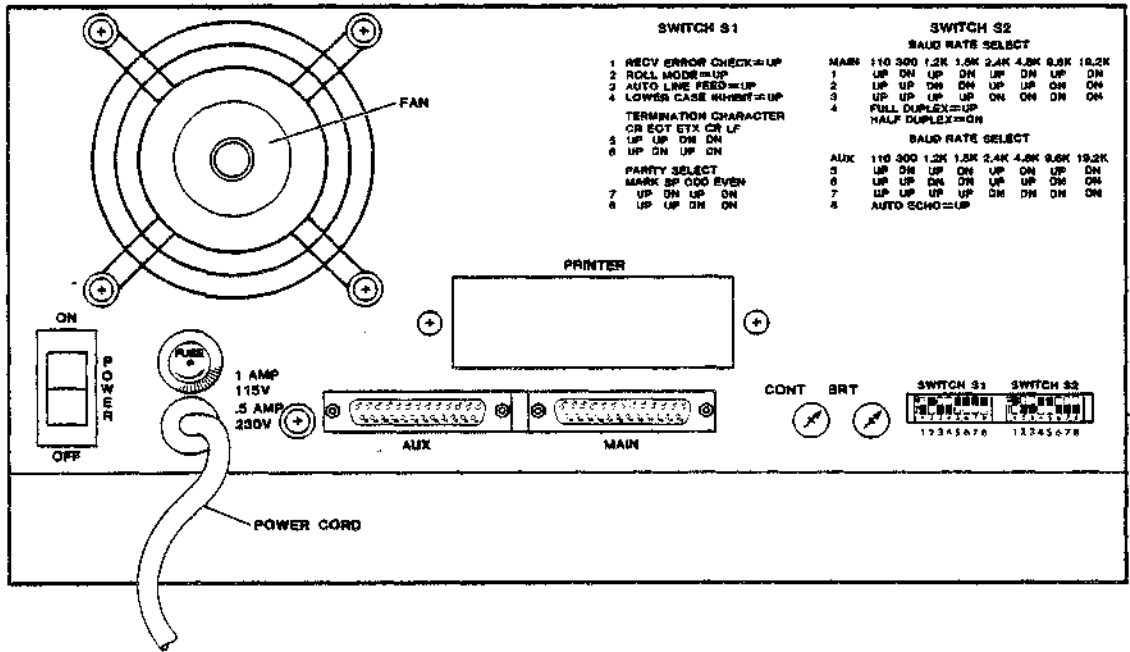


Figure 2-3 3102 Rear Panel Illustration

MAIN PORT

Pin #	RS232-C	Description	Signal Direction	Assignments
1	AA	Frame Ground	n/a	Chassis ground
2	BA	Transmitted Data	out	Terminal output
3	BB	Received Data	in	Terminal input
4	CA	Request to Send	out	In LOCAL, held low. In Full Duplex, high. In Half Duplex, high during transmission; low otherwise.
5	CB	Clear to Send	in	When high, transmission is enabled. When low, transmission is disabled.
6	CC	Data Set Ready	in	Not used by 3102
7	AB	Signal Ground	n/a	Same potential as pin 1
8	CF	Carrier Detect	in	Not used by 3102
20	CD	Data Terminal Ready	out	High when terminal power is on

AUX PORT

1	AA	Frame Ground	n/a	Chassis Ground
2	BA	Received Data	in	Data input to terminal
3	BB	Transmitted Data	out	Data output to aux device
4	CA	Request to Send	in	Ignored
5	CB	Clear to Send	out	When high, aux port enabled and aux device to receive.
6	CC	Data Set Ready	out	High at all times
7	AB	Signal Ground	n/a	Same as pin 1
8	CF	Carrier Detect	out	High at all times
20	CD	Data Terminal Ready	in	Not used by 3102

Figure 2-4 I/O Port Pin Assignment

2.6 INITIAL TURN-ON PROCEDURE

The proper turn-on procedure for terminal is described in 3.3.1.

2.7 REAR PANEL SWITCHES

The operating configuration of the 3102 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. The switch setting recommended for use with CROMEMCO Systems are shown in Figure 2-5.

2.7.1 Receiver Error Check (S1-1)

When Receiver Error Check is selected (S1-1 up), an ASCII substitute (SB) is displayed if the 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 it 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 scrolls 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. The choices are ETX, EOT, CR or CR-LF.

2.7.6 Parity (S1-7,S1-8)

The 3102 ALWAYS uses an eight bit data pattern. The low-order seven bits contain the actual ASCII data. The eighth bit is called the 'parity' bit. The various switch settings allow this bit to be always low (SPACE parity, logical 0), always high (MARK parity, logical 1), or to reflect the actual bit parity of the seven data bits (EVEN or ODD parity as desired). The switches also select the parity bit condition to be checked if switch SW-1 (receiver error check) is on.

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 2-5. For host CPU selection of both main and Aux baud rates, a three-code escape sequence is used (see Figure 2-7).

2.7.8 Full/Half Duplex (S2-4)

The Full/Half Duplex FDX/HDX switch setting (Figure 2-3) has no effect on the operation of the 3102. The terminal always operates in Full Duplex mode. In Full Duplex mode, data entered via the keyboard are sent to the output port only. In order to be displayed, data must be received. Thus, the host system must echo typed characters if they are to appear on the screen.

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

The 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 cursor movement keys (<↑>, <↓>, <←>, <→>) act locally (ie: move the cursor as indicated) and transmit nothing. With the switch set off, when the 3102 is on line, the cursor movement keys have no local effect but transmit control characters (see section 3.4).

2.8 INTERNAL SWITCHES

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. 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)

This 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 S3-4 Unassigned

The setting of this switch has no effect on the operation of the 3102.

2.8.5 Reset (S3-5)

This switch performs a system reset and self-test exactly like powering the terminal down and up again.

NOTE: Screen data is lost due to initialization of the CRT circuitry and system self test diagnostic.

2.8.6 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.

2.8.7 Normal/Reverse Video (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. Brightness and contrast must be adjusted for proper screen display.

2.8.8 Current Loop (S3-8)

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

EXTERNAL SWITCHES (back panel)

Switch S1--

1. Receiver Error Check	OFF	(down)
2. Roll Mode	ON	(up)
3. Auto Linefeed	OFF	(down)
4. Lower Case Inhibit	OFF	(down)
5. Termination Character	CR	(up)
6. " "		(up)
7. Parity Select	MARK	(up)
8. " "		(up)

Switch S2--

1. Main Baud Rate Default		(up)
2. " "	9.6K	(down)
3. " "		(down)
4. Duplex	FULL	(up)
5. Aux Baud Rate Default		(up)
6. " "	9.6K	(down)
7. " "		(down)
8. Auto Echo (Cursor Pad LOCAL/ONLINE)	ONLINE	(down)

INTERNAL SWITCHES

Switch S3--

1. Go On-Line	ON	(up)
2. not assigned	arbitrary	
3. 50/60 Hz	as required	
4. not assigned	arbitrary	
5. Reset	OFF	(down)
6. Normal/Half Intensity	Normal	(down)
7. Normal/Reverse	Normal	(down)
8. Current Loop	OFF	(down)

Figure 2-5 Recommended Switch Settings

3. OPERATION

3.1 POWER-ON

Before the 3102 is used, it must be properly installed and checked-out (see Section 2). When the 3102 is moved to an alternate work station, care should be taken to assure that the power outlet used is properly grounded and supplies the correct voltage and frequency. An identification plate on the bottom cover of the terminal specifies the electrical power requirements of the 3102. In addition, if the 3102 is moved to a location having different lighting conditions than the one at which it was originally installed, the contrast and brightness controls (back panel) may have to be adjusted slightly for maximum readability of displayed material. To perform this adjustment:

- 1) clear the screen if it is not already blank (except for the cursor),
- 2) set the brightness at just below the point where some slightly diagonal lines (raster backtraces) become visible,
- 3) put the 3102 in LOCAL (press the <local> key on the keyboard),
- 4) type some characters on the screen,
- 5) turn on the status line (press <control-status>),
- 6) adjust the contrast so that the typed characters and those on the status line are easily read and so that the difference between full intensity (typed characters) and half intensity (background on status line) can be seen, and
- 7) put the 3102 back online (press MAIN or AUX, depending on the port desired).

When the 3102 is turned on, it performs tests of the display memory and of the system operation. If both tests indicate no faults, the message "READY" is put onto the status line (though the user must press <control-status> to see this). Otherwise, "ERR CK" is put on the status line. If the 3102 is turned off and immediately back on, or if a self-test is initiated from the keyboard or the host computer, the display will flicker briefly while the test is run. When the terminal is turned on after having been off for more than a few seconds, there is no flicker because the test is over before the CRT warms up.

Assuming that the test finds no faults, the positions of the switches on the back panel and those inside the terminal that specify default firmware settings are then noted. In addition to the modes specified by the switches, the 3102 comes on:

- 1) online to the main port,
- 2) with the status line not displayed,
- 3) with software handshaking selected (see 3.3.2),
- 4) with block transmit disabled (see 3.3.7),
and
- 5) with function keys disabled (see 3.3.6).

3.2 REAR PANEL SWITCHES

If any of the rear panel switches have to be changed while the 3102 is in use, the terminal must either be turned off and then on again, reset (press <control-reset>), or self-tested before the new switch setting will take effect. Otherwise, the terminal will continue to operate according to the old switch setting.

3.3 COMMUNICATIONS MODES

3.3.1 Local/Online

Local--

The display accepts characters or commands from the keyboard only, with the exception of the GO ON-LINE command (ESC n). In addition, nothing is transmitted unless the SEND function is invoked from the keyboard. The predefined function keys (except <pause>, <print>, and <help>) have the indicated effect.

Online--

Characters typed on the keyboard are transmitted out of the selected port (MAIN or AUX). Data received over the selected port are displayed. Commands received over the selected port (note: see Host Message Deposit) are carried out by the 3102. The predefined function keys <ce>, <pg/ln mode>, <main>, <aux>, <local>, <send>, <reset>, and <break> have the indicated effect (i.e. they always operate as if the terminal were in LOCAL mode); the rest of the function keys--both predefined and undefined--transmit a two character sequence that indicates which key was pressed (see Keyboard Functions). Whether keyed data are displayed depends on which of the sub-modes HALF DUPLEX and FULL DUPLEX is selected.

HALF DUPLEX -- keyed data are displayed (as well as being transmitted).

FULL DUPLEX -- key data are transmitted only (recommended setting for CROMEMCO systems).

3.3.2 Software Handshaking

Several operator-invoked or CPU-invoked special functions of the 3102 cause a stream of characters to be sent to the host (e.g.: function keys, block send, terminal status, cursor position, terminal ID). Some host systems may not be able to process characters fast enough to keep up with such transmissions. The 3102 supports an optional software handshaking protocol that holds character-stream output until the host is ready to receive

it. If this protocol is selected, any character sent by the 3102 as part of a data stream must be echoed by a STX before the terminal transmits the next character. The last character of a data stream need not be acknowledged. The default setting is with software handshaking selected. The protocol may be deselected (or re-selected) on the main and auxiliary ports independently. When the protocol is deselected, data streams are transmitted by the 3102 at the current baud rate without any pauses.

3.3.3 Monitor Mode

Allows the display of control characters or escape sequences received over the selected port or if the 3102 is in LOCAL mode, typed on the keyboard. Command execution, except for MONITOR MODE OFF (ESC '*'), is inhibited and all codes are displayed. For details, see 3.5.13.

3.3.4 Page/Line Mode

Determines whether a line or a page of characters is sent when the SEND function is invoked from the keyboard or the host. For details, see 3.5.13.

3.3.5 Cursor Pad Local/Online

The cursor pad may be set to operate locally even if the 3102 in general is ONLINE. In this mode, the cursor movement keys (<↑>, <↓>, <←>, <→>) move the cursor on the screen, and transmit nothing. The default mode, however, is such that the cursor movement keys transmit control characters and have no direct effect on the cursor position. It is up to the host to recognize the cursor movement characters and position the cursor accordingly. For details, see 3.5.2.

3.3.6 Function Key Enable/Disable

The 3102 possesses a mechanism for controlling whether the function keys transmit anything when pressed while the 3102 is ONLINE. The default setting is DISABLE: pressing a function key while the terminal is in this state (and ONLINE) does nothing but cause a "beep". This default is to prevent deadlock situations resulting from a function key's being pressed with host software that does not support software handshaking (see 3.3.2). Only host software that supports or has disabled software handshaking and for which the

function keys are meaningful should ENABLE them.

3.3.7 Block Send Enable/Disable

The 3102 possesses a mechanism for controlling whether any BLOCK SEND commands is carried out. The default setting is DISABLED; and BLOCK SEND command received while the terminal is in this state will be ignored. Pressing the SEND key does nothing but cause a "beep". This default is to prevent deadlock situations resulting from a line or page being sent to host software that does not support software handshaking (see 3.3.2). Only host software that supports or has disabled software handshaking and for which BLOCK SEND is necessary should ENABLE it.

3.3.8 Write Control Mode

The next character is entered into display memory (i.e.: displayed) even if it is a control character. For details see 3.5.13.

3.3.9 Boot Load Mode

Data received is interpreted as ASCII representation of hexadecimal numbers, and is stored in RAM for later execution. For details see 3.5.14.

3.3.10 Graphic Mode

Character codes received while this mode is in effect are interpreted as representing special graphics characters rather than alphanumeric characters. For details see 3.5.6

3.4 OTHER MODES

3.4.1 Make Forms

When a form is created locally at the terminal, this mode is used so that the normally invisible logical field attributes will be visible. CROMEMCO discourages the use of this mode in applications, as it requires too much sophistication on the part of the user. Instead, form construction should be handled by interactive software running on the host. For details, see 3.5.5.

3.4.2 Use Forms

Logical attributes, which define fields on the CRT screen, do not go into effect until the 3102 enters USE FORMS mode. For details, see 3.5.5.

3.4.3 Modified Mode

When using FORMS mode, a MODIFIED mode may be selected such that only (unprotected) fields that are modified by the user will be transmitted when the page is transmitted. Unaltered fields are replaced in the data stream by a single TAB code to indicate their position among modified fields. For details, see 3.5.5.

3.5 3102 HOST FUNCTIONS

The 3102 has a large number of special functions, all of which can be invoked by the host system. Provided that the 3102 is online to the port connected to the host (there are cases in which even this provision need not be met--see below), the host indicates that it wants to invoke a special function by sending the terminal special characters. In most cases, the character used to indicate a special function is ESC (1BH). The ESC is followed by one or two characters that serve to identify the function desired, and, if the specified function requires arguments, still more characters. In addition, there are a few 3102 functions that are invoked by the receipt of a single control character other than ESC (see below), and one special function that is invoked not by a character but rather by a BREAK signal (see below).

Note: some of the preassigned function keys on the 3102 keyboard (see 3.6) have labels that correspond with special functions listed below. However, most of these keys carry out the indicated function only if the 3102 is in LOCAL mode. If it is ONLINE, these keys merely identify themselves to the host; nothing happens on the screen. In this case, it is the host system's responsibility to return the correct escape sequence, control character, or break signal to the 3102 if it wants to invoke the indicated function.

For a summary of the Host Functions and the codes required to make them, see Figures 3-1, 3-2, and 3-3.

Code Following ESC (1BH)					
MSB					
LSB	010	011	100	101	110
0000	SP (20H) Set Clock	0 (30H) Aux Send	@ (40H) Insert Char Off	P (50H) Delete Char (Line)	\ (60H) Delete Char (Page)
0001	! (21H) Page Mode	1 (31H) Display Message	A (41H) Cursor Up	Q (51H) Insert Char (Line) On	a (61H) Insert Char (Page) On
0010	* (22H) Boot Load Run	2 (32H) Remove Message	B (42H) Cursor Down	R (52H) Graphic Mode On	b (62H) * Enable Keyboard
0011	# (23H) Line Mode	3 (33H) Aux Page Send	C (43H) Cursor Right	S (53H) Graphic Mode Off	c (63H) * Disable Keyboard
0100	\$ (24H) not assigned	4 (34H) Aux Line Send	D (44H) Cursor Left	T (54H) Modified Mode On	d (64H) Enter Video Attribute
0101	% (25H) Constant Field	5 (35H) Aux Baud Rate Set	E (45H) Clear	U (55H) Modified Mode Off	e (65H) Delete Vid. Attribute
0110	& (26H) Make Forms Mode	6 (36H) Write Cntl Mode	F (46H) Cursor Address	V (56H) Reset	f (66H) Self Test
0111	' (27H) Send Enter Code	7 (37H) Main Baud Rate Set	G (47H) * Read Cursor Character	W (57H) Use Forms Mode	g (67H) Screen Lock
1000	((28H) Select Main Port	8 (38H) Continuous Alarm On	H (48H) Home	X (58H) Make/Use Forms Off	h (68H) Screen Unlock
1001	) (29H) Select Aux Port	9 (39H) * Continuous Alarm Off	I (49H) Page Send	Y (59H) Cursor Address	i (69H) Line Send
1010	* (2AH) Monitor Mode Off	: (3AH) Monitor Mode On	J (4AH) Clear To End of Page	Z (5AH) Cursor Toggle	j (6AH) not assigned
1011	+ (2BH) Start Logical Fld	; (3BH) * Store Message	K (4BH) Clear To End of Line	[(5BH) Unprotected Field	k (6BH) not assigned
1100	, (2CH) Clear Entry	< (3CH) * Line Lock	L (4CH) Insert Line	\ (5CH) * Send Cursor Position	l (6CH) Start Blink
1101	- (2DH) Toggle Status Line	= (3DH) * Line Unlock	M (4DH) Delete Line	] (5DH) Start Prot- ected Field	m (6DH) Normal Video
1110	. (2EH) see figure 3-2	> (3EH) Back Tab	N (4EH) Enter Local Mode	^ (5EH) * Use Invisi- ble Cursor	n (6EH) Go Online
1111	/ (2FH) Aux Page Dump	? (3FH) * Unlock All Lines	O (4FH) Send Status Message	_ (5FH) * Send Inv. Cursor Char	o (6FH) Page Dump

* Only host system can invoke

Figure 3-1 Function Codes

Character Following ESC-'.'	Function
0	Enable software handshaking on main port (default).
1	Disable " " " "
2	Enable software handshaking on aux port (default)
3	Disable " " " "
4	Cursor pad transmits control codes when Online
5	Cursor pad operates locally, transmits nothing
6	Disable block transmissions (default)
7	Enable " "
8	Disable function keys when Online (default)
9	Enable " "

Figure 3-2 Communication Control Functions

LSB	000	MSB	001
0000	NULL <control-@> no effect		DLE <control-P> no effect
0001	SOH <control-A> no effect		DC1 (X-ON) <control-Q> Enable Transmission
0010	STX <control-B> no effect		DC2 <control-R> no effect
0011	ETX <control-C> no effect		DC3 (X-OFF) <control-S> Hold Transmission
0100	EOT <control-D> no effect		DC4 <control-T> no effect
0101	ENQ <control-E> Send Terminal ID		NAK <control-U> no effect
0110	ACK <control-F> no effect		SYN <control-V> no effect
0111	BEL <control-G> Sound Bell		ETB <control-W> Non-specific Block Send
1000	BS <control-H> Back Space		CAN <control-X> no effect
1001	HT <control-I> Horizontal Tab		EM <control-Y> no effect
1010	LF <control-J> Line Feed		SUB <control-Z> no effect
1011	VT <control-K> no effect		ESC <control-[> Interpret Special Function
1100	FF <control-L> no effect		FS <control-\> no effect
1101	CR <control-M> Carriage Return		GS <control-]> no effect
1110	SO <control-N> no effect		RS <control-^> no effect
1111	SI <control-O> no effect		VS <control-_{> no effect

Figure 3-3 Control Code Functions

3.5.1 Editing

Delete Line --

Receipt of an ESC 'M' causes the line occupied by the cursor to be deleted. The remaining lines are each moved up one line and a blank line is inserted at the end of the display. The cursor is left at the beginning of the line that moved into the space formerly occupied by the deleted line. Any attributes on the deleted line are also deleted, even though they may affect several lines.

Illegal in USE FORMS mode (alarm sounds).

Insert Line--

Receipt of an ESC 'L' causes all data starting at the beginning of the line occupied by the cursor to be moved down one line. A blank line is inserted at the original cursor line position and the cursor is left at the beginning of the new blank line. Any data in the last display line (line 24), including attributes, are lost.

Illegal in USE FORMS mode (alarm sounds).

Delete Char (shift line)--

Receipt of an ESC 'P' causes the character under the cursor 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. Attributes cannot be deleted with this function.

In USE FORMS mode, the deletion propagates only to the end of the current field, rather than to the end of the current line.

Delete Char (shift page)--

Receipt of an ESC '`' causes the character under the cursor to be deleted. All characters to the end of the screen are moved left one position (characters in column 1 'wrap' to the end of the previous line) and a space is inserted in last position of line 24.

Illegal in USE FORMS mode (alarm sounds).

Insert Character (shift line)--

Receipt of an ESC 'Q' causes the 3102 to enter a mode in which data to the right of the cursor on the current line shift right as new characters are entered. The cursor moves right one space for each inserted character, indicating where the next character will be inserted. For each character inserted, the character in the last column of the current line is lost. While the 3102 is in this mode, "LINE INSRT" appears in field F of the Status Line.

In USE FORMS mode, character insertion propagates only to the end of the current (unprotected) field.

Insert Character (shift page)--

Receipt of an ESC 'a' causes the 3102 to enter a mode in which data to the right of and below the cursor shift right as new characters are entered (characters column 80 'wrap' to the beginning of the next line). The cursor moves right one space for each inserted character, indicating where the next character will be inserted. For each character inserted, the character in the last column of line 24 is lost. While the 3102 is in this mode, "PAGE INSRT" appears in field F of the Status Line.

Illegal in USE FORMS mode (alarm sounds).

Insert Character OFF--

Receipt of an ESC '@' causes the 3102 to leave Insert Character mode.

3.5.2 Cursor Movement

Cursor Home--

Receipt of an ESC 'H' causes the cursor to move to the Home position: column 1, line 1.

In USE FORMS mode, the cursor moves to the first character position of the first unprotected field on the screen.

If portions of the display are locked (via the Screen Lock or Line Lock functions), the cursor moves to the first unlocked character position on the screen.

Cursor Left--

Receipt of an ESC 'D' causes the cursor to move one position to the left. If the cursor is in column 1 to begin with, it 'wraps' to column 80 of the previous line. If the cursor is in the Home position, it 'wraps' to column 80 of line 24.

In USE FORMS mode, when the cursor is in the first position of a field, it moves to the last position of the previous field, provided that the exit conditions of the current field are met.

On reaching a locked portion of the screen, the cursor 'jumps' over it to the next unlocked position above. If there are no unlocked positions above, it 'wraps' to the last unlocked position below.

Cursor Right--

Receipt of an ESC 'C' causes the cursor to move one space to the right. If the cursor is in column 80 to begin with, it 'wraps' to column 1 of the next line. If the cursor is in column 80 of line 24, it wraps to Home.

In USE FORMS mode, when the cursor is in the last position of the field, it moves to the first position of the next field, provided that the exit conditions of the current field are met.

On reaching a locked portion of the screen, the cursor 'jumps' over it to the next unlocked position below. If there are no unlocked positions below, it 'wraps' to the first unlocked position above.

Cursor Up--

Receipt of an ESC 'A' causes the cursor to move up one line. On reaching line 1, it 'wraps' to line 24.

In USE FORMS mode, the cursor will move up only if the position directly above is part of the current field.

On reaching a locked line, the cursor 'jumps' over it to the next unlocked line above; if there are none, it 'wraps' to the last unlocked line below.

Cursor Down--

Receipt of an ESC 'B' causes the cursor to move down one line. On reaching line 24, it 'wraps' to line 1.

In USE FORMS, the cursor will move only if the position directly below is part of the current field.

On reaching a locked line, the cursor 'jumps' to the next unlocked line below; if there are none, it 'wraps' to the first unlocked line above.

Set Cursor Pad ONLINE--

Receipt of an ESC '.' '4' causes the cursor movement keys to transmit control characters (see 3.6.2) when they are pressed, and to have no local effect.

Set Cursor Pad LOCAL--

Receipt of an ESC '.' '5' causes the cursor movement keys to move the cursor on the screen when they are pressed without transmitting anything.

The 3102 will refuse to invoke this function if it is in LOCAL mode.

Line Feed--

Receipt of a LF causes the cursor to move down to the next line. On reaching line 24, if the terminal is in Roll Mode (switch S1-2, back panel up), all lines on the screen move up one line (the top line is lost) and a blank line is created in line 24; if the terminal is not on roll mode, the cursor 'wraps' to line 1.

In USE FORMS mode, the cursor moves only if the position below is within the current field.

Encountering a locked line causes the cursor to 'jump' to the next unlocked line below; if there are none, it 'wraps' to the first unlocked line above.

Carriage Return--

Receipt of a CR causes the cursor to move to column 1 of the current line. If Auto Line Feed mode is selected (switch S1-3, back panel/UP). The cursor also moves down one line. In this case, when the cursor is on line 24 the screen scrolls or the cursor wraps as described for the LF function.

In FORMS MODE, the cursor moves to the first position of the current field.

Horizontal Tab--

Receipt of a TAB causes the cursor to advance to the next tab stop. Tab stops are fixed at columns 0,8,16,24,32,48,56,64, and 72. If beyond column 72, the cursor will 'wrap' to the next line. At the end of the screen, the screen scrolls or the cursor wraps as described for the LF function.

In USE FORMS mode, the cursor moves to the next field, assuming that the exit conditions for the current field are met. If the cursor is in the last unprotected field on the screen, it will 'wrap' to the first.

Back Tab--

Receipt of an ESC '>' causes the cursor to back up to the previous tab stop, wrapping at line boundaries. If at Home, the cursor will not move. Locked lines are tabbed around, not through.

In USE FORMS mode, the cursor moves to the beginning of the current field. If the cursor is already in the first position of the field, it moves to the first position of the previous field, assuming that the exit conditions for the current field are met.

Cursor Address--

Receipt of an ESC 'F' or an ESC-'Y' causes the 3102 to interpret the next two characters received as indicating a line number and a column number, respectively, and to move the cursor to the specified position if it is a valid screen position. If the indicated position is not on the screen, the cursor does not move. See Figure 3-4 for line and column number codes. Note that to obtain the code for a given column or line number, simply add 19H to the desired line or column number if numbering from 1, or 20H if numbering from 0.

The cursor will not move if the destination is within a locked area of the display.

Illegal in USE FORMS mode.

3.5.3 Screen Erasure

Clear Screen--

Receipt of an ESC 'E' causes the entire display to be erased. The cursor is left in the HOME position.

Locked areas of the display are not erased.

In USE FORMS mode, only unprotected fields are erased.

Clear to End of Line--

Receipt of an ESC 'K' causes all characters on the current line to the right of the cursor to be deleted. Any attributes in the deleted area are also deleted.

In USE FORMS mode, only unprotected fields on the current line are deleted.

Clear to End of Page--

Receipt of an ESC 'J' causes all data on the current line to the right of the cursor and all data on succeeding lines to be deleted. Any attributes in the deleted area are also deleted.

In USE FORMS mode, only unprotected fields will be erased.

Clear Entry--

Receipt of an ESC ',' causes erasure of the current unprotected field, leaving the cursor in the first position of the field.

Legal in USE FORMS mode only.

Line or Column	ASCII Char	Line or Column	ASCII Char	Line or Column	ASCII Char
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		

Figure 3-4 Screen Position Codes

3.5.4 I/O Port Control

Select Main Port--

Receipt of an ESC '(' causes the 3102 to select the main port for subsequent I/O. To be seen by the terminal, this function must be invoked via the current port (i.e.: the AUX port or, in LOCAL mode, the keyboard). The status line is changed such that 'ONLINE' appears in field A, and 'MAIN' appears in field D.

select Aux Port--

Receipt of an ESC ')' causes the 3102 to select the auxiliary port for subsequent I/O. To be seen by the terminal, this function must be invoked via the current port: i.e.: the MAIN port or, in LOCAL mode, the keyboard. The status line is changed such that 'ONLINE' appears in field A, and 'AUX' in field D.

Enter Local (Off-line) Mode--

Receipt of an ESC 'N' causes the 3102 to enter a mode in which data (except commands to go ONLINE, set invisible second cursor, or deposit a message) arriving at the terminal over either I/O port is ignored. In addition, characters typed on the keyboard are displayed (not transmitted), and preassigned function keys (except <help>, <print>, and <pause>) have their indicated effect. Pressing the <send> key when the 3102 is in LOCAL mode will, for example, cause a line or a page to be transmitted. The previous I/O port selection is preserved. The status line is changed such that 'LOCAL' appears in field A.

Go Online to Selected Port--

Receipt of an ESC 'n' causes the 3102 to display or act on data arriving via the selected I/O port and to inhibit direct display of typed characters. The status line is changed such that ONLINE appears in field A.

3.5.5 Defining and Displaying Forms

Forms may be built on the 3012 display by either the host system (preferred) or the keyboard

operator. Forms are built by entering 'logical' field attributes at particular locations on the screen. Such attributes specify that only characters of a certain type may be entered into the field delimited by the attribute and the (spatially) next attribute entered on the screen. A variety of attributes allows for fairly sophisticated type-checking by the 3102 itself when data are being entered into displayed forms.

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, (e.g.: ESC '[' defines a regular unrestricted data field). The cursor must be positioned to the required ending location for that field by means of cursor addressing or by any movement instruction, 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 maybe entered into unprotected areas during definition and remains displayed but unprotected when Forms mode is asserted.

Unprotected (data) fields may be either alphanumeric, numeric, or alphabetic and either "normal", "must enter" or "total fill". An alphanumeric field will accept any character; an alphabetic field will accept any character except the digits 0-9; a numeric field will accept any character with an ASCII code less than that of the letter 'A'. A "normal" field may be skipped over or entered as desired; a "must enter" field must have at least one valid character entered before that cursor may advance to the next field; a "total fill" field must be totally filled with valid characters before the cursor may advance to the next field.

One "constant" field may be defined on a given form. This field contains characters (e.g.: identification data) that are not accessible in USE FORMS mode but that will be transmitted before the unprotected (data) fields when the page send function is invoked. If more than one constant

field is defined on the screen, only the (temporally) last one defined is retained.

Start "must enter", alphanumeric field--

Receipt of an ESC '+' '0' causes the attribute to be entered at the cursor position.

Start "must enter", alphabetic field--

Receipt of an ESC '+' '1' causes the attribute to be entered at the cursor position.

Start "must enter", numeric field--

Receipt of an ESC '+' '2' causes the attribute to be entered at the cursor position.

Start "must enter", alphanumeric field--

Receipt of an ESC '+' '3' causes the attribute to be entered at the cursor position.

Start "total fill", alphanumeric field--

Receipt of an ESC '+' '4' causes the attribute to be entered at the cursor position.

Start "total fill", alphabetic field--

Receipt of an ESC '+' '5' causes the attribute to be entered at the cursor position.

Start "total fill", numeric field--

Receipt of an ESC '+' '6' causes the attribute to be entered at the cursor position.

Start "total fill", alphanumeric field--

Receipt of an ESC '+' '7' causes the attribute to be entered at the cursor position.

Start "normal", alphanumeric field--

Receipt of an ESC '+' '8' causes the attribute to be entered at the cursor position.

Start "normal", alphabetic field--

Receipt of an ESC '+' '9' causes the attribute to be entered at the cursor position.

Start "normal", alphanumeric field--

Receipt of an ESC '+' ':' causes the attribute to be entered at the cursor position.

Start "normal", alphanumeric field--

Receipt of an ESC '[' causes the attribute to be entered at the cursor position.

Start protect (End Field; used after all fields)--

Receipt of an ESC ']' causes the attribute to be entered at the cursor position.

Start Constant field--

Receipt of an ESC '%' causes the attribute to be entered at the cursor position, and causes the characters that follow up to the (spatially) next field attribute to be defined as the constant field for the current form.

Enter USE FORMS Mode--

Receipt of an ESC 'W' causes previously entered logical attributes to be asserted, defining fields on the display. The cursor moves to the first character position of the first unprotected field on the screen. Any data already in unprotected (data entry) fields remains. This feature may be used to display default values or data type information.

When an unprotected field is cleared by using any of the CLEAR functions (e.g. CLEAR ENTRY, CLEAR SCREEN), the character positions are filled with null codes, which display '.'. For some applications, it may be desirable to clear some or all unprotected fields in this way as soon as a form is displayed.

Once a form has been defined and USE FORMS mode initiated, the operator may proceed to enter data as required. The <tab> key may be used to advance to the next field, provided that the exit conditions of the current field have been met. The <back tab> key may be used to move to the previous field, again, provided that the current field's exit conditions are satisfied.

Tab stops may be set within fields by the entry of additional logical attributes of the same type as the first. When the cursor is within a "total fill" field, any attempt to advance the cursor from the field before every character position is filled sounds the bell and displays --on field G of the status line-- a message indicating the field type. Fields defined as "must enter" require the entry of at least one valid character before the cursor is allowed to leave the field. Fields defined as alphabetic or numeric refuse entry of characters and provide an alarm and a status message indicating the field type in the event of an entry error.

Because the 3102 status line is not normally displayed, the error messages displayed when form data entry errors are made will not be visible unless the status line is on. Therefore, CROMEMCO suggests that software that displays forms with restricted fields (i.e. other than "normal" alphanumeric) turn on the status line when the form is ready for operator input.

Editing is permissible within any unprotected field (see 3.5.1). Entering USE FORMS mode revokes SCREEN LOCK or LINE LOCK if they are in effect.

Data entered into forms may be transmitted to the host in a variety of ways. If USE FORMS mode is initiated with the 3102 ONLINE, any characters typed by the operator will be transmitted to the host. Data entered into adjacent fields will be separated by a TAB character only if the <tab> key is typed by the operator. The predefined function keys (including <clear entry>) do not have the indicated effect, but rather transmit a two character sequence (see 3.6). It is the responsibility of the host system to decode these keys, return the appropriate commands to the 3102, and keep track of what field is being modified.

Alternatively, the 3102 can be put in LOCAL mode after USE FORMS mode is invoked. In this case, the entered data is transmitted to the host via the SEND function, which transmits either the current field of data or all data fields, depending on whether the 3102 is in

LINE or PAGE mode, respectively. Thus, host software can select PAGE mode and instruct the operator to press <send> key when all of the data have been entered (or press the <main> or <aux> key to put the terminal back ONLINE so that the host software can itself invoke the PAGE SEND function). Unprotected fields, are transmitted separated by TAB characters. Spaces are not suppressed (i.e. they are transmitted as part of the field), and delete codes are transmitted as spaces. If a constant field is defined, it is transmitted before any of the unprotected field, regardless of where it was defined on the screen. When all of the data has been transmitted (see 3.5.7), the 3102 either remains in LOCAL or goes ONLINE, depending on the setting of internal switch 1 (see 2.8.1).

Enter Modified Mode--

Receipt of an ESC 'T' causes the 3102 to enter a mode in which any unprotected fields that are changed in any way by the keyboard operator are flagged as modified. When the page is transmitted, only those unprotected fields that are modified are transmitted. Unmodified fields are replaced by a TAB character in the data stream to indicate their position among the modified field.

Illegal unless in USE FORMS mode. Also, meaningless unless data entry occurs while 3102 is in LOCAL.

Leave MODIFIED Mode--

Receipt of an ESC 'U' causes the 3102 to leave MODIFIED mode (reverting to ordinary USE FORMS mode).

Enter MAKE FORMS mode--

Receipt of an ESC '&' causes the 3102 to enter a mode in which the normally invisible logical attributes become visible (as half-intensity blinking graphics characters; see Figure 3-5). Also becoming visible are any null codes indicating blank fields. It is assumed that this mode will be used only when the 3102 is set to LOCAL; the defined form will be sent to the host for storage via the PAGE DUMP function.

The cursor may be moved through the use of the <space> bar, cursor movement keys, or <carriage return> key.

Note: Use of this mode is discouraged by CROMEMCO. Forms should be constructed by designing them into software or through the use of interactive form-construction software.

Illegal in USE FORMS mode.

Exit USE FORMS or MAKE FORMS--

Receipt of an ESC 'X' causes the 3102 to leave USE FORMS or MAKE FORMS mode.

Escape Sequence	Graphic Symbol
ESC '+' '0'	
ESC '+' '1'	
ESC '+' '2'	
ESC '+' '3'	
ESC '+' '4'	
ESC '+' '5'	
ESC '+' '6'	
ESC '+' '7'	
ESC '+' '8'	
ESC '+' '9'	
ESC '+' ':'	
ESC '['	
ESC ']'	none
ESC '%'	none

Figure 3-5 Logical Field Attributes

3.5.6 Display Control

Enter Video Attribute--

Receipt of an ESC 'd' causes the 3102 to interpret the next character received as specifying one of 21 video attributes and to enter that attribute at the cursor position. Through the use of video attributes, it is possible to define areas of the 3102 such that characters entered there will be displayed in a particular way. For example, by entering the "reverse-video" video attribute in column 1 of line 12, the entire lower half of the screen (including all characters typed there) is displayed in reverse video. To continue the example, if the "normal" video attribute (not to be confused with any of the "normal" logical field attributes) is then entered in column 1 of line 13, only line 12 will be displayed in reverse video. Finally, if the "underline-reverse" video, video attribute is entered in column 41 of line 12, nothing will change except that any characters entered in the right half of the line 12 (including those already there) will be underlined. The character codes that select particular video attributes are given in Figure 3-6. Up to 16 video attributes can be entered on a given line.

Note that it is possible to define "invisible" areas on the screen, and that "invisible" areas may blink, be in reverse video, half intensity, or combinations thereof. This is not as contradictory as it sounds: characters in an "invisible" area are simply not displayed; what replaces them is a blank area of the specified kind. Once defined, invisible areas of the screen may be modified or erased; anything written into such an area is invisible. Data within an invisible area is rendered visible simply by redefining the area (by deleting the "invisible" video attribute or replacing it with another). Redefining only part of an "invisible" visual field is possible.

Note that ESC 'l' has the same effect as ESC 'd' 'B', and ESC 'm' has the same effect as ESC 'd' '@'.

In Non-Roll mode, a video attribute cannot be the only thing on a line; at least one other character (e.g.: a space) must be entered.

A video attribute may not be entered immediately prior to a graphics character.

Delete Video Attribute--

Receipt of an ESC 'e' causes the 3102 to delete the video attribute, if any, at the cursor position.

Enter Graphics Mode--

Receipt of an ESC 'R' causes the 3102 to enter a mode in which 44 ASCII codes are interpreted as specifying one of 11 different graphics symbols in one of four different ways (see Figure 3-7). These symbols may be used to construct line drawings, borders, etc.

A graphic character may not immediately follow a video attribute.

Character	Attribute Entered
<i>ESC</i> @	Normal (End Range of Video Attribute) <i>also ESC-I</i>
A	Half-Intensity
B	Blinking
C	Half-Intensity Blinking
P	Reverse-Video
Q	Reverse-Video Half-Intensity
R	Reverse-Video Blinking
S	Reverse-Video Half-Intensity Blinking
`	Underline Normal
a	Underline Half-Intensity
b	Underline Blinking
c	Underline Half-Intensity Blinking
p	Underline Reverse-Video
q	Underline Reverse-Video Half-Intensity
r	Underline Reverse-Video Blinking
s	Underline Reverse-Video Half-Intensity Blinking
\$	Invisible
4	Invisible Reverse-Video
5	Invisible Reverse-Video Half-Intensity
6	Invisible Reverse-Video Blinking
7	Invisible Reverse-Video Blinking Half-Intensity

Figure 3-6 Video Attributes

Exit Graphics Mode--

Receipt of an ESC 'S' causes the 3102 to revert to interpreting all ASCII codes as representing the standard alphanumeric characters.

Screen Lock--

Receipt of an ECS 'g' causes all data above, but not including, the line containing the cursor to become locked on the screen. The line containing the cursor becomes the "effective" top line of the display: the cursor cannot move into the locked area (the first column of the top unlocked line becomes Home); when the lower portion of the screen scrolls, the locked portion does not; when the CLEAR SCREEN function is invoked, only the unlocked portion of the screen is cleared. When any part of the display is locked in this way, the message 'SCREEN LOCK' appears in field E of the status line.

The 3102 will refuse to invoke the SCREEN LOCK function if the cursor is on either the top or the bottom (24th) line.

The 3102 will refuse to invoke the SCREEN LOCK function if any lines have been locked on the screen via the LINE LOCK function.

Illegal in USE FORMS mode. Entering USE FORMS mode revokes SCREEN LOCK.

Symbol	Display Mode			
	Normal	Half-Intensity	Blinking	Half-Intensity Blinking
	@	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

Figure 3-7 ASCII Equivalents of Graphics Characters

Line Lock--

Receipt of any ESC '<' causes the 3102 to interpret the next character as indicating a screen line; the indicated line, if in bounds, is locked on the screen. Data typed on the keyboard or received from the host have no effect on locked lines. The cursor cannot move onto a locked line; it will move instead to the next lower unlocked line. CLEAR functions do not affect locked lines. When any lines are locked, the message 'LINE LOCK' appears in field E of the Status Line. The codes used to indicate which line is to be locked are the same as those used for cursor positioning (see Figure 3-4).

The 3102 will refuse to lock a line if it is the only unlocked line on the screen.

Illegal in USE FORMS mode. Entering USE FORMS mode unlocks all lines.

This function cannot be invoked from the keyboard in LOCAL mode by typing ESC '<'.

Unlock Line--

Receipt of an ESC '=' causes the 3102 to interpret the next character as indicating a screen line to be unlocked.

Unlock All Lines--

Receipt of an ESC '?' causes all currently locked lines to be unlocked.

Status Line Toggle--

Receipt of an ESC '-' toggles the normally undisplayed status line (the 25th line of the display) on or off.

Message Deposit--

Receipt of an ESC ';' causes the 3102 to interpret all subsequent characters until receipt of a GS character (<control-]) as comprising a message to be stored for the keyboard operator. When the terminating GS is received, the message "MSSG WAIT" appears in field D of the status line. In this case, the status line will be displayed to inform the

operator of the waiting message (the message may be viewed by pressing <control-message> on the keyboard). The Message Deposit function works in both ONLINE & LOCAL modes.

A message may contain a maximum of 80 characters. Additional characters will overwrite the 80th character position. Control codes in the message string (including ESC) do not have their normal effect, rather, the corresponding control code symbols are displayed (see Figure 3.10).

Null messages (i.e.: ESC ';' GS) may be stored; when the message is viewed the status line will have disappeared (i.e.: it appears blank and non-reversed).

Display Message--

Receipt of an ESC '1' causes the most recently stored message (see Message Deposit) to be displayed on the status line. The message appears in half-intensity reversed video.

Remove Message--

Receipt of an ESC '2' causes the displayed message to vanish. The status line reverts to its previous state (either undisplayed or displayed).

Cursor ON/OFF--

Receipt of an ESC 'Z' toggles the cursor on or off. All cursor control keys and functions continue to operate normally.

3.5.7 Block Transmission

Send--

Receipt of an ETB (17H) causes the 3102 to transmit either the current (cursor) line or the entire screen, depending on whether the terminal is in PAGE or LINE mode, respectively. Such a transmission consists of two STX characters followed by the characters (but not the attributes) in the line or page, and terminated by an EOT character. A transmitted page includes a carriage-return (and a linefeed unless the line is a full 80 characters long) after each line. If software

handshaking (see 3.3.2) is enabled, the data stream will be transmitted according to that protocol. The transmission uses the currently-selected port (MAIN or AUX).

Page Send--

Receipt of an ESC 'I' causes the 3102 to transmit the current page over the currently selected port (see SEND).

Line Send--

Receipt of an ESC ';' causes the 3102 to transmit the cursor line over the currently selected port (see SEND).

Aux Send--

Receipt of an ESC '0' causes the 3102 to transmit the current line or page (depending on whether the terminal is in LINE or PAGE mode, respectively) over the AUX port (see SEND).

Aux Page Send--

Receipt of an ESC '3' causes the 3102 to transmit the current page over the AUX port.

Aux Line Send--

Receipt of an ESC '4' causes the 3102 to transmit the current (cursor) line over the AUX port.

Page Dump--

Receipt of an ESC 'o' causes the 3102 to transmit the entire screen, including graphics, video attributes, and logical attributes, to the host. 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, 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 reconstruction of the original screen contents at a later time. If software handshaking (see 3.3.2) is enabled, the data stream will be transmitted according to that protocol. The transmission uses the currently-selected port (MAIN or AUX).

Aux Page Dump--

Receipt of an ESC '/' causes the 3102 to transmit the contents of the entire screen, including graphics, video attributes, and logical attributes, to the host (see Page Dump).

Disable Block Transmission--

Receipt of an ESC '.' '6' disables Block Transmission invoked in any way. Pressing the <send> key when Block Transmission is DISABLED merely sounds the bell. The default setting is DISABLED.

Enable Block Transmission--

Receipt of an ESC '.' '7' enables block transmission. Because of the potential for deadlocks with host software that does not support software handshaking, CROMEMCO recommends that only software that is prepared for block transmissions ENABLE it.

3.5.8 Baud Rate Control

Set Main Baud Rate--

Receipt of an ESC '7' causes the 3102 to interpret the next character as specifying a new baud rate for the Main port. Fig. 3-8 shows which baud rates are associated with which characters.

Set Aux Baud Rate--

Receipt of an ESC '8' causes the 3102 to interpret the next character as specifying a new baud rate for the Aux port. Fig. 3-8 shows which baud rates are associated with which characters.

3.5.9 Initialization

Reset--

Receipt of an ESC 'V' causes the 3102 to revert to the state it assumed when turned on, except that the contents of the screen are unaffected, the cursor movement keys continue to operate as previously set, and block transmission and the function keys remain enabled or disabled as they were before the reset. Note that software handshaking reverts to being selected.

Desired Baud Rate:	Third Character							
	110	300	1200	1800	2400	4800	9600	19200
Main Port: ESC-'7'	0	1	2	3	4	5	6	7
Aux Port: ESC-'5'								

Figure 3-8
Remote Baud Rate Selection

Self Test--

Receipt of an ESC 'f' causes the 3102 to perform a memory test throughout its RAM, a loop-back I/O test, and an LRC test of the firmware ROMs. Successful completion of the and correct terminal operation is indicated by the appearance of "READY" in field E of the status line. If a test detects an error, "ERR CK" appears in field E of the status line, followed by "RAM", "ROM", or "I/F" (interface), indicating the faulty subsystem. Whether or not an error is detected, all screen data will have been erased, the cursor will be positioned at Home, and the 3102 will be initialized as if it had just been turned on (e.g.: it will begin transmitting CR characters; see below).

Automatic Baud Rate Synchronization--

Receipt of a BREAK signal of more than 100

msecs duration on the Main port causes the 3102 to begin transmitting CR characters at the currently selected baud rate. This allows the host systems to resynchronize baud rates with the terminal when the host somehow loses track (e.g.: host is powered down). When the 3102 is sending CRs, pressing any key will abort the sequence and have whatever effect the key would normally have. This function is also invoked automatically when the 3102 is turned on.

3.5.10 Communication Control

Enable Software Handshaking on Main Port--

Receipt of an ESC '.' '0' causes the software handshaking protocol (see 3.3.2) to go into effect. All subsequent multiple character transmissions that use the main port will follow that protocol. When the 3102 is turned on, handshaking is ENABLED.

Disable Software Handshaking on Main Port--

Receipt of an ESC '.' '1' disables the software handshaking protocol (see 3.3.2) on the main port. All subsequent multiple character transmissions over the main port will take place at current baud rate with no pauses.

Enable Software Handshaking on Aux Port--

Receipt of an ESC '.' '2' causes the software handshaking protocol (see 3.3.2) to go into effect on the auxiliary port. All subsequent multiple character transmissions that use the aux port will follow that protocol. When the 3102 is turned on, handshaking is ENABLED.

Disable Software Handshaking on Aux Port--

Receipt of an ESC '.' '3' disables software handshaking (see 3.3.2) on the aux port. All subsequent multiple character transmissions over the aux port will take place at the current baud rate with no pauses.

Stop Transmission--

Receipt of an X-OFF (<control-S>) character causes the 3102 to halt any transmission in

progress (within 2 character-intervals). Characters-to-be-transmitted will be stored rather than being transmitted immediately. Pressing any key when the buffer is already full will sound the bell and cause the keyed character to be lost.

While terminal output is being held following receipt of an X-OFF, the host should not request any information from the 3102 (eg: block send, terminal status). Failure to observe this rule may cause the 3102 to become inoperative. In this case, turning the terminal off briefly and then back on will allow operation to be resumed.

While terminal output is being held following receipt of an X-OFF and software handshaking is selected, hitting a function key will lock the keyboard against further data entry (ringing the bell for each key struck) until an X-ON is received and the STX of the function key sequence has been echoed.

Resetting the 3102 while it is holding output after having received an X-OFF causes it to revert to immediate transmission of typed characters, however, the data that was being stored is not transmitted, it is lost.

Start Transmission--

Receipt of an X-ON (<control-Q>) character causes any characters currently being stored (from a prior X-OFF command) to be transmitted. If software handshaking is selected, the transmission of stored characters will follow that protocol. The transmission of stored characters may be interrupted by sending the 3102 another X-OFF character.

3.5.11 Keyboard Control

Disable Keyboard--

Receipt of an ESC 'c' causes the 3102 to begin ignoring all keyboard input. This function cannot be invoked from the keyboard with the 3102 in LOCAL.

Enable Keyboard--

Receipt of an ESC 'b' causes the 3102 to respond to the keyboard. This function cannot be invoked from the keyboard with the 3102 in LOCAL.

Disable Function Keys--

Receipt of an ESC '.' '8' causes the 3102 to begin ignoring most of the function keys while the terminal is ONLINE. This function has no effect if the 3102 is in LOCAL mode, and the keys that always operate purely locally continue to operate even if the 3102 is ONLINE. The 3102 comes on with function keys DISABLE.

Enable Function Keys--

Receipt of an ESC '.' '9' causes the 3102 to respond to function keys pressed when the 3102 is ONLINE by transmitting the correct two-character sequence. If software handshaking is selected, the function key sequences will be transmitted according to that protocol.

3.5.12 Terminal Inquiries

Send Terminal Status--

Receipt of an ESC 'O' causes the 3102 to transmit a stream of characters that indicates the status of the terminal, the version number of the resident firmware, and the time (if the clock has been set). The data stream is always 35 characters long, and is preceded by a STX character for a total of 36 characters. The last eight characters are the time, formatted as HH:MM:SS. If the clock has not been set, the last eight characters of the status data stream are blanks. See Fig. 3-9 for details.

Send Cursor Position--

Receipt of an ESC '\ ' causes the 3102 to transmit the current cursor position, using the same format used to position the cursor. That is, an ESC 'F' is transmitted, followed by a code for the line number and a code for the column number (see 3.5.2 for codes). The ESC is preceded by a STX.

Send Cursor Character--

Receipt of an ESC 'G' causes the 3102 to transmit the character at the cursor position. The cursor position is not affected; subsequent invocation of this function with no intervening cursor movement will return the same character.

Send Character at Invisible Second Cursor--

Receipt of an ESC-' ' causes the 3102 to transmit the character at the position of the invisible second cursor. The cursor position is not affected.

Send Enter Code--

Receipt of an ESC ''' causes the 3102 to transmit the character(s) normally sent when the <enter> key is pressed. This function allows host software to determine the setting of back panel switches S1-5 and S1-6 and to adjust its expectations accordingly.

Send Terminal ID--

Receipt of an ENQ (<control-E>) causes the 3102 to transmit a stream of characters that identify the terminal, i.e.: '3102'. This sequence is preceded by two STX characters.

Character Position	Possible Characters	Referenced 3102 Aspect	Meaning
1	1-7	Main Baud Rate	0=110 1=300 2=1200 3=1800 4=2400 5=4800 6=9600 7=19200
2	1-7	Aux Baud Rate	same as above
3	0-3	Termination Character	0=CR,LF 1=ETX 2=EOT 3=CR
4	0-3	Parity Select	0=EVEN 1=SPACE 2=ODD 3=MARK
5	0-3	Self Test	0=No Fault 1=ROM 2=RAM 3=I/O
6	0-1	Switch S1-1	0=OFF 1=ON
7	0-1	Switch S1-2	0=OFF 1=ON
8	0-1	Switch S1-3	0=OFF 1=ON
9	0-1	Switch S1-4	0=OFF 1=ON
10	0-1	Switch S2-4	0=OFF 1=ON
11	0-1	Switch S2-8	0=OFF 1=ON
12	0-1	Display	0=OFF 1=ON
13	0-1	Local/Online	0=LOCAL 1=ONLINE
14	0-1	I/O Port	0=MAIN 1=ADX
15	0-1	Graphics	0=OFF 1=ON
16	0-1	Line Lock	0=OFF 1=ON
17	0-1	Screen Lock	0=OFF 1=ON
18	0-1	Keyboard Lock	0=OFF 1=ON
19	0-1	Error Check	0=No Error 1=Diagnostic Error
20	0-1	Message Wait	0=No Message 1=Message Waiting
21	0-1	Monitor Mode	0=OFF 1=ON
22	0-1	Main Baud Rate Reset	0=Back Panel Switches 1=Software or Keyboard
23	0-1	Aux Baud Rate Reset	same as above
24		Resident Firmware Revision	
25	anything		Reflects ROM Revision Level
26			
27	blank	Not Assigned	

Figure 3-9 Status Message Format

3.5.13 Additional Mode Control

Select Line Mode--

Receipt of an ESC '#' causes the 3102 to enter a mode which forces invocations of the nonspecific SEND function to transmit a line of data, rather than the entire screen.

Select Page Mode--

Receipt of an ESC '!' causes the 3102 to enter a mode which forces invocations of the nonspecific SEND function to transmit the entire screen.

Enter Line Monitor Mode--

Receipt of an ESC '*' causes the 3102 to enter a mode in which normal interpretation of control codes is suspended. Control characters, rather than having their usual effect on the terminal, are simply displayed (see Fig. 3-10). This mode is useful for determining exactly what is being transmitted by a host system.

Exit Line Monitor Mode--

Receipt of an ESC ':' causes the 3102 to revert to normal interpretation of control codes. Control codes displayed while the terminal was in line monitor mode remain (uninterpreted).

Enter Write Control Mode--

Receipt of an ESC '6' causes the 3102 to suspend normal interpretation of control codes for the next character only (see Enter Line Monitor Mode).

LSB	000	MSB	001
0000	NULL <control-@>		DLE <control-P>
0001	SOH <control-A>		DC1 (X-ON) <control-Q>
0010	STX <control-B>		DC2 <control-R>
0011	ETX <control-C>		DC3 (X-OFF) <control-S>
0100	EOT <control-D>		DC4 <control-T>
0101	ENQ <control-E>		NAK <control-U>
0110	ACK <control-F>		SYN <control-V>
0111	BEL <control-G>		ETB <control-W>
1000	BS <control-H>		CAN <control-X>
1001	HT <control-I>		EM <control-Y>
1010	LF <control-J>		SUB <control-Z>
1011	VT <control-K>		ESC <control-[>
1100	FF <control-L>		FS <control-\>
1101	CR <control-M>		GS <control-]>
1110	SO <control-N>		RS <control-^>
1111	SI <control-O>		VS <control-_>

Figure 3-10 Control Code Display Symbols

3.5.14 Miscellaneous Functions

Set Clock--

Receipt of an ESC ' ' (space) causes the 3102 to interpret the next six characters received as comprising a time-of-day, and sets the terminal clock accordingly. The format of the time specification is: HHMMSS. The clock is displayed on the status line and also may be read by the host system. Characters given in the time specification are not checked to see if they are ASCII decimal digits; the clock will display (and increment) any characters given in the specification.

Boot Load Run--

Receipt of an ESC '"' causes the 3102 to interpret subsequent characters until either a '@' or a '#' code as ASCII representations of hexadecimal digits specifying an 8085 program and a load address (in RAM). Codes that are not valid hexadecimal digits are ignored. The load address is given in the first four characters following the ESC '"'; the format for the load address is MSByte-LSByte. If '@' is used to terminate the sequence, execution of the loaded program is begun at the local address. If '#' is used to terminate the sequence, the terminal returns to normal operation (the program has been stored for later execution). Stored programs may be executed later by the sequence: ESC '"' <load address of desired program> '@'.

CROMEMCO discourages the use of this function, as it is very easy to crash the terminal. The 3102 contains no debugging facilities. Also, the resident firmware is not organized as an operating system. To make use of resident routines, down-loaded software must know where they are, however, the exact position of resident routines is subject to change as new versions are released.

Turn On Continuous Alarm--

Receipt of an ESC '8' causes the beeper inside the 3102 to begin emitting a continuous (high) tone. The alarm may be turned off from the keyboard (by pressing any key) or through the use of the next function.

Turn Off Continous Alarm--

Receipt of an ESC '9' causes the beeper inside
the 3102 to cease and desist.

3.6 3102 KEYBOARD

3.6.1 Keyboard Layout

The CROMEMCO 3102 Keyboard is arranged as depicted in Fig. 3.11. Some of the keys are labeled on the front as well as on the top of the keycap. Some of the keys are labeled in red to indicate that the control key--which is red--must be pressed simultaneously to have the indicated effect.

3.6.2 Keyboard Functions

Cursor Motion --

The effect of pressing the <(cursor)↑>, <↓>, <←>, <→> and <control-↑> (home) keys depends on whether the terminal is on-line or off-line and on whether the cursor movement keys are set to transmit characters or act locally (via either the "auto echo" switch on the back panel or the use of the special CPU control sequences ESC '.' 4 and ESC '.' '5').

If the terminal is off-line (regardless of the position of the "auto echo" switch) these keys transmit nothing but have the indicated function.

If the terminal is on-line (the normal mode) and cursor movement keys have been set to operate locally, these keys transmit nothing but have the indicated function. If cursor movement keys have been set to transmit, the keys have no local effect, but transmit the following codes:

^K	Cursor <↑>	-- 0B Hexadecimal
^J	Cursor <↓>	-- 0A Hexadecimal
^H	Cursor <←>	-- 08 Hexadecimal
^L	Cursor <→>	-- 0C Hexadecimal
^Y	Cursor <home>	-- 19 Hexadecimal

<return> --

If the 3102 is off-line, pressing the key moves the cursor to the first column of the current line, and, unless the "Auto Line feed" switch (back panel) is off, advances the cursor one line.

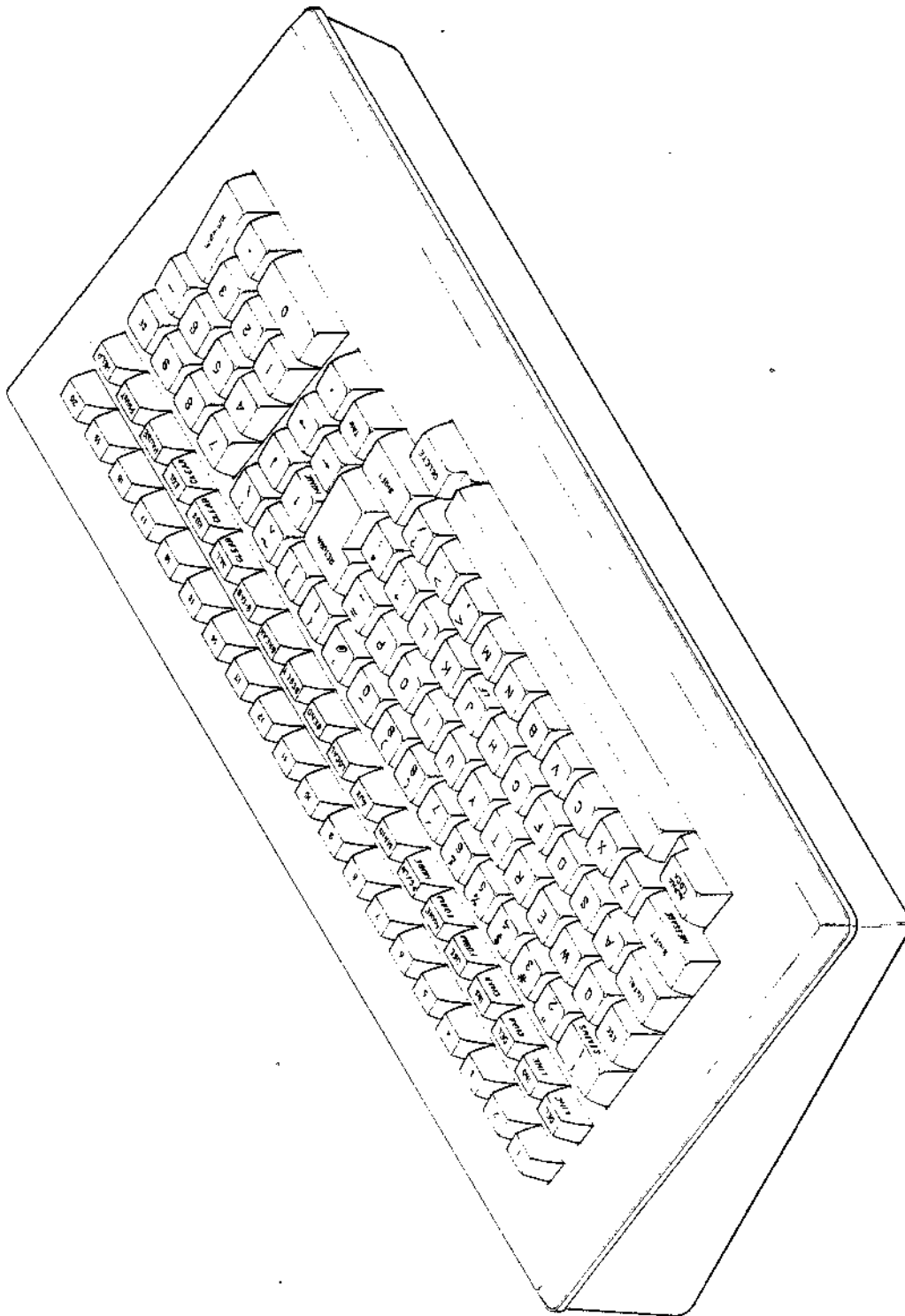


Figure 3-11 Keyboard Drawing

If the 3102 is on-line, no local action is taken, but a CR is transmitted.

<enter> --

This key generates the terminator character(s) selected by the rear panel switches. If "CR" or "CR-LF" are selected, the 3102 performs the corresponding functions or transmits the corresponding characters when the <enter> key is depressed. If "EOT" or "ETX" are selected, the terminal transmits those codes but does not alter the display.

<ce> (clear entry) --

This key sends the two character sequence STX ' ' if the 3102 is on-line. If the software handshaking protocol is selected, both characters must be acknowledged by a STX. If function keys are disabled, pressing this key does nothing but sound the bell. Note: the <ce> key, though not on the top two rows of keys, is a function key.

If the 3102 is off-line and in USE FORMS mode, depressing this key moves the cursor to the beginning of the current unprotected field and erases to the end of the field. If the 3102 is off-line and not in USE FORMS mode, pressing this key does nothing but sound the bell.

<tab> --

Depressing this key causes a TAB character to be transmitted if the terminal is on-line.

If the 3102 is off-line, the cursor moves to the next tab stop or to the next unprotected field.

<delete> --

This key causes a DEL character to be transmitted if the 3102 is on-line.

If off-line, this key has no effect unless the 3102 is in MAKE FORMS mode, in which case a delete code (space filler in empty data fields) is written on the screen (see 3.5.5).

Thus, in MAKE FORMS mode, this key can be used to extend data fields.

<alpha lock> --

Pressing this key once such that it stays down, sets the 3102 such that alphabetic characters typed without the <shift> key will be capitalized; alphabetic characters typed with the <shift> key will be in lower case. The key does not affect the number and special character keys. Pressing it a second time (releasing it) causes the 3102 to revert to normal operation.

<shift> --

If pressed without simultaneously pressing the <cntrl> key, this key operates just like a typewriter <shift> key. If used in combination with the <cntrl> key, this key displays the latest special status line message that the 3102 has received.

<ctrl> (control) --

Holding down this (red) key while pressing any alphabetic key causes the corresponding ASCII control code to be generated. Control codes are generated by forcing bits 6 and 7 of the alphanumeric code to zero. Holding the <cntrl> key down while pressing any key labeled in red causes the indicated action to occur or the indicated character to be generated.

<esc> (escape) --

If the 3102 is on-line, pressing this key causes an ESC to be transmitted.

If the 3102 is off-line, pressing this key causes the next key pressed to have the alternate effect indicated in the Function Code Chart (see Figure 3-1).

<del line> (delete line) --

If the 3102 is on-line and function keys are enabled, this key sends the sequence STX ''. If the software handshaking protocol is selected, both characters must be acknowledged by a STX. If function keys are disabled, pressing this key does nothing but sound the bell.

If the 3102 is off-line, the line containing the cursor is deleted, and all lines below it scroll upward one line (creating a blank line at the bottom of the screen).

If the 3102 is in USE FORMS mode, pressing this key has no effect.

<ins line> (insert line) --

If the 3102 is on-line, this key sends the sequence STX 'a'. If the software handshaking protocol is selected, both characters must be acknowledged by a STX. If function keys are disabled, pressing this key does nothing but sound the bell.

If the 3102 is off-line, a blank line is created at the position of the cursor, and all lines below it scroll downward one line (causing the data in the bottom line to be lost).

If the 3102 is in USE FORMS mode, pressing this key has no effect.

<del char> (delete character) --

If the 3102 is on-line, this key sends the sequence STX 'b'. If the software handshaking protocol is selected, both characters must be acknowledged by a STX. If function keys are disabled, pressing this key does nothing but sound the bell.

If the 3102 is off-line, the character under the cursor is deleted, and all characters to the right of it up to the end of the line move one space leftward, spaces being inserted at the end of the line. If pressed in conjunction with the <cntrl> key, all

characters to the right or below the deleted character move one space to the left (except those in column one, which move to the end of the previous line), spaces being inserted at the end of the screen. If the 3102 is in USE FORMS mode, pressing either <del char> or <cntrl-del char> deletes one character and moves left only those characters in the same field as the deleted character.

<ins char> (insert character) --

If the 3102 is on-line, this key sends the sequence STX 'c'. If the software handshaking protocol is selected, both characters must be acknowledged by a STX. If function keys are disabled, pressing this key does nothing but sound the bell.

If the 3102 is off-line, pressing this key once causes the terminal to enter a mode such that any character typed until <ins char> is pressed again is inserted under the cursor rather than simply replacing what's there. The character which was under the cursor and those to the right of it up to the end of the line (field, in USE FORMS mode) move one space to the right. Any character in column 80 of the line will be lost. If pressed in conjunction with the <cntrl> key, the 3102 enters a mode such that all characters to the right or below the cursor move one space to the right (except those in column 80, which move to the beginning of the next line) whenever a character is typed until <ins char> is pressed again. Any character in column 80 of line 24 will be lost. Pressing this key a second time causes the terminal to leave either line-based or page-based character insert mode.

<use form> --

If the 3102 is on-line, this key sends the sequence STX 'd'. If the software handshaking protocol is selected, both characters must be acknowledged by a STX. If function keys are disabled, pressing this key does nothing but sound the bell.

If the 3102 is off-line it enters a mode such that all previously-defined field attributes

take effect (see Figure 3.5.5).

<make form> --

If the 3102 is on-line, this key sends the sequence STX 'e'. If the software handshaking protocol is selected, both characters must be acknowledged by a STX. If function keys are disabled, pressing this key does nothing but sound the bell.

If the 3102 is off-line, it enters a mode that allows the operator to define fields of various types at selected locations on the screen (i.e., to create forms for later data entry).

<pg/ln mode> (page/line mode) --

Pressing this key changes the 3102 from LINE mode to PAGE mode or vice-versa. Whether the mode is LINE or PAGE at the time the <send> key is pressed determines whether one line of data or the entire page is transmitted. This key operates locally at all times.

<main> --

Pressing this key selects the main I/O port (toggles with <aux> key). This key operates locally at all times.

<aux> --

Pressing this key selects the auxiliary I/O port (toggles with <main> key). This key operates locally at all times.

<local> --

Pressing this key puts the terminal in LOCAL mode. This key operates locally at all times.

<send> --

If block send is enabled, pressing this key initiates transmission of a block of data, the size of which depends on which of PAGE or LINE

mode is currently selected. A block transmission is comprised of two STX characters, followed by a line or a page of screen data (see Operational Differences) and terminated by an EOT character. If the software handshaking protocol is selected, 3102 waits for a STX to be received after every character before sending any more data. Note that this also applies to the final EOT character. This key operates locally at all times.

If block send is disabled (the default mode), pressing this key does nothing and sounds the bell.

<reset> --

Pressing this key without simultaneously pressing the <control> key does nothing. With the control key depressed, this key resets the 3102 software to the state it assumed when turned on, except that the contents of the screen are unaffected, the cursor movement keys continue to operate as previously set, and block send and function keys remain enabled or disabled as they were before the reset. Note that software handshaking reverts to being selected. This key operates locally at all times.

<break> --

Pressing this key without simultaneously pressing the <control> key does nothing. With the <control> key depressed, this key sends a 100 msec break signal to the selected port.

<bktab> (back tab) --

If the 3102 is on-line, this key sends the sequence STX 'i'. If the software handshaking protocol is selected, both characters must be acknowledged by a STX. If function keys are disabled, pressing this key does nothing but sound the bell.

If the 3102 is off-line, pressing this key positions the cursor at the previous tab stop.

<clear all> --

If the 3102 is on-line, this key sends the sequence STX 'f'. If the software handshaking protocol is selected, both characters must be acknowledged by a STX. If function keys are disabled, pressing this key does nothing but sound the bell.

If the 3102 is off-line, pressing this key clears all unprotected fields on the screen and leaves the cursor in the first unprotected location.

<clear eos> (clear to end of screen) --

If the 3102 is on-line, this key sends the sequence STX 'g'. If the software handshaking protocol is selected, both characters must be acknowledged by a STX. If function keys are disabled, pressing this key does nothing but sound the bell.

If the 3102 is off-line, pressing this key clears all unprotected fields to the right of and below the cursor (including visual attributes; see Figure 3.5.6).

<clear eol> (clear to end of line) --

If the 3102 is on-line, this key sends the sequence STX 'h'. If the software handshaking protocol is selected, both characters must be acknowledged by a STX. If function keys are disabled, pressing this key does nothing but sound the bell.

If the 3102 is off-line, pressing this key clears all unprotected fields on the line to the right of the cursor (including field attributes).

<pause> --

If the 3102 is on-line, pressing this key sends the sequence STX '_'. If the software handshaking protocol is selected, both characters must be acknowledged by a STX. If function keys are disabled, pressing this key does nothing but sound the bell.

If the 3102 is off-line, pressing this key does nothing.

<print> --

If the 3102 is on-line, this key sends the sequence STX 'j'. If the software handshaking protocol is selected, both characters must be acknowledged by a STX. If function keys are disabled, pressing this key does nothing but sound the bell.

If the 3102 is off-line, pressing this key does nothing.

<help> --

If the 3102 is on-line, this key sends the sequence STX 'k'. If the software handshaking protocol is selected, both characters must be acknowledged by a STX. If function keys are disabled, pressing this key does nothing but sound the bell.

If the 3102 is off-line, pressing this key does nothing.

Alphanumeric and Special Character Keys --

If the 3102 is on-line, depressing one of these keys causes the corresponding ASCII character to be transmitted over the selected port.

If the 3102 is off-line, depressing one of these keys causes the keyed character to appear on the screen at the cursor position.

Regardless of whether the 3102 is on- or off-line, pressing the <l> key while holding down the <cntrl> key causes the status line to appear or disappear, depending on whether or not it was already being displayed.

Number pad keys other than <ce> and <enter>--

These keys (the digits '0'-'9', '.', and '-') have the same effect as their counterparts on the alphanumeric keyboard. They are duplicated in the form of a number pad only for convenience.

Numbered Function Keys --

If the 3102 is on-line, depressing one of these keys sends a two-character sequence consisting of a STX followed by the code indicated in the following table:

<u>Key #</u>	<u>Code Following STX</u>
1	70Hexadecimal
2	71H
3	72H
4	73H
5	74H
6	75H
7	76H
8	77H
9	78H
10	79H
11	7AH
12	7BH
13	7CH
14	7DH
15	7EH
16	7FH
17	6FH
18	6EH
19	6DH
20	6CH

If the software handshaking protocol is selected, both characters must be acknowledged by a STX.

If function keys are disabled, pressing any of these keys does nothing but sound the bell.

If the 3102 is off-line, pressing any of these keys does nothing.

3.7 3102 STATUS LINE

The bottom (25th) line of the screen can display information concerning the status of the 3102 (i.e.: whether it is ON-LINE or OFF-LINE, in LINE mode or PAGE mode, etc.) However, the 3102 does not normally display the status line. The operator can display the status line or cause it to disappear from the keyboard by simultaneously depressing the <control> key and the <status> key (labelled in red on the front of the <1> key), or it can be turned on and off by the host system. The status line appears automatically (i.e.: without operator intervention) when the CPU-message deposit function (see Micro Bee 2 Technical Users Manual) is invoked, informing the operator that there is a message waiting to be read.

The status line is divided into fields, A-H.

The messages that may appear in the various fields are as follows:

Field A--

Indicates whether the terminal is ONLINE or in LOCAL mode.

Field B--

Indicates whether the terminal is in LINE mode, PAGE mode, or LINE MONITOR mode.

Field C--

Indicates the state of the Data Set Ready line of the MAIN I/O port. DSR indicating TRUE, blank indicating FALSE.

Field D--

Indicates which I/O port (MAIN or AUX) is currently selected.

Field E--

Normally displays 'READY' indicating that nothing out of the ordinary has occurred, but also informs the operator of events that require immediate attention. If the initial self-testing detects any problems, either "ERR CK I/F", "ERR CK RAM", or "ERR CK ROM" is displayed in full intensity reverse video, blinking. If a message for the operator is waiting to be read, "MSSG WAIT" appears in full intensity reverse video blinking. If the 3102 is involved in a block transmission operation (and hence unable to service the keyboard), "MAIN SEND" or "AUX SEND" is displayed. Finally, if lines are locked on the screen through the use of the Screen Lock or the Line Lock functions, "SCREEN LOCK" or "LINE LOCK" is displayed.

Field F--

Usually blank. Used for:

- 1) indicating when the 3102 is "MODIFIED MODE",
- 2) indicating whether Insert Mode is in effect, and whether it is "LINE INSRT" or "PAGE INSRT".
- 3) indicating, when the 3102 is in USE FORMS mode, that the user has attempted to enter an invalid character into a restricted data field. The various messages are:

ALP/NUM MUST (alphanumeric must-enter)

ALPHA MUST (alphabetic must enter)

NUMERIC MUST (numeric must enter)

ALP/NUM TOTAL (alphanumeric total fill)

ALPHA TOTAL (alphabetic total fill)

NUMERIC TOTAL (numeric total fill)

ALPHA ONLY (alphanumeric no exit requirements)

NUMERIC ONLY (alphanumeric no exit requirements)

Field G--

Indicates whether the 3102 is in "USE FORMS", "MAKE FORMS", or "GRAPHIC" mode.

Field H--

Displays the 24-hour clock if it has been set. The format of the clock display is: HH:MM:SS.

Note: Fields F and G are used to display the terminal status message if it is invoked from the keyboard. This message supersedes existing information in these fields and will remain until any key is pressed. At that time, the status line returns to its previous state. See Fig. 3-9 for the interpretation of character positions in the status message.

