

Cromemco

C-5

Technical Reference Manual

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Chapter 1

INTRODUCTION

The Cromemco C-5 terminal is a microprocessor-controlled terminal offering many features usually found in more expensive terminals. The C-5 is designed to support a wide variety of data protocols, allowing it to be used as a component even in non-Cromemco systems.

The C-5 terminal provides many special features and capabilities. For example, you can:

1. Select from among six screens for display and writing. Write to one screen while displaying another.
2. Choose from among four complete ASCII character sets.
3. Define reverse video, blinking, half intensity, and underlined portions of the screen, in any combination.
4. Lock portions of the screen while allowing normal operation in the unlocked portion of the screen.
5. Read the cursor position or read the character at the cursor position.
6. Use a second, invisible cursor to write data to the screen independently from the main cursor.
7. Create charts and tables with a special set of graphics characters.
8. Set the C-5 internal clock and display the time on the bottom (25th) line of the screen.
9. Display messages on the bottom (25th) line of the screen.
10. Emulate the Zenith Z-29 terminal.

1. Introduction

Topics covered in this manual include C-5 setup, CKBA and CKBC keyboard operation, user-selectable modes of operation, C-5 special functions, graphics capabilities (including use of the C-5's four character sets), hardware disassembly, and technical specifications.

Chapter 2 explains the process of setting up the C-5 terminal. Chapter 3 describes the use of the CKBA and CKBC keyboards, including keyboard modification and the use of special keyboard and terminal functions. Chapter 4 describes user-controllable features of the C-5, and provides basic information on the C-5's various modes of operation. Chapter 5 gives a complete description of the C-5 special functions available to programmers writing application programs. Chapter 6 cover various hardware topics, such as disassembly and line voltage specification.

Appendix A uses programming examples from Cromemco Structured Basic and Z80 assembly language to illustrate some of the graphics capabilities described in Chapters 4 and 5. Appendix B through Appendix H summarize the keyboard and terminal information contained in Chapter 5. Appendix I through Appendix K provide technical information on a variety of topics, including connector descriptions, cable specifications, and character set modification.

Chapter 2

SETTING UP THE C-5 TERMINAL

ATTACHING CABLES

The cables transmit both power and information between the C-5 terminal, the keyboard, and the computer. By taking advantage of the connecting cables, the C-5 components can be arranged to suit your convenience.

The cables should be connected before the C-5 is plugged into a standard electric socket. The following information describes how to make the connections.

C-5 to Keyboard Cable

To connect the keyboard to the C-5, insert one end of the coiled keyboard cable into the back of the keyboard as shown in Figure 2-1. The cable will click into place when properly attached.

Insert the other end of the coiled cable into the connector labeled **KEYBOARD** on the back of the C-5, as shown in Figure 2-2. The cable will click into place when properly attached.

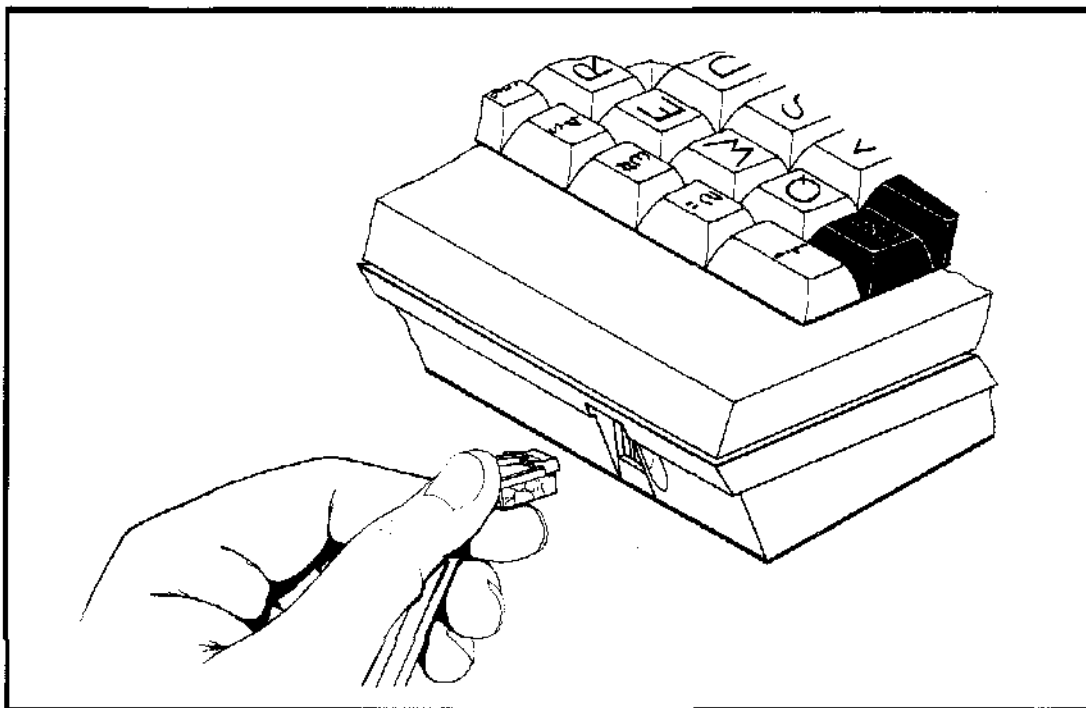


Figure 2-1: KEYBOARD CABLE TO KEYBOARD

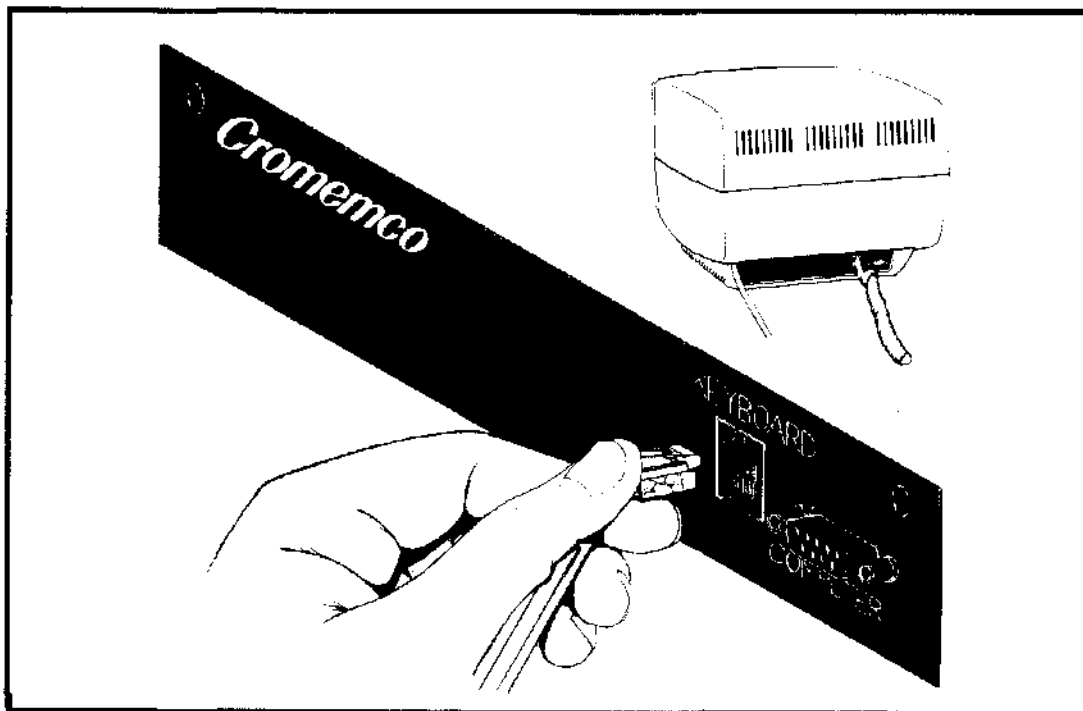


Figure 2-2: KEYBOARD CABLE TO C-5

C-5 to Computer Cable

Connect the C-5 to the computer using Cromemco cable model **CBL-CS** (part number 519-0161). Connect the 9-pin end of the cable to the connector labeled **COMPUTER** on the back of the C-5. Connect the 25-pin end of the cable to one of the connectors on the back of the computer system, as shown in Figure 2-3.

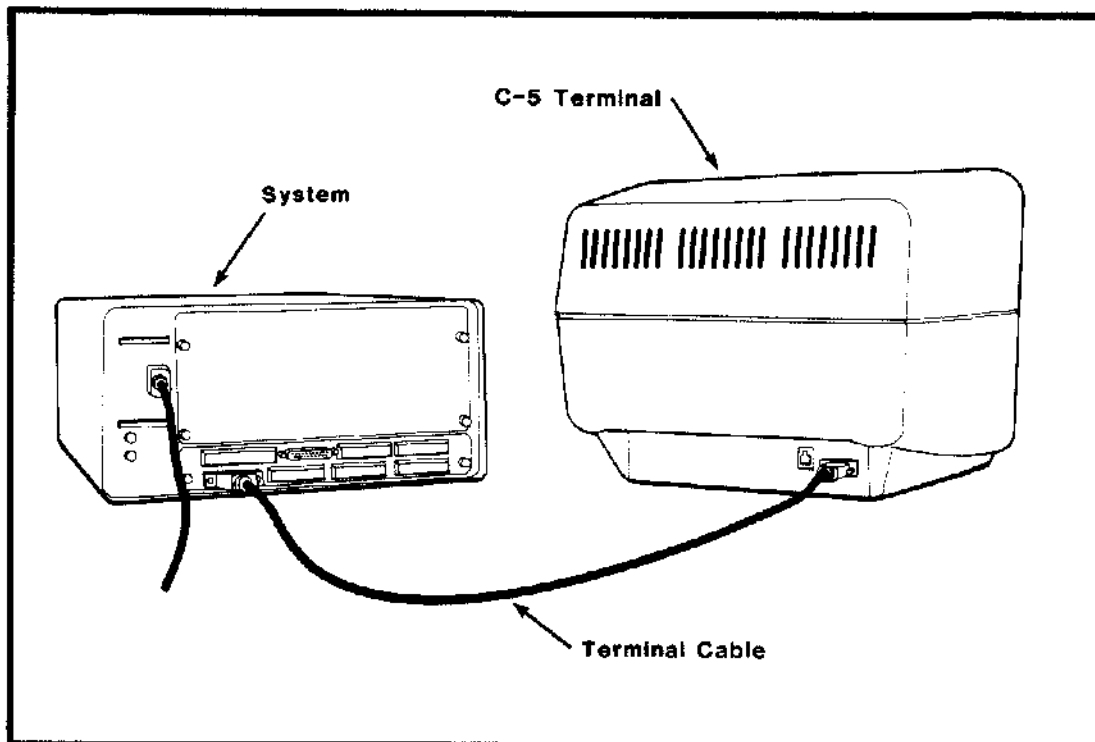


Figure 2-3: COMPUTER CABLE

TURNING ON THE POWER

There are two versions of the C-5, one designed for use with 110 volts AC and the other for use with 220 volts AC. It is possible to change the line voltage on your C-5 by following the instructions in Chapter 6. After making sure that your C-5 is designed to use the line voltage in your area, it can be plugged into any standard wall socket.

When the cables have been connected and the C-5 has been plugged in, it is ready to be turned on. Find the On-Off switch on the back of the C-5, next to the power cord (see Figure 2-4). Turn on the power by moving this switch to the ON position.

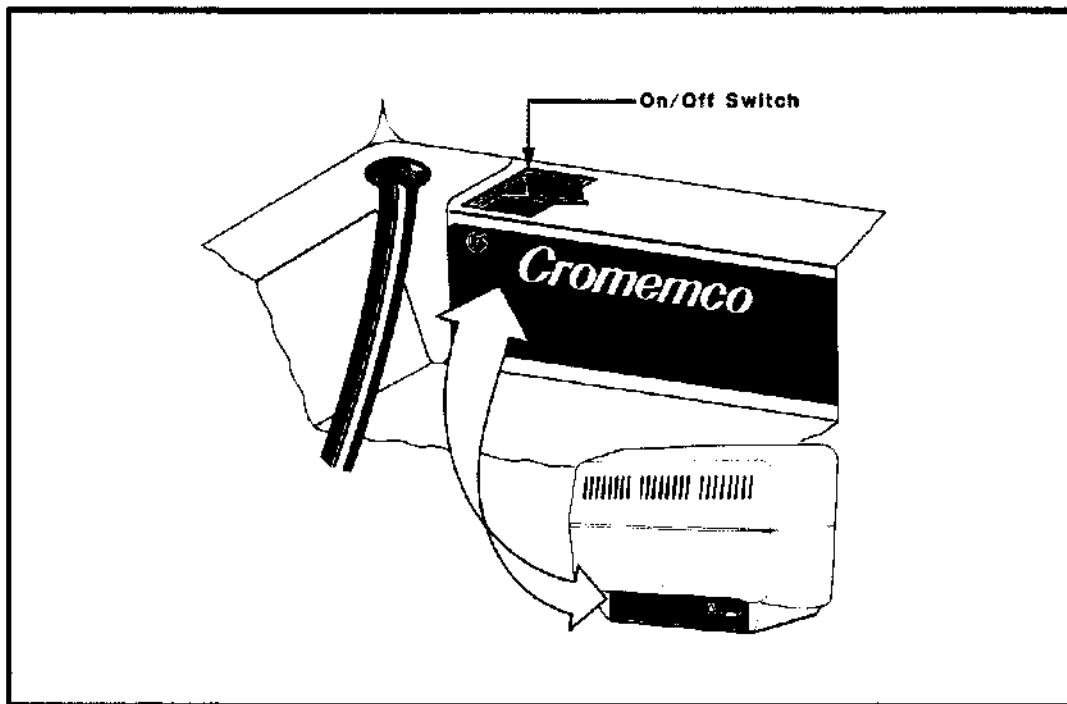


Figure 2-4: C-5 ON-OFF SWITCH

DIAGNOSTIC TESTS

Whenever the C-5 is turned on, it first checks to make sure that all its circuits are operating correctly. These diagnostic tests include a ROM checksum test, a RAM test, a bank switching test, and an interrupt test. About twenty seconds after turning on the C-5, the keyboard should beep once, indicating that the tests have been successful.

In the unlikely event that a problem is discovered during the automatic check, the screen will display the following message:

```
This C-05 may not be operating properly
Press C to use C-05, M for more information
```

If you are using your C-5 for the first time and receive this message, turn off the power switch, unplug the C-5 from the wall socket, and check all cable connections. Then plug the C-5 in again and turn it back on. If the message reappears, contact your authorized Cromemco dealer or repair facility for further instructions. If this message appears on a C-5 that has been operating properly, it is generally helpful to respond to the message (by pressing the letter **m** on the keyboard) and obtaining the additional information before contacting your dealer or repair facility.

COMMUNICATION SETTINGS

If the C-5 has passed the self-diagnostic tests performed during power-on, the operating system prompt from the remote computer should appear on the screen of the C-5 terminal. If the screen remains blank, press the RETURN key several times. If there is still nothing on the screen, or if strange characters appear when you type on the keyboard, you will have to change one or more of the C-5 default communication settings.

For example, the default baud rate of the C-5 is 9600 baud. If the operating system running on the computer expects the terminal to use some other baud rate, such as 19200, the C-5 baud rate will have to be changed using the following procedure.

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2. Setting Up the C-5 Terminal

To change any of the communication settings, or simply to view a list of the settings currently in effect, hold down both the CONTROL and SHIFT keys and press q. The following display will appear on the C-5 screen:

Press RETURN to use default settings (below), C to change settings

Baud Rate	= 9600
Stop Bit	= 1
Word length excluding parity	= 8
Parity	= None
Duplex	= Full
Xon-Xoff protocol	= Off
Terminal type	= C-05

Press RETURN if all the standard settings are acceptable. If the C-5 is connected to a Cromemco computer running the Cromix Operating System, you should not need to change any of the standard settings.

Press the c key to change one or more of the standard settings. The C-5 will prompt you for the proper values, as shown below. For each setting, type in the desired value and press RETURN. In each case, you can select the standard setting (displayed on the C-5 screen in angle brackets) by pressing RETURN.

0-19200	3-4800	6-1800	9-300	12-110
1-9600	4-3600	7-1200	10-150	13- 75
2-7200	5-2400	8- 600	11-135	14- 50

Baud Rate? <1>

Stop Bit (1 or 2)? <1>

Word length excluding parity (8, 7, 6, or 5)? <8>

Parity (0=odd, 1=even, 2=mark, 3=space, 4=none)? <4>

Duplex (0=full, 1=half)? <0>

Xon/Xoff protocol (1=On, 0=Off)? <0>

Terminal type (0=C-05, 1=Z-29)? <0>

Chapter 3

USING THE KEYBOARD

The CKBA and CKBC keyboards are used much like a typewriter keyboard to perform standard keyboard entry. These keyboards also perform many other functions. This chapter describes the keyboard layout and explains how to change keyboard characteristics to suit your needs.

KEYBOARD LAYOUT

On both the CKBA and CKBC keyboards, most of the keys operate exactly as they would on a typewriter. There are a few keys that are either not found on a typewriter or that act differently from what you might expect. The following paragraphs describe how to use these keys.

SHIFT Key

The SHIFT key performs the same function it does on a typewriter. It makes all alphabetic entries uppercase, and enters the upper symbol on all nonalphabetic keys. When used in conjunction with the ALPHA LOCK key (refer below), the SHIFT key performs the reverse of its normal function, changing uppercase to lowercase.

ALPHA LOCK Key

The ALPHA LOCK key makes all alphabetic entries uppercase, but does not affect any other keys. This feature is especially useful when typing material consisting of uppercase text and digits, such as computer programming statements. Press this key once to turn on the ALPHA LOCK feature. Press the ALPHA LOCK key once again to turn the feature off. When the keyboard is in the ALPHA LOCK mode, the SHIFT key makes alphabetic entries lowercase.

CKBC SHIFT LOCK Key

The SHIFT LOCK key on the CKBC keyboard makes all entries, both alphabetic and numeric, uppercase. Press this key once to turn on the SHIFT LOCK feature. Press the SHIFT LOCK key once again to turn the feature off. When the CKBC SHIFT LOCK key is depressed, pressing the SHIFT key has no effect.

ARROW Keys

The **cursor** is a marker on the screen indicating where typed characters will appear. When editing a file with a program such as WriteMaster, the cursor can be moved in any direction by pressing the ARROW keys. Pressing an ARROW key moves the cursor in the direction shown on the key.

DELETE Key

The DELETE key moves the cursor backwards one space, automatically erasing the character typed there.

CONTROL Key

The CONTROL key expands the capabilities of the keyboard by allowing regular alphabetical or numerical keys to perform different functions. The process is analogous to what happens when you use the SHIFT key. The SHIFT key enables another single key to perform a different function (e.g., print uppercase instead of lowercase, or print an entirely different symbol). Similarly, the CONTROL key enables each key on the keyboard to select a function that is different from its usual one of entering text. The specific function a particular key selects usually depends on the software your computer is currently using.

ESCAPE Key

The ESCAPE key is often used by itself to cancel an operation currently in progress and return you to what you were doing previously.

Like the CONTROL key, the ESCAPE key can be used in conjunction with other keys to specify alternative functions. The main difference (besides the particular functions selected) is that the other key is pressed only after the ESCAPE key is released. The functions these ESCAPE sequences perform are described in Chapter 5.

CKBA Function Keys

The top row of keys on the CKBA keyboard has an important purpose in addition to standard keyboard entry. These keys may be used to select useful operations when the C-10 is running a program that accepts function key input. In the WriteMaster word processing system, these function keys perform useful functions such as automatic centering of titles on a page, or displaying text in **boldface** type.

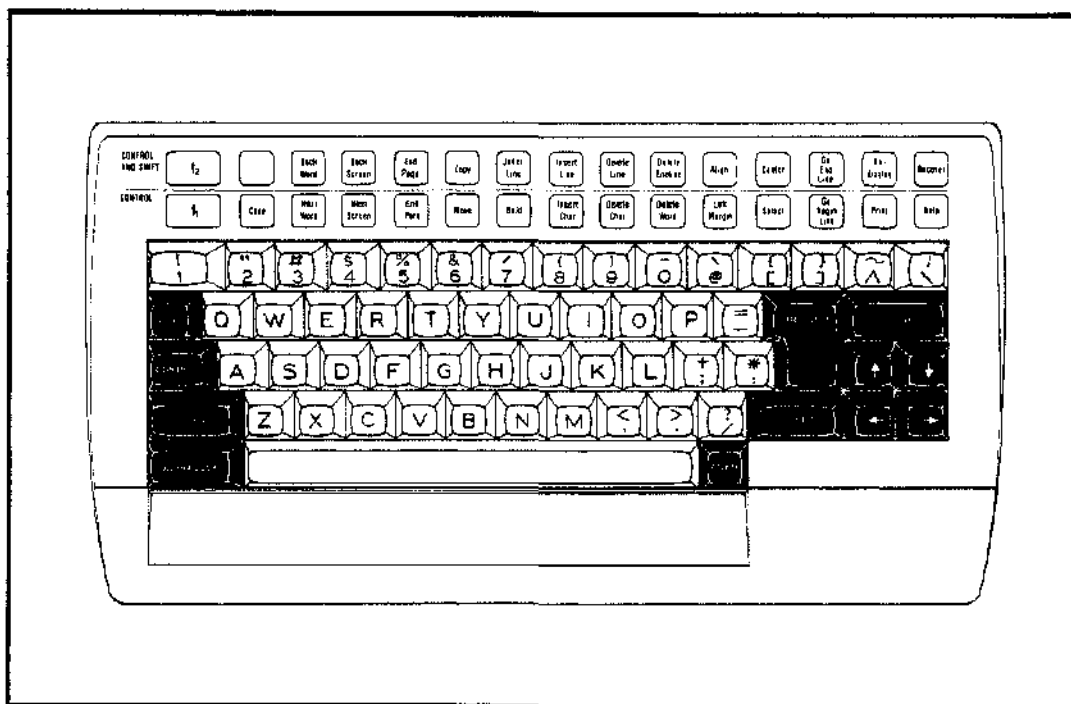


Figure 3-1: THE CKBA KEYBOARD

These special functions are identified on the label supplied with the CKBA keyboard. The label specifies two special functions that each key may perform. The function identified in the lower box of the label is performed if the CONTROL key is pressed and held down when that key is pressed. The function identified in the upper box of the label is performed if the CONTROL and SHIFT keys are pressed and held down together while that key is pressed. Information on the use of function keys with WriteMaster can be found in the Cromemco WriteMaster manual.

CKBC Function Keys

A row of twenty function keys occupies the upper portion of the CKBC keyboard. A translucent keystick supplied with the keyboard fits over this row of keys. The keystick indicates the functions these keys perform when you are using the WriteMaster word processing system. Functions listed on the bottom row of the keystick are selected by pressing the corresponding function key. Functions listed on the top row of the keystick are selected by holding down the SHIFT key while pressing the corresponding function key. Information on the use of function keys with WriteMaster can be found in the Cromemco WriteMaster manual.

The function key on the extreme right of the keyboard can be used anytime, even when you are not using the WriteMaster program. The functions for this key are labeled in red on the keystick, to indicate that the CONTROL key (a red key) must be held down while the key is pressed. Resetting the keyboard returns all the user-selectable keyboard characteristics (described as follows) to their default values. Resetting the terminal returns all the user-selectable terminal characteristics (described in Chapter 5) to their default values.

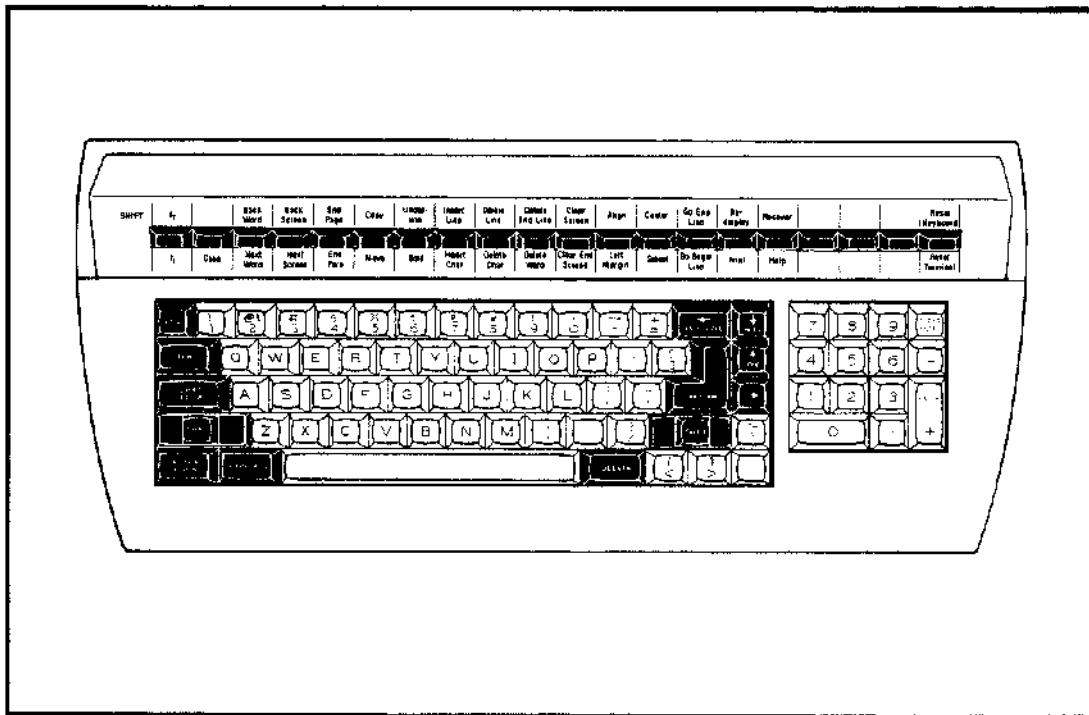


Figure 3-2: THE CKBC KEYBOARD

MODIFYING KEYBOARD CHARACTERISTICS

Several characteristics of the CKBA and CKBC keyboards can be changed to make them more suitable for certain projects or to accommodate user preferences. These characteristics are described below.

Audible Click

Normally the keyboard is silent except for the slight noise that pressing the keys makes. However, the keyboard can be changed so that each time a key is pressed, the keyboard will emit an audible click. This is particularly useful in numerical work, where confirmation of each entry is desirable.

To enable this option, hold down the CONTROL and SHIFT keys while pressing the c (for click) key. After releasing these keys, the keyboard will emit an audible click whenever any key is pressed.

When you want to disable the Audible Click option, hold down both the CONTROL and SHIFT keys and press the c key again. The Audible Click option will be disabled. The option is automatically disabled when the C-10 is turned on or when the keyboard is reset.

Rate of Repetition for Automatic Repeat

All alphanumeric keys on the keyboard automatically repeat when held down. The rate of repetition can be speeded up or slowed down, as can the delay between the time the key is first pressed and when it starts repeating.

There are five repeat rates and delay intervals that can be selected. These are summarized in the table below.

Rate of Repetition	Initial Delay
50 characters per second	0.3 second
33 characters per second	0.4 second
20 characters per second	0.5 second
17 characters per second	0.6 second
14 characters per second	0.7 second

The standard, or default, rate of repetition is represented by the second line in the table (33 characters per second and a delay of 0.4 second before repetition begins).

To select any other rate or delay interval, hold down the CONTROL and SHIFT keys and press the d (for delay) key. The rate of repetition (and corresponding delay interval) changes to the next line in the table (e.g., 20 characters per second and a delay of 0.5 second).

If the CONTROL, SHIFT, and d keys are pressed once again, the rate changes to the next line in the table, and so on. Once the bottom line of the table is reached, the next selection activates the top line of the table, and the five-choice cycle can be repeated. The keyboard emits a short beep each time a new repeat rate is selected. A louder beep is emitted when the default repeat rate is selected once again. The default rate is automatically selected when the C-10 is turned on, or when the keyboard is reset.

CKBC Turn Off Automatic Repeat

You can turn off the automatic repeat feature by holding down both the CONTROL and SHIFT keys and pressing the a key. To turn on automatic repeat once again, press the same combination of keys. Automatic repeat is enabled each time the C-10 is turned on and each time the keyboard is reset.

CKBA Numeric Keypad

It is often faster and more convenient to enter numeric information via a standard 10-key keypad than to enter it using the top row of keys, as with a typewriter. The CKBA keyboard accommodates this need in an unusually efficient way. Because the 7, 8, and 9 keys occur both on the top row of a standard keyboard and the top row of a standard numeric keypad, they are used to define a section of the CKBA keyboard that can be converted from normal entry to standard 10-key numeric entry as shown in Figure 3-3.

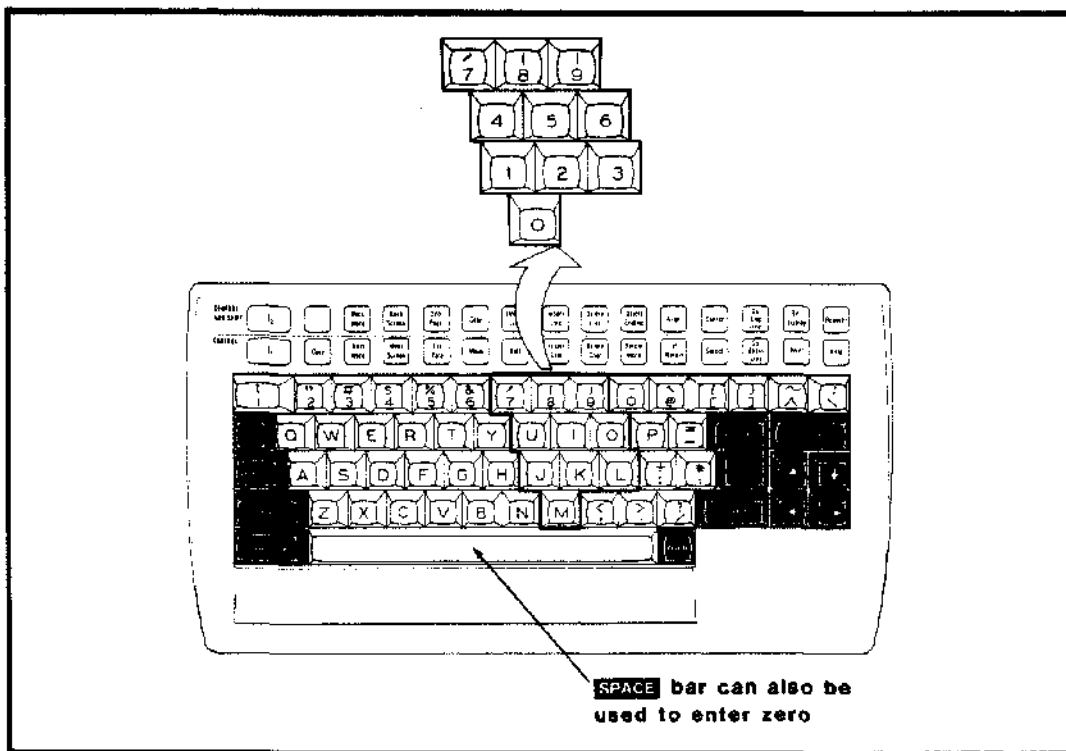


Figure 3-3: THE CKBA NUMERIC KEYPAD

3. Using the Keyboard

To convert this section of the CKBA keyboard to a 10-key numeric keypad, hold down the CONTROL and SHIFT keys, and then press the **n** (for numeric) key. When this is done, numeric information can be entered on the illustrated section of the keyboard, and surrounding keys on the keyboard will be disabled (to prevent entry of unwanted information). A few standard keyboard characters (such as a decimal point), which are often used during numeric entry, continue to work when the Numeric Keypad option is in operation. The characters that continue to work when the numeric keypad is in operation are:

- , (comma)
- . (period, or decimal point)
- (dash, or minus sign)
- + (plus sign)
- * (asterisk)
- / (slash mark)

RETURN

When the Numeric Keypad option is engaged, the SHIFT or ALPHA LOCK keys cause all keys to temporarily revert to their standard definitions.

To disengage the Numeric Keypad option and restore the keyboard to normal entry, hold down CONTROL and SHIFT and press **n**. Then release these keys, and normal operation will be restored.

Special Points about the CKBC Keyboard

Four keys on the CKBC keyboard:

- 1/4
- 1/2
- CENT (SHIFT-6)
- CLEAR ENTRY

only pass function codes to the application program currently running. The particular application program may or may not be designed to take advantage of these keys. These symbols are not displayed with the standard software supplied, though future versions of the software may support them.

One other symbol:

` (SHIFT-2)

is selected by holding down the CONTROL key while pressing the 2 key. Holding down the SHIFT key while pressing the 2 key selects the symbol @.

KEYBOARD ADJUSTMENT

Normal wear may occasionally cause the keys around the edges of the keyboard to stick. This can also occur after shipping. To correct this, simply recenter the keyboard in its plastic casing. For minor sticking problems, stand the keyboard on its side with the sticking keys at the top end. Tap the keyboard gently on a hard surface. This should eliminate any problem with sticking keys.

Chapter 4

C-5 TERMINAL OPERATION

USER-CONTROLLABLE FEATURES OF THE C-5

Many of the features available on the C-5 are designed to be controlled easily from the keyboard. This section describe the features you will find most useful.

Brightness

You can adjust the brightness of the screen using the ARROW keys with the CONTROL and SHIFT keys. Hold down both the CONTROL and SHIFT keys, and press the ARROW keys for the desired effect:

up	increase foreground brightness
down	decrease foreground brightness
right	increase background brightness
left	decrease background brightness

Screen Selection

The C-5 has six independent screens, numbered 0 through 5. The default screen (the screen that is normally displayed and written to) is screen 0. If you turn on the C-5 status line (described later in this chapter), you will see the message **screen 0** displayed in field C.

Screen 0 is the screen normally used for display and writing, but you can select any of the other five screens for display and writing by using the angle-bracket keys, < and >, with the CONTROL and SHIFT keys. Hold down both the CONTROL and SHIFT keys, and press one of the angle-bracket keys. Pressing > selects the next screen for display and writing. Pressing < selects the previous screen for display and writing. If you turn on the C-5 status line (described later in this chapter), you will see the number of the currently selected screen displayed in field C.

4. C-5 Terminal Operation

This multi-screen capability of the C-5 serves many purposes. For example, whatever is displayed on the currently selected screen can be saved for later display by selecting another screen for display and writing. This could be a list of files on a diskette, error messages, or the text of a letter you are writing a response to. You can even switch back and forth between screens while using a text editor or other program.

Screen On/Off

The C-5 screen shuts off automatically after ten minutes of keyboard inactivity, thereby prolonging the life of the screen.

To turn on the screen, press any key on the C-5 keyboard. To turn on the screen without moving the cursor or otherwise altering the display, hold down both the CONTROL and SHIFT keys and press the f key.

You can turn the screen off at any time by holding down both the CONTROL and SHIFT keys and pressing the x key.

Status Line

The bottom (25th) line of the screen can display information concerning the status of the C-5 (for example, whether it is in Online Mode or Local Mode, which screen is currently being displayed, etc). The C-5 does not normally display the status line. To display the status line, hold down the CONTROL and SHIFT keys and press the s (for status) key. You can turn off the status line by pressing CONTROL-SHIFT-S again, or you can leave the status line turned on. The status line can also be turned on or off with the command **ESCAPE - (1Bh 2Dh)**.

The status line is divided into fields A through F. The messages that may appear in the various fields are shown in Figure 4-1. The shaded portion of the figure indicates the contents of the status line when all the default settings are in effect. The remaining portion indicates other messages that are only displayed when specific settings are changed.

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 4. C-5 Terminal Operation

online		screen 0				
local keytest	ln ins pg ins	screen 1 screen 2 screen 3 screen 4 screen 5	line lock area lock key lock	British German French Spanish . . . graphic SO mode monitor	<user/host-definable message> (29 characters)	HH:MM:SS

Figure 4-1: THE C-5 STATUS LINE

Field A - This field indicates whether the C-5 is in Online Mode, Local Mode or Keystest Mode.

Field B - This field indicates when the C-5 is in Line Insert Mode (ln ins) or Page Insert Mode (pg ins).

Field C - This field shows which of the six screens is currently being displayed.

Field D - If lines are locked on the screen through the use of the Screen Lock or the Line Lock functions, **line lock**, **area lock**, or **key lock** is displayed.

Field E - This field is used to mark the use of other character sets, Graphics mode, SO mode, and Monitor mode).

Field F - This field can be used to display a message of up to 30 characters. Field F can be programmed to stay on continually, or to disappear when the status line is turned off. Refer to the section Status Line and Message Line Functions in Chapter 5 for information on displaying short messages in this field.

Field G - This field displays the 24-hour clock if it has been set. To set the clock, first enter Local Mode using the CONTROL-SHIFT-L command. Next, press the ESCAPE key and then the SPACE key (1Bh 20h). The C-5 interprets the next six characters typed as indicating the time of day: **HHMMSS** (hours, minutes, and seconds). Remember to return to Online Mode using the CONTROL-SHIFT-L command. (This same sequence could be sent from the host, without changing to Local Mode and back to Online Mode.)

Field G can be programmed to stay on continually, or to disappear when the status line is turned off. Refer to the section Status Line and Message Line Functions in Chapter 5 for more information on setting and displaying the C-5 clock.

Message Line

The bottom (25th) line of the screen can display an 80-character message line. The C-5 does not normally display the message line. To display the message line, hold down the CONTROL and SHIFT keys and press the m (for message) key. You can turn off the message line by pressing CONTROL-SHIFT-M again. Refer to the section Status Line and Message Line Functions in Chapter 5 for information on depositing, displaying, and removing messages.

C-5 MODES OF OPERATION

The C-5 can operate in many different modes, both to fit the requirements of the host system and to meet the specialized needs of the programmer. The most important of these modes are described in this section. Refer to Appendix E for information on other options.

Online Mode and Local Mode

Online Mode is the normal mode of operation for the C-5. In Online Mode, characters typed on the keyboard are transmitted to the computer and data received from the computer is displayed on the screen. It may seem that you are typing characters directly on the screen, but it is, in fact, a two-step process.

In Local Mode, characters typed on the keyboard are displayed directly on the screen, not passed through the computer. You can use the ARROW keys to move the cursor around the screen, typing characters in any location. When the C-5 is in Local Mode, you can give most of the commands in this chapter by typing them on the keyboard. For example, you can select different character sets and video attributes by typing the appropriate commands. In Local Mode, you can use the screen as a scratchpad, experimenting with the effects of the various commands described in this chapter.

When you first turn on the C-5, it is in Online Mode. To select Local Mode, hold down both the CONTROL and SHIFT keys and press the 1 (for local) key. To select Online Mode again, use this same procedure.

Monitor Mode

The first two rows of each character set (00h through 1Fh) correspond to nonprinting CONTROL characters (refer to the character set tables in Appendix B). They are called CONTROL characters because they can be typed on the keyboard by holding down the CONTROL key while pressing another key. The C-5 must be in Monitor Mode to display these characters.

In Monitor Mode normal interpretation of control characters is suspended. For this reason, most C-5 commands do not work in Monitor Mode. For example, command sequences beginning with ESCAPE cannot be executed because ESCAPE is a control character (CONTROL-[, 1Bh). Even the TAB (CONTROL-I, 09h) and RETURN (CONTROL-M, 0Dh) keys represent CONTROL characters that cannot perform their normal functions in Monitor Mode. Enter Monitor Mode only to display characters in the first two rows of each character set. Exit Monitor Mode immediately afterwards. (Note that all printable ASCII characters can also be printed in Monitor Mode.)

For details on using Monitor Mode, refer to the section Mode Control Functions in Chapter 5. The Cromemco Structured Basic programming example provided in Appendix A illustrates the use of Monitor Mode to display CONTROL characters. All CONTROL character printed representations are included in the character set tables in Appendix B.

Cursor Pad Local/Online

The cursor pad may be set to operate locally even if the C-5 is in Online Mode. In this mode, the cursor movement keys move the cursor on the screen without transmitting anything. However, in the Cursor Pad Online Mode, the cursor movement keys transmit CONTROL characters and have no direct effect on the cursor position. The sequence ESCAPE . 4 sets the cursor pad Online. The sequence ESCAPE . 5 sets the cursor pad Local.

For details, refer to the section Cursor Control Functions in Chapter 5.

Graphic Mode

In Graphic Mode, certain ASCII characters are interpreted as specifying one of 11 different graphics symbols with one of four different video attributes. These symbols may be used in constructing line drawings, charts, etc. Appendix D shows the Graphic Mode symbols and their ASCII equivalents.

Graphic Mode is turned on by **ESCAPE R** (1Bh 52h) and turned off by **ESCAPE S** (1Bh 53h). The commands **ESCAPE R** and **ESCAPE S** can be given either from the keyboard in Local Mode or from a program running on the remote computer in Online Mode.

Graphic Mode is not the same as the graphics character set. For details, refer to the section Character Set and Video Attribute Functions in Chapter 5.

SO Mode

SO Mode is used with alternately defined character sets (for example, foreign language and graphic character sets). Entering SO Mode causes the C-5 to "shift out" of the standard ASCII set into the alternately defined character set.

On the C-5 screen, ASCII characters 40h through 5Fh are displayed in SO Mode as CONTROL characters 00h through 1Fh. For the display symbols corresponding to these CONTROL characters, refer to the character set tables in Appendix B.

CONTROL-N (0Eh) turns on SO Mode and **CONTROL-O** (0Fh) turns off SO Mode.

CHARACTER SETS

The C-5 can display four different character sets. In addition to the normal alphanumeric character set, there are character sets for graphics, alphanumeric boldface, and technical/math.

Appendix B contains complete tables of all four character sets. The row and column numbers for each character correspond to its ASCII code. For example, the character "n" (row 6, column E) has the ASCII code 6E (hexadecimal). Each ASCII code corresponds to four different characters, one from each character set. Which of the four characters appears on the screen depends on which of the four character sets has been selected.

In addition to the four character sets, there are several video attributes that determine how the characters will appear on the screen. Each of the four character sets can be displayed using any of these video attributes.

Normal (light characters, dark background)
Reverse (dark characters, light background)
Half-intensity (medium characters, dark background)
Blinking (characters blink on and off)
Underlined (underlined characters)

These video attributes can be used individually or in combination. For example, you can have the screen display underlined, blinking, half-intensity, reverse characters, using any of the four character sets. You can select up to 16 different character set and video attribute combinations on each line of the screen.

A character set and video attribute combination is selected with a special sequence of characters: an ESCAPE character (1Bh), followed by a lowercase d (64h), and finally the code for the particular combination of character set and video attributes that you want. (Appendix C gives the codes for selecting various combinations of character sets and video attributes.) For example, the sequence ESCAPE d V selects the graphics character set in blinking reverse video. The sequence ESCAPE d @ reselects the standard character set and normal video attribute.

A video setting selected with the ESCAPE d command creates a video field that extends "downstream" from the current cursor position to the position of the next video setting on the screen (or to the end of the screen if no other video setting is encountered). Any characters you type in this video field, and any characters that were already typed there, will be displayed in the selected character set and video attribute combination.

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Up to 16 video settings can be entered on a given line. Additional settings will be ignored.

Once you have defined a particular video field by placing a video setting on the screen, you can redefine that field either by replacing the old video setting with a new one using the **ESCAPE d** command, or by erasing the old video setting with the **ESCAPE e** command. In either case, the cursor must be located at the position of the old setting when the command is given. Refer to the section Cursor Control Functions in Chapter 5 for information on how to move the cursor to a given location on the screen. Refer to the section Character Set and Video Attribute Functions in Chapter 5 for further information on using video settings.

Chapter 5

C-5 SPECIAL FUNCTIONS

The C-5 has a large number of special functions. These functions can be called from the keyboard in Local Mode, or from a program running on the remote system connected to the C-5. These functions are called with special sequences of characters. In most cases, the first character used is ESCAPE (1Bh). The ESCAPE is followed by one or two characters that serve to identify the function desired; if the specified function needs further arguments, more characters must be supplied.

The C-5 functions are described in detail in this chapter. For a summary of the C-5 functions and the codes used to select them, see the tables in Appendix E.

EDITING FUNCTIONS

Delete Line - Receipt of an **ESCAPE M** (1Bh 4Dh) causes the line the cursor is on to be deleted. The remaining lines are each moved up one line, and a blank line is inserted at the bottom-most unlocked line of the screen. The cursor is left at the beginning of the line that moved into the space formerly occupied by the deleted line. Video attributes, if any, on the deleted line are also removed. The last (rightmost) video attribute that was on the deleted line is automatically placed in column one of the following line if a video attribute does not already exist there. If no attribute was deleted, then no attribute is carried over.

Insert Line - Receipt of an **ESCAPE L** (1Bh 4Ch) causes all data starting at the beginning of the line the cursor is on 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 bottom-most unlocked display line, including attributes, is lost.

5. C-5 Special Functions

Delete Character (on a LINE basis) - Receipt of an **ESCAPE P** (1Bh 50h) 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. Video attributes cannot be deleted or shifted with this function.

Delete Character (on a PAGE basis) - Receipt of an **ESCAPE `** (1Bh 60h) 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, unless wraparound is turned off) and a SPACE is inserted in last position of line 24. Video attributes are not disturbed or shifted in any way by this function.

Insert Character (on a LINE basis) - Receipt of an **ESCAPE Q** (1Bh 51h) causes the C-5 to enter a mode in which data to the right of the cursor on the current line shifts 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 C-5 is in this mode, **ln ins** appears in field B of the Status Line. Video attributes are not shifted when this function is used.

Insert Character (on a PAGE basis) - Receipt of an **ESCAPE a** (1Bh 61h) causes the C-5 to enter a mode in which data to the right of and below the cursor shifts right as new characters are entered (characters in column 80 wrap to the beginning of the next line, unless wraparound has been turned off). 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 C-5 is in this mode, **pg ins** appears in field B of the Status Line. Video attributes are not shifted when this function is used.

Turn Off Wraparound - Receipt of an **ESCAPE . J** (1Bh 2Eh 4Ah) is used with the mode Insert Character (on a PAGE basis). Inserting a character with wraparound turned off causes the character in the last column of each line to drop off the right edge of the display and be lost.

Turn On Wraparound - Receipt of an **ESCAPE . L** (1Bh 2Eh 4Ch) is used with the mode Insert Character (on a PAGE basis). Inserting a character with wraparound turned on causes the character in the last column of each line to be moved to the first column of the following line. Wraparound On is the default mode of the C-5.

Insert Character OFF - Receipt of an **ESCAPE @** (1Bh 40h) causes the C-5 to leave Insert Character Mode.

Insert Column on Left - Receipt of an **ESCAPE . O** (1Bh 2Eh 4Fh) causes a sequence of characters to be inserted in the first column of each line. To use the command **ESCAPE . O**, perform the following steps:

1. Move the cursor to the first column of the first row (**ESCAPE H**).
2. Turn off wraparound (**ESCAPE . J**).
3. Select the mode Insert Character (on a PAGE basis) (**ESCAPE a**).
4. Insert one space at the cursor position.
5. Give the command **ESCAPE . O**.
6. Supply a one-byte value (between 1 and 24) specifying the number of characters to be inserted.
7. Supply the number of characters specified in step 6. One character will be placed in the first column of each line.

Insert Column on Right - Receipt of an **ESCAPE . P** (1Bh 2Eh 50h) causes a sequence of characters to be inserted in the last (80th) column of each line. To use the command **ESCAPE . P**, perform the following steps:

1. Move the cursor to the first column of the first row (**ESCAPE H**).
2. Turn off wraparound (**ESCAPE . J**).
3. Select the mode Delete Character (on a PAGE basis) (**ESCAPE `**).
4. Delete one space at the cursor position.
5. Give the command **ESCAPE . P**.

6. Supply a one-byte value (between 1 and 24) specifying the number of characters to be inserted.
7. Supply the number of characters specified in step 6. One character will be placed in the last column of each line.

These two functions, Insert Column on Left and Insert Column on Right, can be used to implement horizontal scrolling.

CURSOR CONTROL FUNCTIONS

Cursor Toggle - Receipt of an **ESCAPE Z** (1Bh 5Ah) toggles the cursor on or off. This function simply makes the cursor visible or invisible; all cursor control keys and functions associated with the cursor continue to operate normally.

Cursor Off - Receipt of an **ESCAPE q** (1Bh 71h) turns off the cursor. If the cursor is already turned off, this command has no effect. All cursor control keys and functions associated with the cursor continue to operate normally.

Cursor On - Receipt of an **ESCAPE r** (1Bh 71h) turns on the cursor. If the cursor is already turned on, this command has no effect.

Cursor Home - Receipt of an **ESCAPE H** (1Bh 48h) causes the cursor to move to the Home position: column 1, line 1. If portions of the display are locked (through the Screen Lock or Line Lock functions), the cursor moves to the first unlocked character position on the screen.

Cursor Left - Receipt of an **ESCAPE D** (1Bh 44h) 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.

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 **ESCAPE C** (1Bh 43h) 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 the Home position.

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 **ESCAPE A** (1Bh 41h) causes the cursor to move up one line. On reaching line 1, it wraps to line 24.

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

Cursor Down - Receipt of an **ESCAPE B** (1Bh 42h) causes the cursor to move down one line. On reaching line 24, it wraps to line 1.

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

Arrow Keys Online - Receipt of an **ESCAPE . 4** (1Bh 2Eh 34h) causes the cursor movement keys to transmit CONTROL characters when they are pressed, and to have no local effect.

Arrow Keys Local - Receipt of an **ESCAPE . 5** (1Bh 2Eh 35h) causes the cursor movement keys to move the cursor on the screen when they are pressed without transmitting anything, regardless of whether the C-5 is in Local or Online Mode.

The C-5 will refuse to invoke this function if it is in Local Mode.

Line Feed - Receipt of a linefeed character (LF, 0Ah) causes the cursor to move down to the next line. The lateral (horizontal) position of the cursor is not altered. 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.

5. C-5 Special Functions

Carriage Return - Receipt of a RETURN character (0Dh) causes the cursor to move to column 1 of the current line.

Horizontal Tab - Receipt of a TAB character (09h) 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.

Back TAB - Receipt of an ESCAPE > (1Bh 3Eh) causes the cursor to back up to the previous TAB stop, wrapping at line boundaries. If in the Home position, the cursor will not move.

Cursor Address - Receipt of an ESCAPE F (1Bh 46h) or an ESCAPE Y (1Bh 59h) causes the C-5 to interpret the next two characters received as a line number and a column number, 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. Refer to Appendix G for line and column number codes. To obtain the code for a given column or line number, simply add 1Fh 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 screen.

Use Invisible Second Cursor - The Invisible Second Cursor is used to write data to the screen independently from the main cursor. The Invisible Second Cursor must be explicitly positioned every time it is used. The line and column codes used for positioning the cursor are identical to those used to position the main cursor (refer to Appendix G). The Invisible Second Cursor cannot be used in Local Mode.

The data sequence is: ESCAPE (1Bh), ^ (5Eh), line address, column address, data, GS (1Dh). The line and column addresses are similar in form to those described above in the section Cursor Address. If an invalid row or column address is issued, the sequence is ignored and aborted.

After the two cursor positioning characters are sent, the data to be displayed on the screen is sent. Attempting to write beyond column 80 of the current line causes an automatic wrap to the beginning of the next line. Upon reaching column 80 of line 24, the display wraps to column 1 of line 1.

Any CONTROL or attribute characters (with the exception of a GS character) are not acted upon, but are displayed as in Monitor Mode, described in the section Additional Mode Control.

The GS (Group Separator, 1Dh) character is used to terminate the entry of the data. If it is desired only to position the cursor, and not display any data, the sequence ESCAPE (1Bh), ^ (5Eh), line, column, GS (1Dh) is used. This would normally be done in conjunction with the function Read Character at Invisible Second Cursor, described in the section Terminal Inquiries.

The Invisible Second Cursor is not affected by any of the screen lock or line lock functions and, therefore, may write to any area of the screen.

SCREEN CONTROL FUNCTIONS

The C-5 contains six pages of screen memory. The keyboard commands for controlling these six screens are described in Chapter 4. In addition, these screens can be controlled from a program by using the commands described in this section.

Initialize and Write to a Screen - Receipt of an ESCAPE . S (1Bh 2Eh 53h), followed by an ASCII number from 0 to 5, causes the designated screen to be selected for writing. (This command is included for compatibility with the Cromemco C-10 computer. On the C-5, this command does not erase the screen.) All screen input will be directed to the selected screen until a different screen is selected for writing. Selecting a screen for writing does not automatically select that screen for display.

Display a Screen - Receipt of an ESCAPE . U (1Bh 2Eh 55h), followed by an ASCII number from 0 to 5, causes the designated screen to be selected for display. Selecting a screen for display does not automatically select that screen for writing.

Write to a Screen - Receipt of an **ESCAPE . W** (1Bh 2Eh 57h), followed by an ASCII number from 0 to 5, causes the designated screen to be selected for writing.

All screen input will be directed to the selected screen until a different screen is selected for writing. Selecting a screen for writing does not automatically select that screen for display.

Change Screen-Link Flag - Receipt of an **ESCAPE . n** (1Bh 2Eh 6Eh), followed by an ASCII digit '0' or '1', causes the screen-link flag to be set. A '0' turns the flag off, a '1' turns the flag on. Normally, after writing to the last line on the currently selected screen, the text on the screen scrolls upward and is lost, while new text continues to be written to the currently selected screen. When the screen-link flag is set, writing to the last line on the currently selected screen causes the next screen to be erased and then selected for writing and display. This linking from one screen to the next will continue as long as the flag is set. When all six screens have been cycled through, the starting screen will be erased and selected for writing and display.

Disable "Change Page" - Receipt of an **ESCAPE . V** (1Bh 2Eh 56h) causes the C-5 to ignore attempts to select a screen using the keyboard commands **CONTROL-SHIFT-<** AND **CONTROL-SHIFT->**.

Enable "Change Page" - Receipt of an **ESCAPE . T** (1Bh 2Eh 54h) causes the C-5 to let the user select a screen using the keyboard commands **CONTROL-SHIFT-<** AND **CONTROL-SHIFT->**.

Turn Off the Screen - Receipt of an **ESCAPE . X** (1Bh 2Eh 58h) causes the C-5 screen to be turned off.

Turn On the Screen - Receipt of an **ESCAPE . Y** (1Bh 2Eh 59h) causes the C-5 screen to be turned on, with no changes (any character sent to the C-5 can turn on the screen).

SCREEN ERASURE FUNCTIONS

Clear Screen - Receipt of an **ESCAPE E** (1Bh 45h) causes the entire display to be erased. This also includes all logical and video attributes. If a Screen Lock is currently in effect, the locked portion of the screen will not be cleared. In addition, locked lines will not be erased. The cursor is moved to the Home position (the uppermost unlocked line of the screen, column 1).

Clear to End of Line - Receipt of an **ESCAPE K** (1Bh 4Bh) causes all characters on the current line to the right of the cursor to be deleted. Any video and logical attributes in the deleted area are also removed. However, the last video attribute, if any, that is deleted by this function is automatically placed in column 1 of the following line. If a video attribute already exists in column 1 of this line, the last deleted attribute is not carried over.

Clear to End of Screen - Receipt of an **ESCAPE J** (1Bh 4Ah) causes all characters on the current line to the right of the cursor and all data on succeeding lines to be deleted. Any video and logical attributes in the deleted area are also removed.

CHARACTER SET AND VIDEO ATTRIBUTE FUNCTIONS

Enter Video Setting - Receipt of an **ESCAPE d** (1Bh 64h) causes the C-5 to interpret the next character received as specifying a character set and video attribute combination, and to enter that video setting immediately before the character at the current cursor position. In this way, it is possible to select alternate character sets and to define areas of the C-5 screen so that characters entered there will be displayed in a particular way. For example, by entering a **reverse-video** video setting 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 setting is then entered in column 1 of line 13, only line 12 will be displayed in reverse video. Finally, if the **underline-reverse** video attribute is entered in column 41 of line 12, nothing will change except that any characters entered in the right half of line 12 (including those already there) will be underlined. The

character codes that select particular video settings are given in Appendix C. Appendix A contains example programs in Structured Basic and Z80 assembly language.

Up to 16 video settings can be entered on a given line.

A very important consideration when using video settings is that they always remain fixed in their originally assigned position within a line; they do not shift position with any of the Insert Character or Delete Character functions. However, the line a video setting is on will shift up or down with the Insert Line or Delete Line functions.

ESCAPE l (1Bh 6Ch) has the same effect as **ESCAPE d B** (1Bh 64h 42h). **ESCAPE (** (1Bh 28h) has the same effect as **ESCAPE d P** (1Bh 64h 70h). **ESCAPE m** (1Bh 6Dh) and **ESCAPE)** (1Bh 29h) have the same effect as **ESCAPE d @** (1Bh 64h 40h).

A video setting should not be placed at a location containing a Graphic Mode character.

Delete Video Setting - Receipt of an **ESCAPE e** (1Bh 65h) causes the C-5 to delete the video attribute, if any, at the current cursor position.

Swap Character Sets 1 and 2 - Receipt of an **ESCAPE . E** (1Bh 2Eh 45h) causes character sets 1 and 2 to be interchanged. Note that swapping character sets does not affect data and attributes already existing on the screen, but rather changes the way in which subsequently entered attributes are interpreted.

Swap Character Sets 1 and 3 - Receipt of an **ESCAPE . F** (1Bh 2Eh 46h) causes character sets 1 and 3 to be interchanged.

Swap Character Sets 1 and 4 - Receipt of an **ESCAPE . G** (1Bh 2Eh 47h) causes character sets 1 and 4 to be interchanged.

Reestablish Character Set Defaults - Receipt of an **ESCAPE . @** (1Bh 2Eh 40h) causes the character sets to return to their default assignments. Refer to Appendix B for tables of the default character set assignments.

Enter Graphic Mode - Receipt of an **ESCAPE R** (1Bh 52h) causes the C-5 to enter a mode in which some ASCII codes can specify one of 11 different graphic symbols in four different ways (refer to Appendix D). These symbols may be used to construct line drawings, borders, etc.

A Graphic Mode character should not be placed in a location where a video setting has been placed.

Exit Graphic Mode - Receipt of an **ESCAPE S** (1Bh 53h) turns the Graphic Mode off. It causes the C-5 to again interpret all ASCII codes as representing the standard alphanumeric characters.

LOCKING FUNCTIONS

Lock Screen - Receipt of an **ESCAPE g** (1Bh 67h) 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.

The C-5 will refuse to invoke the Screen Lock function if the cursor is on either the top or the bottom (24th) line. The C-5 will refuse to invoke the Screen Lock function if any lines have been locked on the screen via the Line Lock function.

Unlock Screen - Receipt of an **ESCAPE h** (1Bh 68h) revokes the Screen Lock function.

Lock Line - Receipt of an **ESCAPE <** (1Bh 3Ch) causes the C-5 to interpret the next character as indicating a screen line; the indicated line, if in bounds, is locked on the screen. The codes used to indicate which line is to be locked are the same as those used for cursor positioning (refer to Appendix G).

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Data typed on the keyboard or received from the computer has no effect on locked lines. The cursor cannot move into a locked line; instead, it will move 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 C-5 will refuse to lock a line if it is the only unlocked line on the screen. This function cannot be invoked from the keyboard in Local Mode.

Unlock Line - Receipt of an **ESCAPE** = (1Bh 3Dh) causes the C-5 to interpret the next character as a screen line to be unlocked. Refer to Appendix G to obtain the necessary character to unlock a particular line.

Unlock All Lines - Receipt of an **ESCAPE ?** (1Bh 3Fh) causes all currently locked lines to be unlocked.

STATUS LINE AND MESSAGE LINE FUNCTIONS

Status Line Toggle - Receipt of an **ESCAPE -** (1Bh 2Dh) toggles the status line (the bottom line of the display) on or off. This command is identical to **CONTROL-SHIFT-S**, except that the **CONTROL-SHIFT-S** command can only be given from the keyboard in Online Mode.

Display Short Message in Message Field - Receipt of an **ESCAPE . M** (1Bh 2Eh 4Dh) causes the C-5 to interpret all subsequent characters until receipt of a GS character (**CONTROL-l**, 1Dh) as comprising a message to be displayed in field F of the C-5 status line. A message may contain a maximum of 29 characters. Characters beyond the 29th will be ignored.

User Message Field Hard - Receipt of an **ESCAPE . y** (1Bh 2Eh 79h) causes the user message field (field F of the C-5 status line) to remain displayed even when the status line is turned off.

User Message Field Soft - Receipt of an **ESCAPE . z** (1Bh 2Eh 7Ah) causes the user message field (field F of the C-5 status line) to be turned off whenever the status line is turned off.

Set Clock - Receipt of an **ESCAPE ' '** (1Bh 20h, ESCAPE followed by SPACE) causes the C-5 to interpret the next six characters received as the time of day, and sets the terminal clock accordingly. The format of the time specification is **HHMMSS** (hours, minutes, and seconds). 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.

Clock Field Hard - Receipt of an **ESCAPE . w** (1Bh 2Eh 77h) causes the clock field (field G of the C-5 status line) to remain displayed even when the status line is turned off.

Clock Field Soft - Receipt of an **ESCAPE . x** (1Bh 2Eh 78h) causes the clock field (field G of the C-5 status line) to be turned off whenever the status line is turned off.

Deposit and Display Message - Receipt of an **ESCAPE ;** (1Bh 3Bh) causes the C-5 to interpret all subsequent characters until receipt of a GS character (CONTROL-], 1Dh) as comprising a message to be displayed for the keyboard operator. When the terminating GS is received, the message appears on the 25th line of the screen. The Message Deposit function works only in Online Mode.

A message may contain a maximum of 80 characters. Additional characters will overwrite the character in column 80. CONTROL codes in the message string (including ESCAPE) do not have their normal effect; rather, the corresponding CONTROL code symbols are displayed (see Appendix B, and the section Additional Mode Control).

Display Message - Receipt of an **ESCAPE 1** (1Bh 31h) causes the most recently stored message (see the section Message Deposit) to be displayed on the status line. The message appears in half-intensity, reverse video.

Remove Message - Receipt of an **ESCAPE 2** (1Bh 32h) causes the displayed message to vanish. The status line reverts to its previous state (either not displayed or displayed).

INITIALIZATION FUNCTIONS

Reset - Receipt of an **ESCAPE V** (1Bh 56h) causes the C-5 to be reset to its default settings. The cursor moves to the home position (line 1, column 1). Screen 0 is automatically selected for display and writing, but the contents of the other screens are unaffected. The cursor movement keys continue to operate as previously set. Software handshaking is disabled.

The terminal can be reset using the keyboard command **CONTROL-SHIFT-/** (C6h). This is the only command that can be entered from the keyboard when the keyboard is locked. The CKBC keyboard has a special function key, **Reset Term**, which is equivalent **CONTROL-SHIFT-/**.

COMMUNICATION CONTROL FUNCTIONS

Software Handshaking - Several special functions of the C-5 cause a stream of characters to be sent to the external system (for example, function keys, terminal status, cursor position, or terminal ID). Some external systems may not be able to process characters fast enough to keep up with such transmissions. The C-5 supports a standard 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 C-5 as part of a data stream must be echoed by a STX (same as CONTROL-B or 02h) before the terminal transmits the next character. The last character of a data stream must be acknowledged. When the C-5 is turned on, the software handshaking protocol is enabled. When the protocol is disabled, data streams are transmitted by the C-5 at the current baud rate without any handshaking required.

Receipt of an **ESCAPE . 0** (1Bh 2Eh 30h) enables the software handshaking protocol. All subsequent multiple character transmissions that use the I/O port will follow that protocol. When the C-5 is turned on, handshaking is enabled.

Receipt of an **ESCAPE . 1** (1Bh 2Eh 31h) disables the software handshaking protocol on the I/O port. All subsequent multiple character transmissions over the I/O port will take place at the current baud rate with no pauses.

Start/Stop Transmission (X-ON/X-OFF) Protocol - The C-5 contains a receiver buffer 256 bytes in length. In situations where the host computer is sending data to the C-5 faster than it can be processed, the buffer may become full, resulting in some characters being missed.

When the X-ON/X-OFF protocol is turned on, whenever the buffer is more than three-fourths full, the C-5 sends a CONTROL-S character to the host, indicating that the host should stop sending characters. When the buffer becomes less than one-fourth full, the C-5 sends a CONTROL-Q character to the host, indicating that more characters may be sent.

To turn the X-ON/X-OFF protocol on or off, use the menu of communication settings described in Chapter 2, or set the X-ON/X-OFF protocol flag described in the following paragraph.

Change X-ON/X-OFF Protocol Flag - Receipt of an ESCAPE . m (1Bh 2Eh 6Dh), followed by an ASCII digit '0' or '1', causes the X-ON/X-OFF protocol flag to be set. A '0' turns the flag off, a '1' turns the flag on.

KEYBOARD CONTROL FUNCTIONS

Disable Keyboard - Receipt of an ESCAPE c (1Bh 63h) causes the C-5 to ignore all keyboard input. The only command that can be input from the disabled keyboard is CONTROL-SHIFT-/, which reenables the keyboard and resets the terminal.

Enable Keyboard - Receipt of an ESCAPE b (1Bh 62h) causes the C-5 to start responding to keyboard input.

Disable Function Keys - Receipt of an ESCAPE . 8 (1Bh 2Eh 38h) causes the C-5 to ignore most of the function keys while the terminal is in Online Mode. This function has no effect if the C-5 is in Local Mode. The keys that always operate locally continue to operate even if the C-5 is in Online Mode. When the C-5 is first turned on, the function keys are disabled.

Enable Function Keys - Receipt of an **ESCAPE . 9** (1Bh 2Eh 39h) causes the C-5 to respond to function keys pressed when the C-5 is in Online Mode by transmitting the correct two-character sequence. If software handshaking is selected, the function key sequences will be transmitted according to that protocol.

Send a Command to the Keyboard - Receipt of an **ESCAPE . K** (1Bh 2Eh 4Bh) causes the next byte to be interpreted as a command to the keyboard. This command allows a program running on the remote computer to control C-5 keyboard settings such as the key-repeat rate, key click, keyboard reset, and the numeric keypad.

Byte	Command
80h	beep
81h	change repeat rate
82h	toggle key click
83h	keyboard reset
84h	toggle numeric keypad
85h	send login message
86h	toggle automatic repeat
8Eh	toggle continuous alarm
8Fh	toggle external alpha lock

TERMINAL INQUIRY FUNCTIONS

Read Cursor Position - Receipt of an **ESCAPE ** (1Bh 5Ch) causes the C-5 to transmit the current cursor position, using the same format used to position the cursor. That is, an **ESCAPE F** (1Bh 46h) is transmitted, followed by a code for the line number and a code for the column number (refer to Appendix G for codes). The **ESCAPE** is preceded by two STX characters, giving a total sequence length of six bytes.

Read Cursor Character - Receipt of an **ESCAPE G** (1Bh 47h) causes the C-5 to transmit the character at the cursor position. The cursor position is not affected; subsequently invoking this function with no intervening cursor movement will return the same character. A character will be returned even if it is in an invisible (security video attribute) area of the screen.

Read Character at Invisible Second Cursor - Receipt of an **ESCAPE _** (1Bh 5Fh) causes the C-5 to transmit the character at the position of the invisible second cursor. The invisible cursor position automatically advances one character to the right after completing this command.

Read Terminal ID - Receipt of a **CONTROL-E** (ENQ, 05h) causes the C-5 to transmit a stream of four characters that identify the terminal as a C-5. This sequence is preceded by two STX characters, giving a total sequence length of six bytes. If software handshaking is on, the sequence will be transmitted according to that protocol.

Return Number of Selected Screen - Receipt of an **ESCAPE . o** (1Bh 2Eh 6Fh) causes the C-5 driver to return the ASCII byte (30h - 35h) that represents the number of the currently selected screen.

MODE CONTROL FUNCTIONS

Enter Local Mode - Receipt of an **ESCAPE N** (1Bh 4Eh) causes the C-5 to enter Local Mode. Refer to Chapter 4 for a description of the differences between Online Mode and Local Mode.

Enter Monitor Mode - Receipt of an **ESCAPE :** (1Bh 3Ah) causes the C-5 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.

Exception: The X-ON and X-OFF codes will still control terminal output, and the C-5 will still be able to recognize the code **ESCAPE *** (1Bh 2Ah, Exit Monitor Mode).

This mode is useful for displaying symbols for nonprinting CONTROL characters and for determining exactly what is being transmitted by a host system. Note that this method of display is always in effect for the Invisible Second Cursor and the CPU Message Deposit functions.

Exit Monitor Mode - Receipt of an **ESCAPE p** or an **ESCAPE *** (1Bh 2Ah) causes the C-5 to revert to interpreting CONTROL characters normally. Control codes displayed while the terminal was in Monitor Mode are unaffected; Monitor Mode is not a video attribute. The **ESCAPE *** command causes the C-5 bell to sound once when exiting Monitor Mode.

Enter One-time Monitor Mode - Receipt of an **ESCAPE 6** (1Bh 36h) causes the C-5 to suspend normal interpretation of control codes for the next character only.

Change Terminal Mode - Receipt of an **ESCAPE . 1** (1Bh 2Eh 6Ch) followed by the ASCII digit '0' or '1' causes the corresponding terminal mode to be selected. A '0' selects C-5 terminal mode (this is the default setting), and a '1' selects Zenith Z-29 terminal mode.

When the C-5 is in Z-29 terminal mode, the following **ESCAPE** sequences are emulated (a complete emulation of the Z-29 is not possible, due to hardware differences):

ESCAPE n	Cursor position report
ESCAPE j	Clear to the end of the screen
ESCAPE N	Delete character
ESCAPE @	Insert mode on
ESCAPE O	Insert mode off
ESCAPE z	Reset the terminal
ESCAPE p	Enter Reverse Video
ESCAPE q	Exit Reverse Video
ESCAPE F	Enter graphic mode
ESCAPE G	Exit graphic mode
ESCAPE }	Enable keyboard
ESCAPE {	Disable keyboard
ESCAPE -	Backtab
ESCAPE _	Transmit character at cursor

It is also possible to change from one terminal mode to another using the menu of communication settings described in Chapter 2.

Transparent Keyboard Mode On - Receipt of an **ESCAPE . :** (1Bh 2Eh 3Ah) causes the C-5 to display the hexadecimal ASCII value for any character typed on the keyboard. For example, pressing the = key will cause the value 3D to be displayed on the screen. You must be in Local Mode to give this command from the keyboard.

Transparent Keyboard Mode Off - Receipt of an **ESCAPE . ;** (1Bh 2Eh 3Bh) causes the C-5 to stop displaying hexadecimal ASCII values when characters are typed on the keyboard.

MISCELLANEOUS FUNCTIONS

Turn On Continuous Alarm - Receipt of an **ESCAPE 8** (1Bh 38h) causes the C-5 bell to begin sounding continuously. The alarm may be turned off through the use of the Turn Off Continuous Alarm function.

Turn Off Continuous Alarm - Receipt of an **ESCAPE 9** (1Bh 39h) turns off the continuous alarm function.

Set Blackout Time - Receipt of an **ESCAPE . Q** (1Bh 2Eh 51h) causes the C-5 to interpret the next byte as the number of minutes of keyboard inactivity required to turn off the C-5 screen. A value of between 1 and 255 indicates the number of minutes. A value of 0 turns off the automatic blackout feature.

Set Brightness - Receipt of an **ESCAPE . R** (1Bh 2Eh 52h) causes the C-5 to interpret the next two bytes as new settings for the screen's foreground brightness and background brightness. The value for each byte can range from 0 to 15, where 0 is darkest and 15 is brightest. To prevent problems with CONTROL characters, the brightness value should be given as an ASCII digit (e.g., 30h for the value 0).

Foreign Language Character Sets - The ESCAPE sequences in the following table allow for different physical arrangements of some of the keys on the keyboard to accommodate European standards. To use this feature, the C-5 must contain the appropriate character ROM.

ESCAPE . `	American (default)
ESCAPE . a	British
ESCAPE . b	German
ESCAPE . c	French
ESCAPE . d	Spanish
ESCAPE . e	Italian
ESCAPE . f	Swedish/Finnish
ESCAPE . g	Dutch
ESCAPE . h	Danish/Norwegian
ESCAPE . i	Portuguese
ESCAPE . j	Yugoslavian
ESCAPE . k	Greek

Chapter 6

C-5 HARDWARE

SPECIFYING THE LINE VOLTAGE

The line voltage of the C-5 is set by a jumper located on the power supply board. This jumper is attached to either the 115-volt connector pin or the 230-volt connector pin (see Figure 6-1). Before shipment, your C-5 was set for the line voltage available in your area. A label on the outside of the box specifies this setting. You can change the line voltage easily with the following procedure.

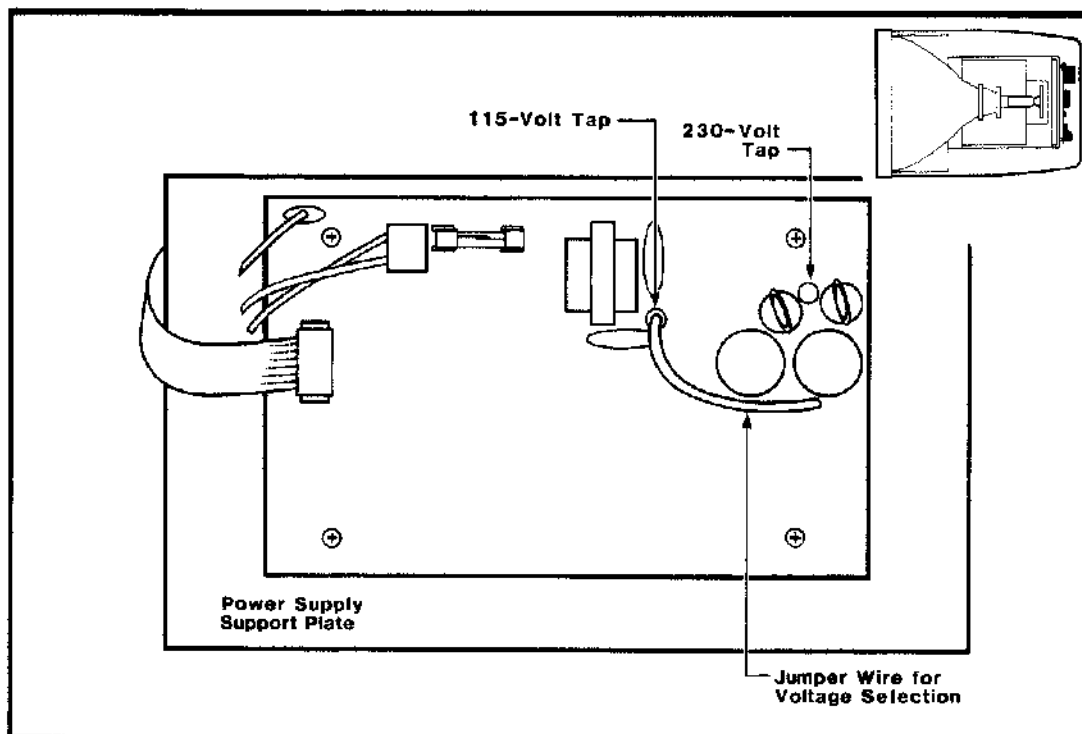


Figure 6-1: THE C-5 LINE VOLTAGE JUMPER

1. Turn off the system and unplug it.
2. Remove the C-5 top cover, following the instructions later in this chapter.
3. Locate the voltage jumper on the power supply board (see Figure 6-1).
4. Remove the jumper from its current position, and place it on the pin marked with the desired voltage. If it is difficult to remove the jumper cable from its original position, gently wiggle the connector to loosen it. Do not force the connector or pull on the wire.
5. Replace the C-5 cover.

VIDEO ADJUSTMENTS

The video settings for your C-5 have been adjusted before shipment. The following information will allow you to make any necessary adjustments.

The controls for adjusting all video settings are located on the video electronics board. Each control is labeled with an identifying number. The label and corresponding function for each video control is as follows:

Label	Function
R418	Focus
R109	Brightness (maximum)
R108	Brightness (default)
L401	Horizontal hold
R306	Vertical size (also stops rolling)
R303	Vertical hold
R319	Vertical linearity

DISASSEMBLY INSTRUCTIONS

Warning: Always remove power before attempting any type of disassembly procedure on the C-5. Sensitive components and monitor voltages should be allowed to settle for at least 15 minutes before opening the unit.

Removing the C-5 Top Cover

1. Position the C-5 with its screen facing downwards on a clean soft cloth. Locate the two screw holes just above the rear connector plate. With a Phillips screwdriver, unscrew the two 6-32 x 3/8" screws securing the top cover (Figure 6-2).
2. To lift off the top cover, start at the back end and carefully rock the cover back and forth until it releases from the bottom part of the monitor assembly (Figure 6-3). Set the C-5 back on its base.
3. To re-install the cover, reverse the above procedure.

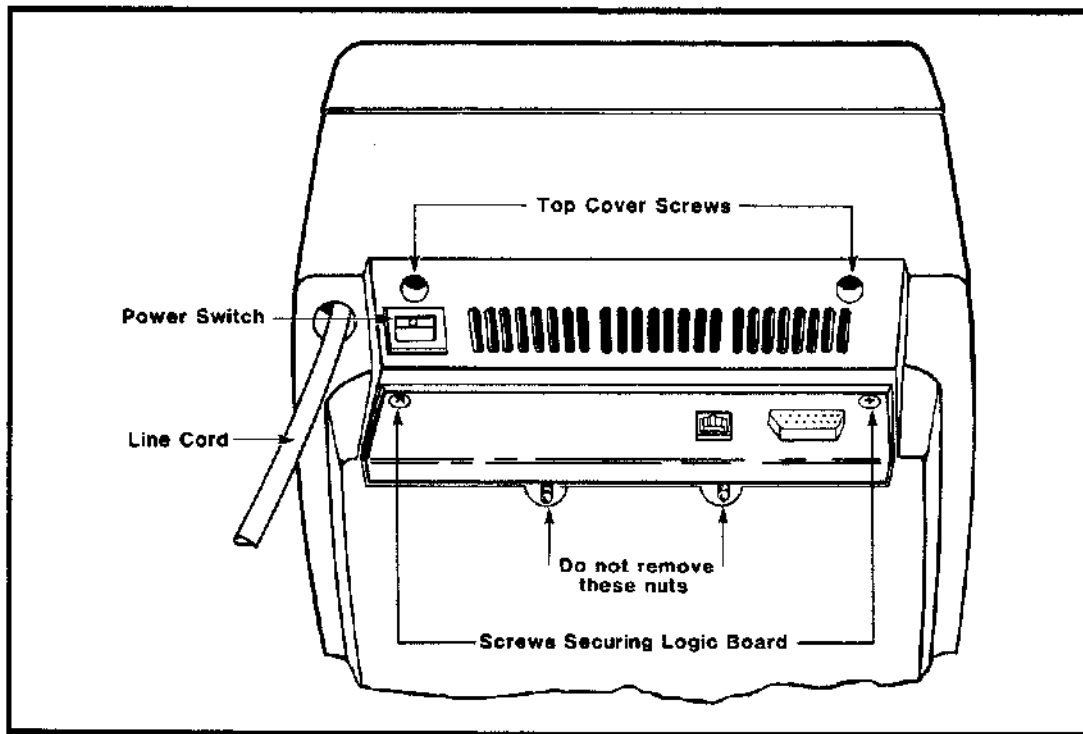


Figure 6-2: REMOVING THE C-5 TOP COVER SCREWS

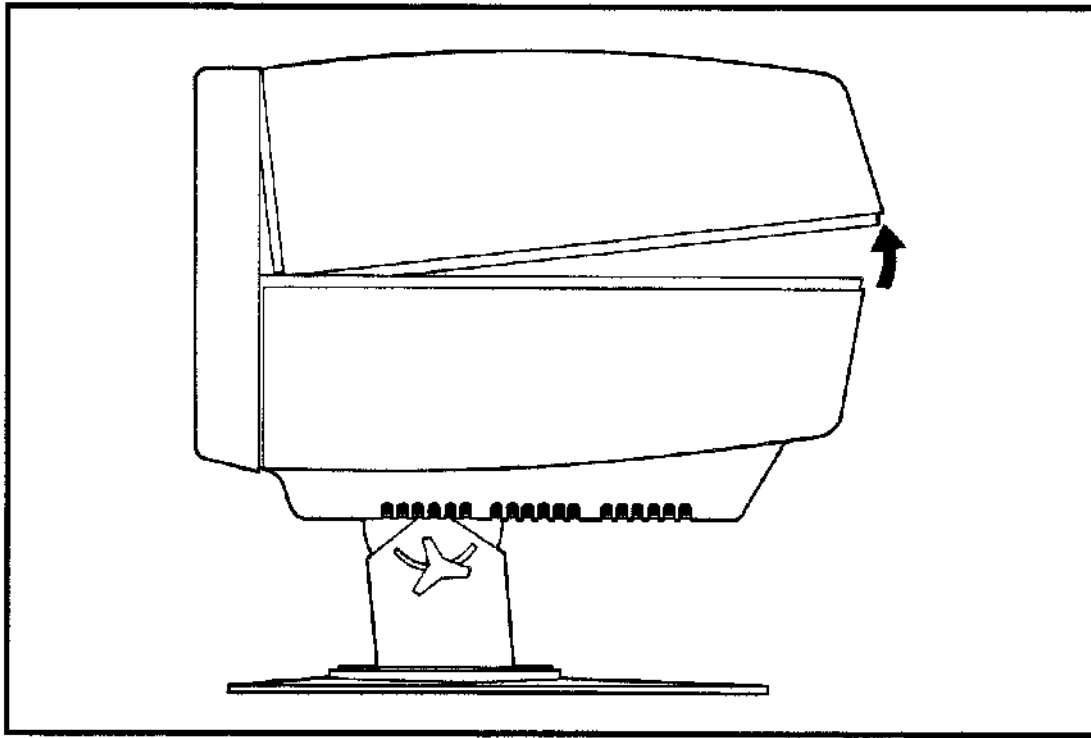


Figure 6-3: REMOVING THE C-5 TOP COVER

Removing the C-5 Power Supply

1. Remove the top cover as described above.
2. Remove the three power connectors from the power supply by gently lifting up on each connector housing (Figure 6-4). Mark the orientation of each connector so that you can replace it correctly.
3. Remove the four plated screws that secure the power supply to the power supply mounting plate. Be careful not to let the securing nuts on the other side of the mounting plate fall into the bottom of the unit.
4. Lift the power supply out of the C-5.

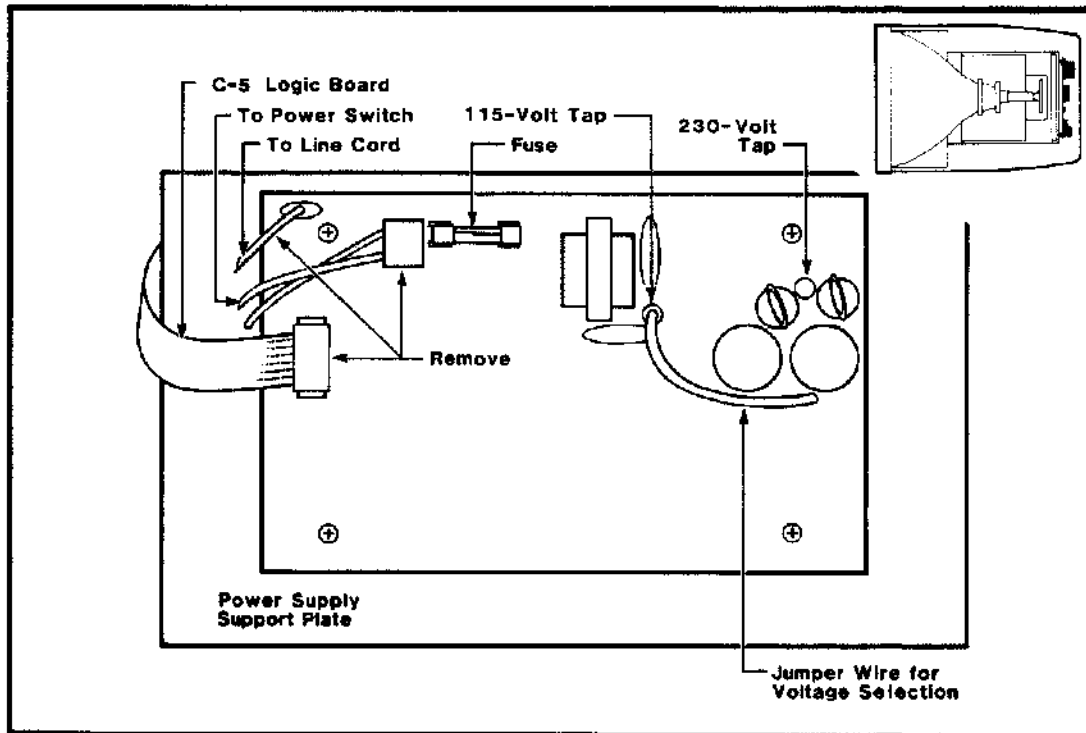


Figure 6-4: REMOVING THE C-5 POWER SUPPLY

Removing the C-5 Logic Board

1. Turn off and unplug the C-5 for at least 15 minutes.
2. Remove the C-5 top cover as described above.
3. Look into the logic board connector access area and locate the large video cable and the smaller power cable (Figure 6-5). Remove the two cables, first noting their respective orientation. The cables are polarized to prevent improper connection, but forcing them may render the polarization useless.
4. Remove the two 6-32 x 3/8" screws holding the logic board and back panel to the rear of the C-5 (see Figure 6-2). The C-5 logic board can now be removed by sliding it toward you.

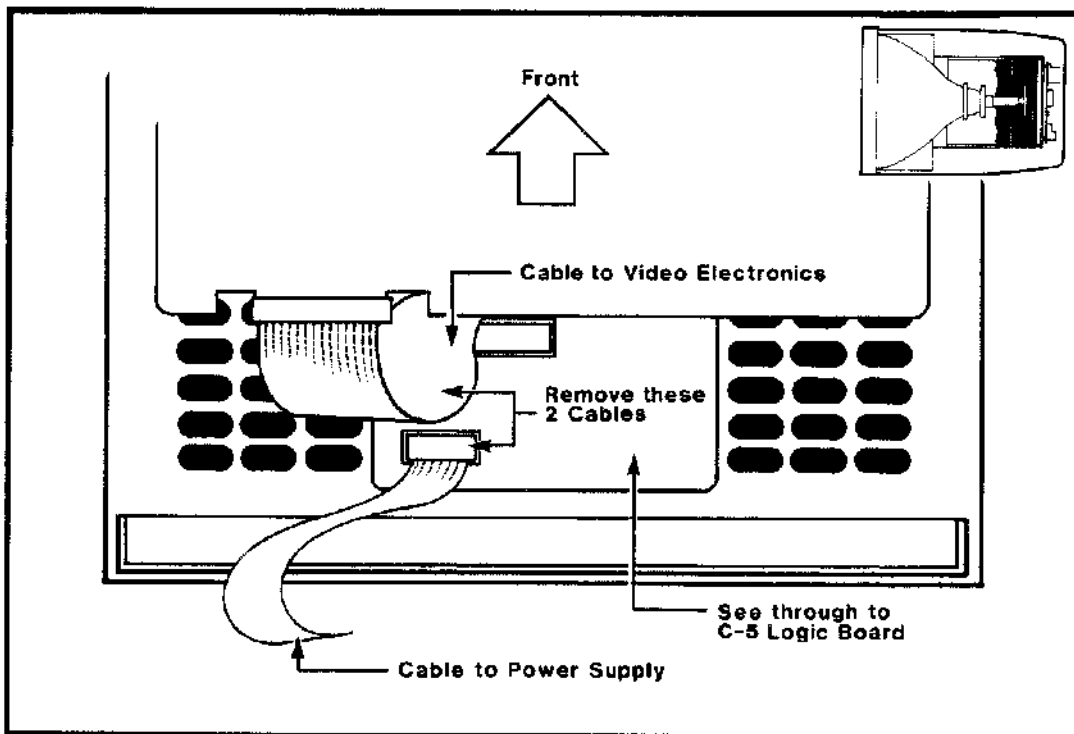


Figure 6-5: REMOVING THE C-5 LOGIC BOARD

Removing the Video Electronics Board

1. Turn off and unplug the C-5 for at least 15 minutes.
2. Remove the top cover as described above.
3. Remove the edge connector that connects the video electronics board to the C-5 logic board (Figure 6-6).
4. Remove the four plated 6-32 x 3/8" slotted screws that secure the video circuit board to the RF cage.
5. Disconnect the CRT connector card. This is the small circuit card that is plugged into the pointed end of the video tube. Remove this card by gently pulling it away from the tube neck with a light rocking motion. With the CRT connector card removed, gently disconnect the thick red wire connected to the side of the tube. This wire, called the high voltage anode, should be handled with caution as some voltage may still be present in the circuitry (Figure 6-7).

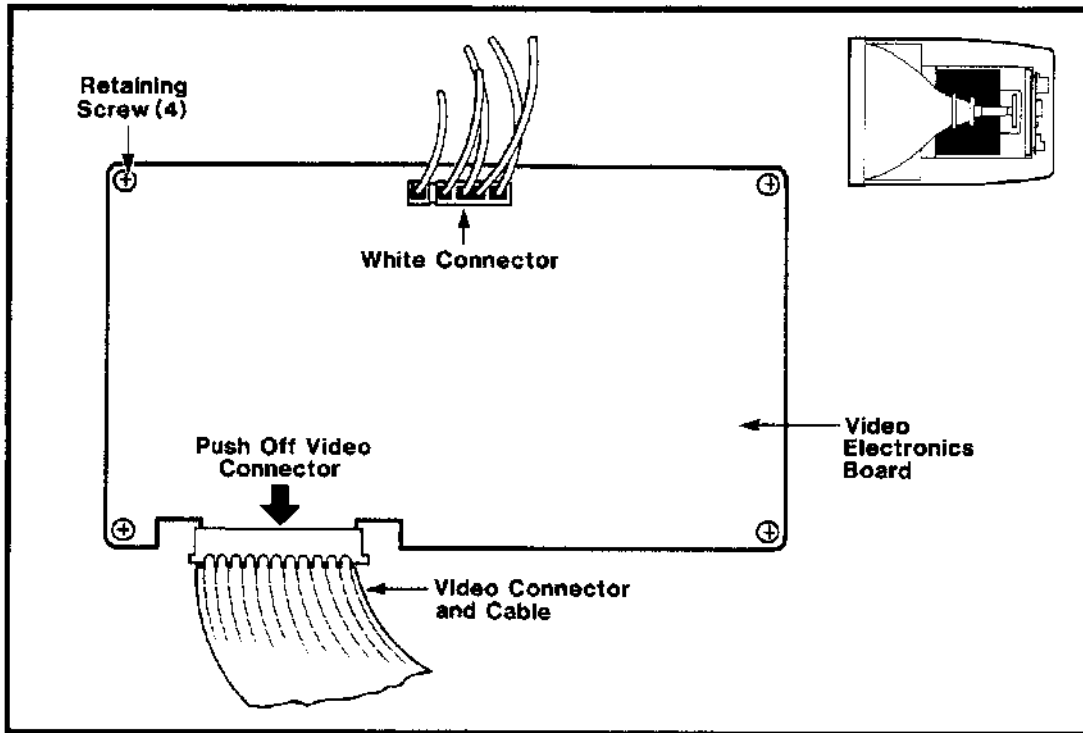


Figure 6-6: REMOVING THE VIDEO BOARD CONNECTORS

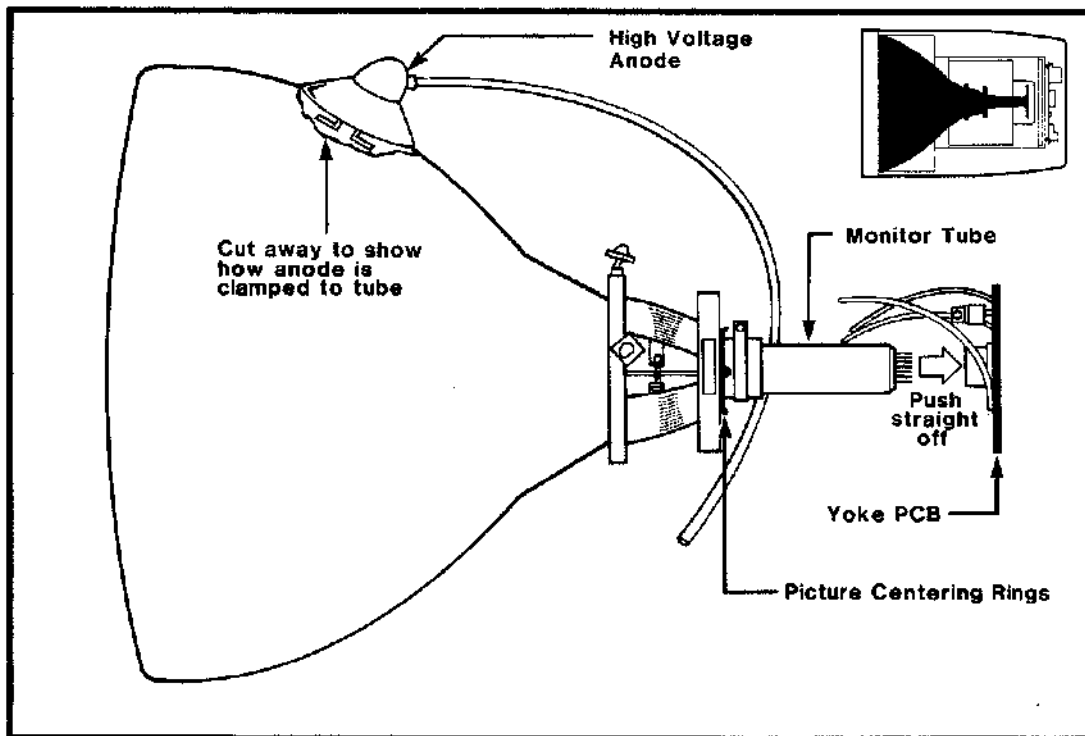


Figure 6-7: REMOVING THE VIDEO TUBE CONNECTORS

6. Remove the white connector (toward the front of the C-5) from the video electronics board, noting polarization (Figure 6-6).
7. The video electronics board may now be removed from the C-5.

Removing the C-5 Video Tube Assembly

1. Turn off and unplug the C-5 for at least 15 minutes.
2. Remove the top cover as described above.
3. Remove the CRT anode. This is the thick red wire connected to the upper portion of the video tube (Figure 6-7). Do not remove this wire until the C-5 has been turned off and unplugged for at least 15 minutes. Being very careful not to chip or break the surrounding glass tube, lift up on the rubber cup at the tube connection. The two steel wires that hold the connector in place should be visible. Push down on the top of the rubber cup and move the connector to one side until one of these wires comes out of the hole in the tube. The wire will now come right off.
4. Remove the CRT connector card. This is the small 2" x 2" circuit card that is plugged into the back tip of the video tube. Remove this card by gently pulling it away from the tube neck with a light rocking motion.
5. Disconnect the black grounding wire (Figure 6-8). You will find it connected either to the upper left corner of the video tube or to the video tube support bracket below.
6. Remove the four Phillips screws securing the video tube support bracket to the C-5 chassis (Figure 6-8).
7. Remove the video connector plug from the front section of the video circuit board. The video tube assembly may now be lifted out of the C-5.

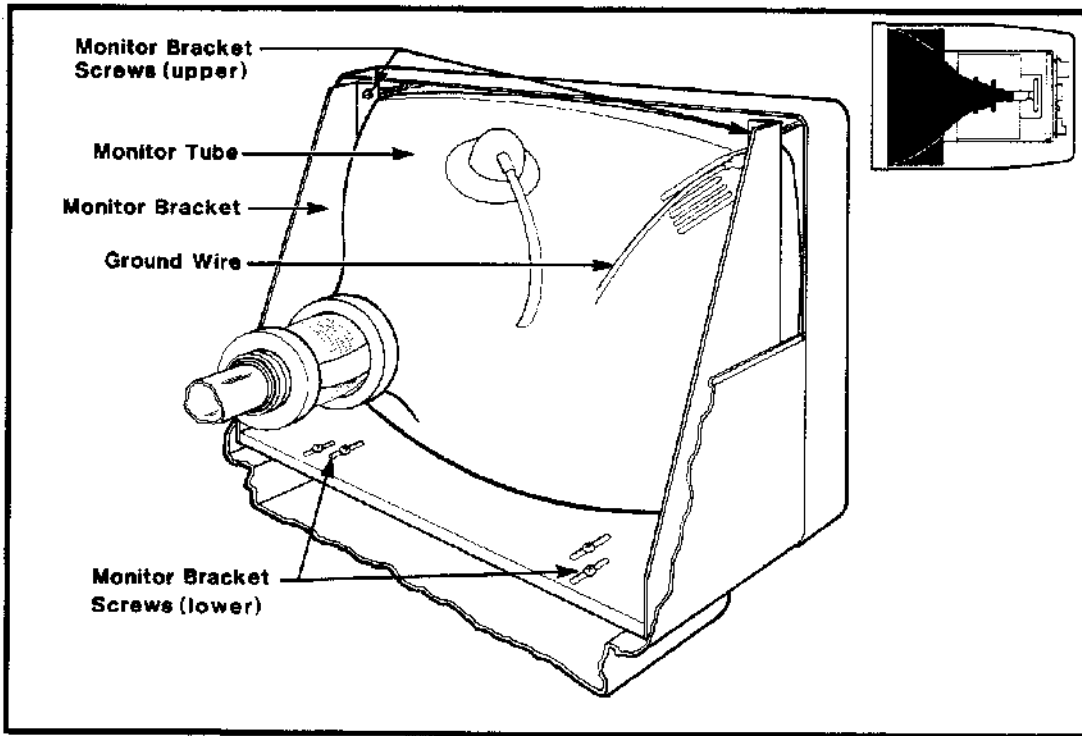


Figure 6-8: REMOVING THE C-5 VIDEO TUBE ASSEMBLY

Appendix A

PROGRAMMING EXAMPLES

STRUCTURED BASIC

The following program illustrates the use of character sets, video attributes, and cursor addressing from the Cromemco Structured Basic programming language.

```
10 Let Esc$=Chr$(27) : Rem          ASCII code for ESCAPE is 27.
20 Print Esc$;"E" : Rem            ESCAPE E clears the screen.
30 Print Esc$;"F@" : Rem          ESCAPE F positions cursor.
40 Rem                             %= indicates cursor position 6,30
50 Rem
60 Rem The sequence "ESCAPE d" followed by another character sets a
70 Rem video attribute at the current location of the cursor.
80 Rem The default video attribute is standard charset, normal video,
90 Rem so no video attribute is set before the normal text in line 50.
100 Rem
110 Print"This is normal text"
120 Print
130 Print Esc$;"dA" : Rem          ESCAPE dA -> standard charset,
140 Print"Half-intensity text"; : Rem half-intensity
150 Print Esc$;"d@" : Rem        ESCAPE d@ -> standard charset,
160 Rem                             normal video
170 Print
180 Print Esc$;"d`" : Rem        ESCAPE d` -> standard charset,
190 Print"Underlined text"; : Rem underlined video
200 Print Esc$;"d@" : Rem        ESCAPE d@ -> standard charset,
210 Rem                             normal video
220 Print
230 Print Esc$;"dP" : Rem        ESCAPE dP -> standard charset,
240 Print"Reverse text"; : Rem   reverse video
250 Print Esc$;"d@" : Rem        ESCAPE d@ -> standard charset,
260 Rem                             normal video
270 Print
280 Print Esc$;"dH" : Rem        ESCAPE dH -> boldface charset,
290 Print"Boldface text"; : Rem  normal video
300 Print Esc$;"d@" : Rem        ESCAPE d@ -> standard charset,
310 Rem                             normal video
320 Print
330 Print Esc$;"dD" : Rem        ESCAPE dD -> graphics charset,
340 Print"  \a WY"; : Rem        normal video
350 Print Esc$;"d@ <- Graphics" : Rem ESCAPE d@ -> standard charset,
360 Rem                             normal video
370 Print
380 Print Esc$;"dB" : Rem        ESCAPE dB -> standard charset,
390 Print"Blinking text"; : Rem  blinking video
400 Print Esc$;"d@" : Rem        ESCAPE d@ -> standard charset,
410 Rem                             normal video
420 Print
430 Print Esc$;"dH" : Rem        ESCAPE dH -> boldface charset,
440 Rem                             normal video
450 Print ESC$;" : " : Rem        ESCAPE : -> monitor mode on
460 Print Chr$(0);Chr$(1);Chr$(2);Chr$(3);
470 Print Esc$;"p" : Rem        ESCAPE p -> monitor mode off
480 Rem                             Monitor mode must be turned off
490 Rem                             to reposition the cursor.
500 Print Esc$;" : " : Rem        ESCAPE : -> monitor mode on
510 Print Chr$(16);Chr$(17);Chr$(18);Chr$(19);
520 Print Esc$;"p" : Rem        ESCAPE p -> monitor mode off
530 Print Esc$;"d@" : Rem        ESCAPE d@ -> standard charset,
540 Rem                             normal video
550 Print
560 End
```

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 A. Programming Examples

Z80 ASSEMBLY LANGUAGE

The following program illustrates the use of character sets, video attributes, and cursor addressing from Cromemco Z80 assembly language.

```

; This sample program shows how to clear the screen, position the cursor,
; and output text using the different character sets and video attributes.

ESC      EQU      1BH                      ; ESCAPE character

START:   LD       DE,CLEAR_SCREEN_COMMAND ; ESCAPE E clears the screen
        CALL    PRINT_BUFFERED_LINE      ; and positions cursor at 1,1

        LD       DE,POSITION_CURSOR_COMMAND ; ESCAPE F positions cursor
        CALL    PRINT_BUFFERED_LINE      ; at requested location

        LD       DE,NORMAL                 ; Line of normal video
        CALL    PRINT_BUFFERED_LINE      ; Print to CRT
        CALL    NEWLINE                   ; Cursor return, 2 line feeds

        LD       DE,REVERSE                ; Line of reverse video
        CALL    PRINT_BUFFERED_LINE      ; Print to CRT
        CALL    NEWLINE                   ; Cursor return, 2 line feeds

        LD       DE,BOLD                   ; Line of boldface text
        CALL    PRINT_BUFFERED_LINE      ; Print to CRT
        CALL    NEWLINE                   ; Cursor return, 2 line feeds

        LD       DE,GRAPHIC                ; Line of graphics and text
        CALL    PRINT_BUFFERED_LINE      ; Print to CRT
        CALL    NEWLINE                   ; Cursor return, 2 line feeds

        LD       DE,BLINK                  ; Line of blinking text
        CALL    PRINT_BUFFERED_LINE      ; Print to CRT
        CALL    NEWLINE                   ; Cursor return, 2 line feeds

        JP       0                          ; Return to CDOS

PRINT_BUFFERED_LINE: LD DE,C,09             ; CDOS system call, prints a
                   CALL 5                   ; string of ASCII characters
                   RET

NEWLINE:  LD DE,CRLF                       ; Cursor return & line feed
         CALL PRINT_BUFFERED_LINE
         RET

CLEAR_SCREEN_COMMAND DEFB ESC,'E$'        ; ESCAPE E clears the screen
POSITION_CURSOR_COMMAND DEFB ESC,'F$='    ; ESCAPE F positions cursor
                                         ; "$" = line 6, "=" = column 30

CRLF     DEFB 0DH,0AH,0AH,'$'            ; Carriage return, 2 line feeds

; The sequence "ESCAPE d" followed by another character sets a video attribute
; at the current location of the cursor.

NORMAL DEFB 'This is normal text$'      ; '$' marks end of
REVERSE DEFB ESC,'d','This is reverse',ESC,'d$' ; text for CDOS
BOLD DEFB ESC,'dH','This is boldface',ESC,'d$'
GRAPHIC DEFB ESC,'dD','ahijkpq',ESC,'d@ <= Graphics$'; "ESCAPE d@" sets nor-
BLINK DEFB ESC,'dB','This is blinking',ESC,'d$' ; mal video attribute

        END      START

```

Appendix B
 CHARACTER SETS

MSD LSB	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0																
1																
2																
3																
4																
5																
6																
7																

CHARACTER SET 1: STANDARD

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$\begin{matrix} L \\ M \\ S \\ D \end{matrix}$	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0																
1																
2																
3																
4																
5																
6																
7																

CHARACTER SET 2: GRAPHICS

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 B. Character Sets

M S D	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0																
1																
2																
3																
4																
5																
6																
7																

CHARACTER SET 3: BOLDFACE

MSD LSB	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
1	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
2	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
3	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
4	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
5	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
6	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
7	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F

CHARACTER SET 4: MISCELLANEOUS

Appendix C

SELECTING CHARACTER SETS AND VIDEO ATTRIBUTES












Various video characteristics can be established by sending escape sequences to the C-5. All sequences start with **ESCAPE d** and terminate with the characters indicated in the following table. Uppercase and lowercase characters are not equivalent.

Character Set				Video Attribute
standard	graphics	bold	misc.	
e	D	H	L	normal
A	E	I	M	half-intensity
B	F	J	N	blinking
C	G	K	O	half-intensity blinking
P	T	X	\	reverse
Q	U	Y	|	half-intensity reverse
R	V	Z	~	blinking reverse
S	W	[	-	half-intensity blinking reverse
`	d	h	l	underlined
a	e	i	m	half-intensity underlined
b	f	j	n	blinking underlined
c	g	k	o	half-intensity blinking underlined
p	t	x	|	reverse underlined
q	u	y	~	half-intensity reverse underlined
r	v	z	~	blinking reverse underlined
s	w	{	DELETE	half-intensity blinking reverse underlined

Appendix D

GRAPHICS SYMBOLS AND ASCII EQUIVALENTS

The ASCII characters in the following table produce the indicated graphics symbols when the C-5 is in Graphics mode. Graphics mode is described in the section Display Control in Chapter 5.

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

Appendix E

ESCAPE CODE AND CONTROL CODE FUNCTIONS

The Escape Code functions listed in this appendix are all invoked with an ESCAPE character followed by one or two identifying characters. For example, the command for turning off the cursor is ESCAPE q (1Bh 71h). These commands can be sent to the C-5 from the remote system or typed on the C-5 keyboard while in Local Mode (press CONTROL-SHIFT-L to enter or exit Local Mode).

The Additional Escape Code functions are invoked with an ESCAPE, followed by a period and one of the characters listed in the table. For example, the sequence ESCAPE . C changes the cursor to blinking reverse video. These commands can be sent to the C-5 from the remote system or typed on the C-5 keyboard while in Local Mode (press CONTROL-SHIFT-L to enter or exit Local Mode).

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 E. Escape Code and Control Code Functions

Code Following ESCAPE (1Bh)						
MSB LSB	010	011	100	101	110	111
0000	SP (20h) Set Clock	0 (30h)	@ (40h) Insert Char Off	P (50h) Delete Char (Line Mode)	^ (60h) Delete Char (Page Mode)	p (70h) Monitor Mode Off
0001	! (21h)	1 (31h) Display Message	A (41h) Cursor Up	Q (51h) Insert Chars (Line Mode)	a (61h) Insert Chars (Page Mode)	q (71h) Cursor Off
0010	" (22h)	2 (32h) Remove Message	B (42h) Cursor Down	R (52h) Graphics Mode On	b (62h) * Enable Keyboard	r (72h) Cursor On
0011	# (23h)	3 (33h)	C (43h) Cursor Right	S (53h) Graphics Mode Off	c (63h) * Disable Keyboard	s (73h)
0100	\$ (24h)	4 (34h)	D (44h) Cursor Left	T (54h)	d (64h) Enter Video Attribute	t (74h)
0101	% (25h)	5 (35h)	E (45h) Clear Screen	U (55h)	e (65h) Delete Video Attribute	u (75h)
0110	& (26h)	6 (36h) One-time Monitor Mode	F (46h) Cursor Address	V (56h) Reset Terminal	f (66h)	v (76h)
0111	' (27h) Send Enter Code	7 (37h)	G (47h) * Read Cursor Character	W (57h)	g (67h) Screen Lock	w (77h)
1000	((28h) Inverse Video On	8 (38h) Continuous Alarm On	H (48h) Home Cursor	X (58h)	h (68h) Screen Unlock	x (78h)
1001	) (29h) Inverse Video Off	9 (39h) Continuous Alarm Off	I (49h)	Y (59h) Cursor Address	i (69h)	y (79h)
1010	* (2Ah) Monitor Mode Off (bell)	: (3Ah) Monitor Mode On	J (4Ah) Clear To End of Page	Z (5Ah) Cursor Toggle	j (6Ah)	z (7Ah)
1011	+ (2Bh)	; (3Bh) * Store Message	K (4Bh) Clear To End of Line	[(5Bh)	k (6Bh)	{ (7Bh)
1100	, (2Ch)	< (3Ch) * Line Lock Mode	L (4Ch) Insert Line	\ (5Ch) * Send Cursor Position	l (6Ch) Start Blink- ing Video	! (7Ch)
1101	- (2Dh) Toggle Status Line	= (3Dh) * Line Unlook Mode	M (4Dh) Delete Line	] (5Dh)	m (6Dh) Normal Video Attribute	} (7Dh)
1110	. (2Eh) see next page	> (3Eh) Back Tab	N (4Eh) Enter Local Mode	^ (5Eh) * Use Invisi- ble Cursor	n (6Eh)	~ (7Eh)
1111	/ (2Fh)	? (3Fh) * Unlock All Lines	O (4Fh) Read Termi- nal Status	_ (5Fh) * Send Invisible Cursor Char	o (6Fh)	DEL (7Fh)

* Available only to host computer

ESCAPE CODES

Cromemco C-5 Technical Reference Manual
 E. Escape Code and Control Code Functions

Code Following ESCAPE . (1Bh 2Eh)						
MSB LSB	010	011	100	101	110	111
0000	SP (20h)	0 (30h) Enable Handshaking Protocol	@ (40h) Character Sets: Default Order	P (50h) * Insert Rightmost Column	` (60h) Standard Character Set	p (70h)
0001	[(21h)	1 (31h) Disable Handshaking Protocol	A (41h) Cursor is Non-blinking Reverse	Q (51h) Set Black-out Time	a (61h) British Character Set	q (71h)
0010	* (22h)	2 (32h)	B (42h) Cursor is Non-blinking Underline	R (52h) Set Screen Brightness	b (62h) German Character Set	r (72h)
0011	# (23h)	3 (33h)	C (43h) Cursor is Blinking Reverse	S (53h) * Initialize and Write to a Screen	c (63h) French Character Set	s (73h)
0100	\$ (24h)	4 (34h) Arrow Keys Xmit Control Codes Online	D (44h) Cursor is Blinking Underline	T (54h) Enable Changing Pages	d (64h) Spanish Character Set	t (74h)
0101	% (25h)	5 (35h) Arrow Keys Operate Locally	E (45h) Swap Character Sets 1 & 2	U (55h) * Display a Screen	e (65h) Italian Character Set	u (75h)
0110	& (26h)	6 (36h)	F (46h) Swap Character Sets 1 & 3	V (56h) Disable Changing Pages	f (66h) Swe/Fin Character Set	v (76h)
0111	' (27h)	7 (37h)	G (47h) Swap Character Sets 1 & 4	W (57h) * Write to a Screen	g (67h) Dutch Character Set	w (77h) Clock Field Hard
1000	((28h)	8 (38h) Disable Function Keys Online	H (48h)	X (58h) Turn Off Screen	h (68h) Dan/Nor Character Set	x (78h) Clock Field Soft
1001	) (29h)	9 (39h) Enable Function Keys Online	I (49h)	Y (59h) Turn On Screen	i (69h) Portuguese Character Set	y (79h) User Message Hard
1010	* (2Ah)	: (3Ah) Transparent Keyboard Mode On	J (4Ah) Wraparound Mode Off	Z (5Ah)	j (6Ah) Yugoslavian Character Set	z (7Ah) User Message Soft
1011	+ (2Bh)	; (3Bh) Transparent Keyboard Mode Off	K (4Bh) Send Command to Keyboard	[(5Bh)	k (6Bh) Greek Character Set	{ (7Bh)
1100	, (2Ch)	< (3Ch)	L (4Ch) Wraparound Mode On	\ (5Ch)	l (6Ch) Change Mode (C-05/Z-29)	| (7Ch)
1101	- (2Dh)	= (3Dh)	M (4Dh) Display Short Message	] (5Dh)	m (6Dh) Change Xon/Xoff Flag	} (7Dh)
1110	. (2Eh)	> (3Eh)	N (4Eh)	^ (5Eh)	n (6Eh) Change Screen-Link Flag	~ (7Eh)
1111	/ (2Fh)	? (3Fh)	O (4Fh) Insert Leftmost Column	_ (5Fh)	o (6Fh) Return Number of Current Screen	DEL (7Fh)

* Available only to host computer

ADDITIONAL ESCAPE CODE FUNCTIONS

Cromemco C-5 Technical Reference Manual
 E. Escape Code and Control Code Functions

HEX VALUE	NAMES	FUNCTION
00	NUL CONTROL-@	(no effect)
01	SOH CONTROL-A	(no effect)
02	STX CONTROL-B	See note 1
03	ETX CONTROL-C	(no effect)
04	EOT CONTROL-D	(no effect)
05	ENQ CONTROL-E	Return terminal ID
06	ACK CONTROL-F	(no effect)
07	BEL CONTROL-G	Beep
08	BS CONTROL-H	Backspace
09	HT CONTROL-I	Horizontal TAB
0A	LF CONTROL-J	Linefeed
0B	VT CONTROL-K	(no effect)
0C	FF CONTROL-L	(no effect)
0D	CR CONTROL-M	Carriage Return
0E	SO CONTROL-N	NEC translation ON
0F	SI CONTROL-O	NEC translation OFF
10	DLE CONTROL-P	(no effect)
11	DC1 CONTROL-Q	Enable transmission (X-ON)
12	DC2 CONTROL-R	(no effect)
13	DC3 CONTROL-S	Hold transmission (X-OFF)
14	DC4 CONTROL-T	(no effect)
15	NAK CONTROL-U	(no effect)
16	SYN CONTROL-V	(no effect)
17	ETB CONTROL-W	(no effect)
18	CAN CONTROL-X	(no effect)
19	EM CONTROL-Y	(no effect)
1A	SUB CONTROL-Z	(no effect)
1B	ESC CONTROL-[	Escape
1C	FS CONTROL-\	(no effect)
1D	GS CONTROL-]	See note 2
1E	RS CONTROL-^	(no effect)
1F	US CONTROL-_	(no effect)

Note 1 -- This character is used to acknowledge each character of a multiple character message transmitted under the software handshaking protocol. Issuing this character at other times has no effect on the C-5.

Note 2 -- This character is used to end a message deposit field. Issuing this character at other times has no effect.

CONTROL CODE FUNCTIONS

Appendix F

CODES OUTPUT BY THE KEYBOARD

The keyboard emits eight-bit codes when certain keys or key combinations are pressed. If a single key is pressed and that key is marked with a character that is a member of the ASCII code definitions, the keyboard generally emits the seven-bit ASCII code (the eighth bit being 0) corresponding to the pressed key (20h through 7Fh). If the CONTROL key is held down while another key is pressed, the keyboard emits the seven-bit ASCII code (the eighth bit being 0) corresponding to the selected CONTROL character (00h through 1Fh), or in some cases, the eight-bit code corresponding to a function key. Some special keys corresponding to CONTROL characters, such as RETURN and TAB, emit the ASCII code for that CONTROL character with the eighth bit set.

If the CONTROL and SHIFT keys are simultaneously held down while another key is pressed, the keyboard emits a special eight-bit code. Not all such key combinations emit an eight-bit code; some emit standard seven-bit ASCII codes (the eighth bit being 0).

Table F-1: CKBA KEYBOARD CODES

Alpha-Numeric Keys	Single Key	Press SHIFT	Press CONTROL	Press CONTROL-SHIFT
\	5C	7C	1C	EC
^	5E	7E	1E	ED
/	2F	3F	8D	C6
.	2E	3E	8E	C7
:	2C	3C	8F	C8
;	3B	2B	C1	D1
'	27	22	FC	FD
[	5B	7B	FF	EF
]	5D	7D	1D	EE
_	2D	3D	C2	EB
LEFT ARROW	88	88	88	C5
RIGHT ARROW	8C	8C	8C	C4
UP ARROW	8B	8B	8B	CF
DOWN ARROW	8A	8A	8A	CE
RETURN	8D	8D	8D	8D
DELETE	7F	7F	DE	DE
SPACE	20	20	20	20
ESCAPE	9B	9B	C3	83*
TAB	89	89	E9	E9
A	61	41	01	D8
B	62	42	02	CA
C	63	43	03	82*
D	64	44	04	81*
E	65	45	05	DB
F	66	46	06	D6
G	67	47	07	D5
H	68	48	08	99
I	69	49	09	E6
J	6A	4A	0A	D4
K	6B	4B	0B	D3
L	6C	4C	0C	D2
M	6D	4D	0D	C9
N	6E	4E	0E	84*
O	6F	4F	0F	DF
P	70	50	10	EA
Q	71	51	11	DD
R	72	52	12	DA
S	73	53	13	D7
T	74	54	14	D9
U	75	55	15	E7
V	76	56	16	CB
W	77	57	17	DC
X	78	58	18	CC
Y	79	59	19	E8
Z	7A	5A	1A	CD
0	30	5F	1F	E8
1	31	21	F0	F1
2	32	22	F2	F3
3	33	23	F4	F5
4	34	24	F6	F7
5	35	25	F8	F9
6	36	26	FA	FB
7	37	27	FC	FD
8	38	28	E3	E1
9	39	29	E2	E0

*Local keyboard functions (no code sent to terminal drivers):

- 81h-Change auto-repeat rate
- 82h-Toggle key click on/off
- 83h-Reset keyboard
- 84h-Toggle numeric keypad on/off

Table F-2: CKBC KEYBOARD CODES

Alpha-Numeric Keys	Single Key	Press SHIFT	Press CONTROL	Press CONTROL-SHIFT
<	3C	7B	BF	C8
>	3E	7D	BE	C7
\	5C	7C	1C	EC
^	5E	7E	1E	ED
/	2F	3F	BD	C6
:	2E	2E	BE	C7
;	2C	2C	BF	C8
'	3B	3A	C1	D1
!	27	22	FC	FD
]	5D	5B	1D	1D
1/2	B6	B5	C2	EB
-	2D	5F	1F	EB
=	3D	2B	C2	EB
LEFT ARROW	88	88	88	C5
RIGHT ARROW	8C	8C	8C	C4
UP ARROW	8B	8B	8B	CF
DOWN ARROW	8A	8A	8A	CE
RETURN	8D	8D	8D	8D
DELETE	7F	7F	DE	DE
SPACE	20	20	20	20
ESCAPE	9B	9B	C3	83*
TAB	89	89	E9	E9
A	61	41	01	86*
B	62	42	02	CA
C	63	43	03	82*
D	64	44	04	81*
E	65	45	05	DB
F	66	46	06	D6
G	67	47	07	D5
H	68	48	08	99
I	69	49	09	E6
J	6A	4A	0A	D4
K	6B	4B	0B	D3
L	6C	4C	0C	D2
M	6D	4D	0D	C9
N	6E	4E	0E	84
O	6F	4F	0F	DF
P	70	50	10	EA
Q	71	51	11	DD
R	72	52	12	DA
S	73	53	13	D7
T	74	54	14	D9
U	75	55	15	E7
V	76	56	16	CB
W	77	57	17	DC
X	78	58	18	CC
Y	79	59	19	E8
Z	7A	5A	1A	CD
0	30	29	1F	E8
1	31	21	F0	F1
2	32	40	60	00
3	33	23	F4	F5
4	34	24	F6	F7
5	35	25	F8	F9
6	36	B7	FA	FB
7	37	26	FC	FD
8	38	2A	E3	E1
9	39	28	E2	E0

Cromemco C-5 Technical Reference Manual
 F. Codes Output by the Keyboard

Function Keys	Single Key	Press SHIFT	Press CONTROL	Press CONTROL-SHIFT
1	F0	F1	EC	EC
2	F2	F3	ED	ED
3	F4	F5	EE	EE
4	F6	F7	EF	EF
5	F8	F9	F0	F0
6	FA	FB	F1	F1
7	FC	FD	F2	F2
8	E3	E1	F3	F3
9	E2	E0	F4	F4
10	1F	E8	F5	F5
11	E7	E6	F6	F6
12	00	FE	F7	F7
13	FF	EF	F8	F8
14	1D	EE	F9	F9
15	1E	ED	FA	FA
16	1C	EC	FB	FB
17	DD	DC	FC	FC
18	DB	DA	FD	FD
19	D9	D8	FE	FE
20			C5	83*

Numeric Keypad	Single Key	Press SHIFT	Press CONTROL	Press CONTROL-SHIFT
.	2E	2E	2E	2E
+	8D	8D	8D	8D
-	2D	2D	2D	2D
CLEAR ENTRY	DE	DE	DE	DE
0	30	30	30	30
1	31	31	31	31
2	32	32	32	32
3	33	33	33	33
4	34	34	34	34
5	35	35	35	35
6	36	36	36	36
7	37	37	37	37
8	38	38	38	38
9	39	39	39	39

*Local keyboard functions (no code sent to terminal drivers):
 81h-Change repeat rate
 82h-Toggle key click
 83h-Reset keyboard
 86h-Toggle key repeat

Appendix G
CURSOR POSITION CODES

The cursor position codes shown here are used with the Cursor Address command (described in the section Cursor Control in Chapter 5) and with the Read Cursor Position command (described in the section Terminal Inquiries in Chapter 5).

Line or Column	ASCII Char	Column	ASCII Char	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		

Appendix H
ASCII CHARACTER CODES

HEX	CHARACTER	HEX	CHAR	HEX	CHAR	HEX	CHAR
00h	NUL (CONTROL-@)	20h	SPACE	40h	@	60h	'
01h	SOH (CONTROL-A)	21h	!	41h	A	61h	a
02h	STX (CONTROL-B)	22h	"	42h	B	62h	b
03h	ETX (CONTROL-C)	23h	#	43h	C	63h	c
04h	EOT (CONTROL-D)	24h	\$	44h	D	64h	d
05h	ENQ (CONTROL-E)	25h	%	45h	E	65h	e
06h	ACK (CONTROL-F)	26h	&	46h	F	66h	f
07h	BEL (CONTROL-G)	27h	'	47h	G	67h	g
08h	BS (CONTROL-H)	28h	(	48h	H	68h	h
09h	HT (CONTROL-I)	29h	)	49h	I	69h	i
0Ah	LF (CONTROL-J)	2Ah	*	4Ah	J	6Ah	j
0Bh	VT (CONTROL-K)	2Bh	+	4Bh	K	6Bh	k
0Ch	FF (CONTROL-L)	2Ch	,	4Ch	L	6Ch	l
0Dh	CR (CONTROL-M)	2Dh	-	4Dh	M	6Dh	m
0Eh	SO (CONTROL-N)	2Eh	.	4Eh	N	6Eh	n
0Fh	SI (CONTROL-O)	2Fh	/	4Fh	O	6Fh	o
10h	DLE (CONTROL-P)	30h	0	50h	P	70h	p
11h	DC1 (CONTROL-Q)	31h	1	51h	Q	71h	q
12h	DC2 (CONTROL-R)	32h	2	52h	R	72h	r
13h	DC3 (CONTROL-S)	33h	3	53h	S	73h	s
14h	DC4 (CONTROL-T)	34h	4	54h	T	74h	t
15h	NAK (CONTROL-U)	35h	5	55h	U	75h	u
16h	SYN (CONTROL-V)	36h	6	56h	V	76h	v
17h	ETB (CONTROL-W)	37h	7	57h	W	77h	w
18h	CAN (CONTROL-X)	38h	8	58h	X	78h	x
19h	EM (CONTROL-Y)	39h	9	59h	Y	79h	y
1Ah	SUB (CONTROL-Z)	3Ah	:	5Ah	Z	7Ah	z
1Bh	ESC (CONTROL-[)	3Bh	;	5Bh	[	7Bh	{
1Ch	FS (CONTROL-\)	3Ch	<	5Ch	\	7Ch	|
1Dh	GS (CONTROL-])	3Dh	=	5Dh	]	7Dh	}
1Eh	RS (CONTROL-^)	3Eh	>	5Eh	^	7Eh	~
1Fh	US (CONTROL-_)	3Fh	?	5Fh	_	7Fh	DEL

<p>NUL = null SOH = start of heading STX = start of text ETX = end of text EOT = end of transmission ENQ = enquiry ACK = acknowledge BEL = bell BS = backspace HT = horizontal tab LF = line feed VT = vertical tab FF = form feed CR = carriage return SO = shift out SI = shift in DLE = data link escape</p>	<p>DC1 = device control 1 DC2 = device control 2 DC3 = device control 3 DC4 = device control 4 NAK = negative acknowledge SYN = synchronous idle ETB = end transmission block CAN = cancel EM = end of medium SUB = substitute ESC = escape FS = file separator GS = group separator RS = record separator US = unit separator SP = space DEL = delete</p>
---	--

Appendix I

CHARACTER SET MODIFICATION

The appearance of characters displayed on the C-5 screen is determined by the contents of the character generator ROM. This ROM contains images of characters in the form of bit maps. Simply by installing a character generator ROM or PROM with different character images, you can change the characters that will be displayed when the C-5 displays ASCII codes.

This means that the Cromemco C-5 can be easily modified, by changing a ROM, to display character sets for languages other than English or to display any special character set you may require. This appendix explains how to make PROMs for this purpose.

ORGANIZATION OF THE C-5 CHARACTER ROM

Each character set for the C-5 requires 2048 bytes of ROM. The character cell is eight cots wide by nine lines high. Therefore the display information may be coded in nine bytes per character, with the first byte giving the location of dots in the top line of the character, the second byte giving the location of dots in the second line, and so on. The location of these nine-byte groups in the ROM address space is determined by the address inputs, which are as follows:

A0 - A3	Line Count
A4 - A10	Character Code
A11 - A12	Character Set

Notice that four address lines carry the line count. The C-5 uses the first nine lines out of the sixteen possible; the remainder are reserved for future use.

AN EXAMPLE

The character "A" is designated by the ASCII character code 41h. The table below shows how the dot pattern for this character is entered in the proper data area of the character ROM.

	A10 Char-Code	A0 Line	D7 Data	D0	
(410h)	100 0001	0000:	0000	1000	(08h)
(411h)	100 0001	0001:	0001	0100	(14h)
(412h)	100 0001	0010:	0010	0010	(22h)
(413h)	100 0001	0011:	0010	0010	(22h)
(414h)	100 0001	0100:	0011	1110	(3Eh)
(415h)	100 0001	0101:	0010	0010	(22h)
(416h)	100 0001	0110:	0010	0010	(22h)
(417h)	100 0001	0111:	0000	0000	(00h)
(418h)	100 0001	1000:	0000	0000	(00h)

The next seven entries (419h through 41Fh) should be filled with 00s.

Address bits A11 and A12 should be prefixed onto bits A10-A0 above to select the character set that the character will appear in. A11 and A12 have the following meanings:

A12	A11	Char. Set	Starting Location in ROM
0	0	#1	0h
0	1	#2	800h
1	0	#3	1000h
1	1	#4	1800h

Most user-designed characters will be placed in character set 4; hence, the complete address of the character "A" in the above example would be:

1 1100 0001 0000 (1C10h)

I. Character Set Modification

Assembly language programmers may prefer programming the new characters as a series of DBs (defined bytes), which may then be assembled as a **.hex** file, loaded into memory with Debug, and programmed into a PROM with the P command. As an example, the character "A" might consist of the following in a file called **four.z80**:

```
Four_A:  db  08h,14h,22h,22h,3Eh,22h,22h,0
          db  0,0,0,0,0,0,0,0
```

This file should also contain 127 other similar entries for the other characters in the character set (totaling 2048 bytes). The file is assembled by the command:

```
asmb four hex
```

The file **four.hex** is then ready to be programmed at address 1800h in the character PROM, either by using Debug or by downloading the file to an external PROM programmer.

Appendix J

C-5 CONNECTOR DESCRIPTIONS

KEYBOARD CONNECTOR (base port 30h)
(four-pin modular telephone connector)

pin	function
1	Serial data to keyboard (RS-232)
2	+12V
3	Ground
4	Serial data from keyboard (RS-232)

SERIAL PORT CONNECTOR (base port 38h)
(DB-9 connector, labeled **COMPUTER**)

pin	function
1	n/c
2	DCD (data carrier detect)
3	TxD (transmit data)
4	RxD (receive data)
5	GND (ground)
6	n/c
7	DTR (data terminal ready)
8	DSR (data set ready)
9	TST (pulled up to +12V)

Appendix K

C-5 CABLE SPECIFICATIONS

Cromemco cable model CBL-CS (part number 519-0161) connects the C-5 terminal to a computer system. Figure K-1 shows the wiring specifications for this cable.

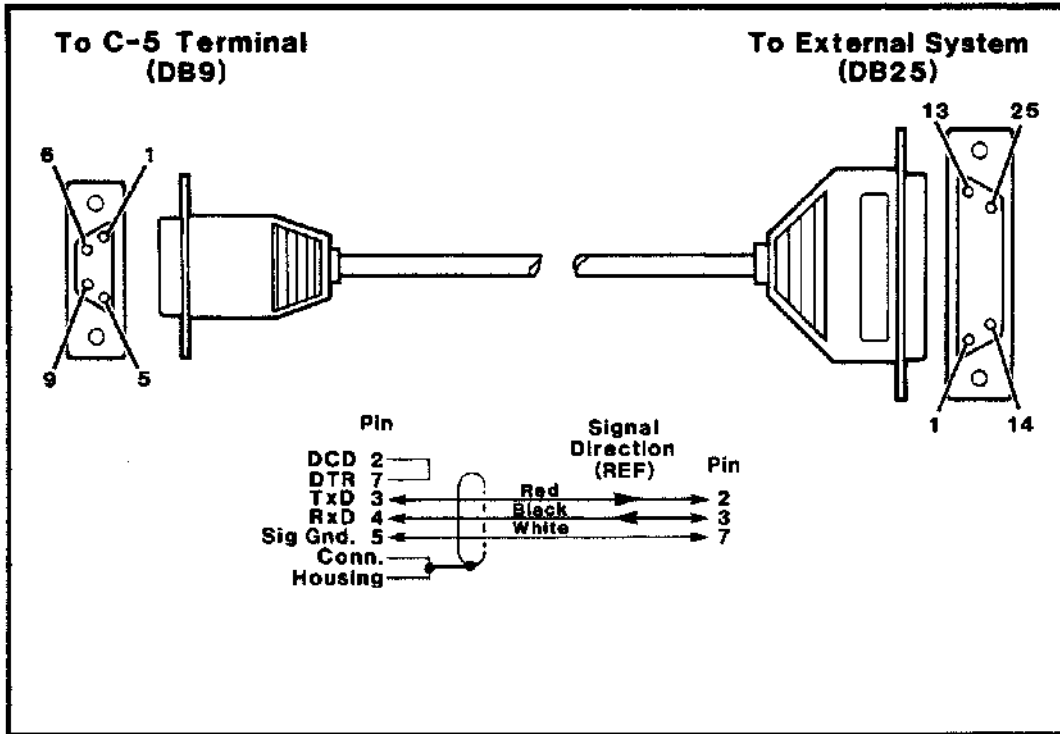


Figure K-1: CBL-CS CABLE SPECIFICATIONS

Appendix L

PARTS LIST

Integrated
Circuits

Designation	Cromemco Description	Part No.
IC2	74LS367	010-0108
IC5	C10 I/O & Disk Support Sekt 40 Pin	011-0083 017-0006
IC7	74LS74	010-0055
IC8	7406	010-0028
IC9	8275	011-0068
IC10	Sekt 24 Pin Character Rom	017-0005 502-0054-1
IC11	C10 Video Support Sekt 40 Pin	011-0096 017-0006
IC13	74LS08	010-0064
IC17	74LS670	010-0260
IC18	C10 CPU & Mem Support Sekt 40 Pin	011-0095 017-0006
IC19	74LS74	010-0055
IC20	74LS32	010-0058
IC21	Sekt 28 Pin CROS	017-0071 502-0055
IC22	8257	011-0069
IC23	74LS373	010-0102
IC24	Z80-A/3880P-44 Sekt 40 Pin	011-0010 017-0006
IC25	74LS04 (NON TI) 74S04	010-0066 010-0123
IC26	74LS00	010-0069
IC28	74LS245	010-0120
IC30	74LS173	010-0119
IC31-34	TMS416P-2	011-0079
IC35	74LS157	010-0046
IC36	74LS14	010-0061
IC37-38	75189/1489	010-0077
IC39-40	SYP6551A	011-0078
IC41	75188/1488	010-0076
IC42	75150	010-0211
IC44	74LS244	010-0100
IC45-48	TMS416P-2	011-0079
IC49	74LS157	010-0046
IC50	2966PC	010-0331
IC51	7406	010-0028

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**Diodes/
 Transistors**

Designation	Cromemco Description	Part No.
D2	1N4733 5.IV 1% 1W	008-0029
Q8-10	2N3646	009-0000
Q11-12	2N3906	009-0002

Capacitors

Designation	Cromemco Description	Part No.
C2-3	.047/50V	004-0061
C6	.047/50V	004-0061
C8-9	.047/50V	004-0061
C10	47 pf crdc	004-0005
C11	.047/50V	004-0061
C22	.047/50V	004-0061
C25	47 pf crdc	004-0005
C28	470 uf 10V elect	004-0103
C29-37	.047/50V	004-0061
C38	100 uf 15-35V	004-0082
C39-41	.047/50V	004-0061
C42	75 pf crdc	004-0007
C43	.047/50V	004-0061
C44-46	.001 uf crdc	004-0022
C47-49	.047/50V	004-0061
C50-53	1 uf mono	004-0070
C54	47 uf 16V tant	004-0111
C55-59	.047/50V	004-0061
C60-63	1 uf mono	004-0070
C65	.047/50V	004-0061

Resistors

Designation	Cromemco Description	Part No.
MOD #1	75 ohm 1/4	001-0006
R3	470 ohm 1/4	001-0014
R6	2.2 kohm 1/4	001-0021
R8-9	10 kohm 1/4	001-0030
R10	100 ohm 1/4	001-0007
R11	1 kohm 1/4	001-0018
R12	4.7 kohm 1/4	001-0024
R13	1 kohm 1/4	001-0018

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Resistors (Continued)

Designation	Cromemco Description	Part No.
R14	100 ohm 1/4	001-0007
R16	33 ohm 1/4	001-0071
R18	330 ohm 1/4	001-0012
R19-20	4.7 kohm 1/4	001-0024
R21	22 ohm 1/4	001-0001
R23	10 kohm 1/4	001-0030
R24	2.2 kohm 1/4	001-0021
R25	470 ohm 1/4	001-0014
R26	680 ohm 1/4	001-0016
R28	5.1 kohm 1/4	001-0025
R29	1 kohm 1/4	001-0018
R30	4.7 kohm 1/4	001-0024
R31	10 kohm 1/4	001-0030
R32	47 kohm 1/4	001-0037
R33	100 ohm 1/4	001-0007
R34-35	4.7 kohm 1/4	001-0024
R36	47 ohm 1/4	001-0003
R37-38	10 kohm 1/4	001-0030

Resistor Networks

Designation	Cromemco Description	Part No.
RN7	R-R2 8P 5%	003-0061
RN8	2.2 kohm 7R 8P	003-0008
RN9	4.7 kohm 7R 8P	003-0009
RN10	4.7 kohm 9R 10P	003-0014
RN12	100 ohm 4R 8P	003-0001
RN13	100 ohm 8R 16P	003-0020
RN14	2.2 kohm 7R 8P	003-0008
RN15-16	10 kohm 7R 8P	003-0025

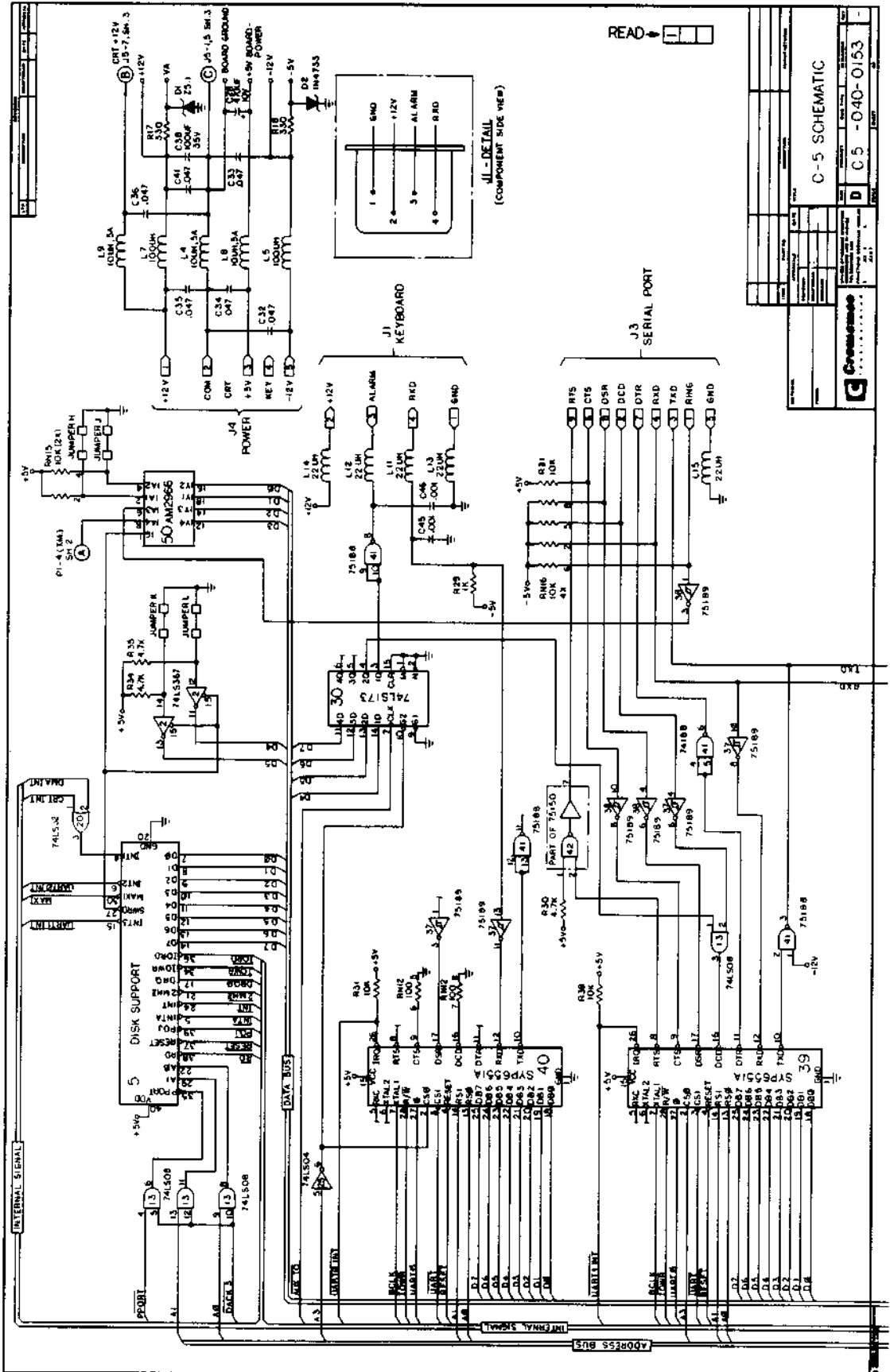
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Inductors

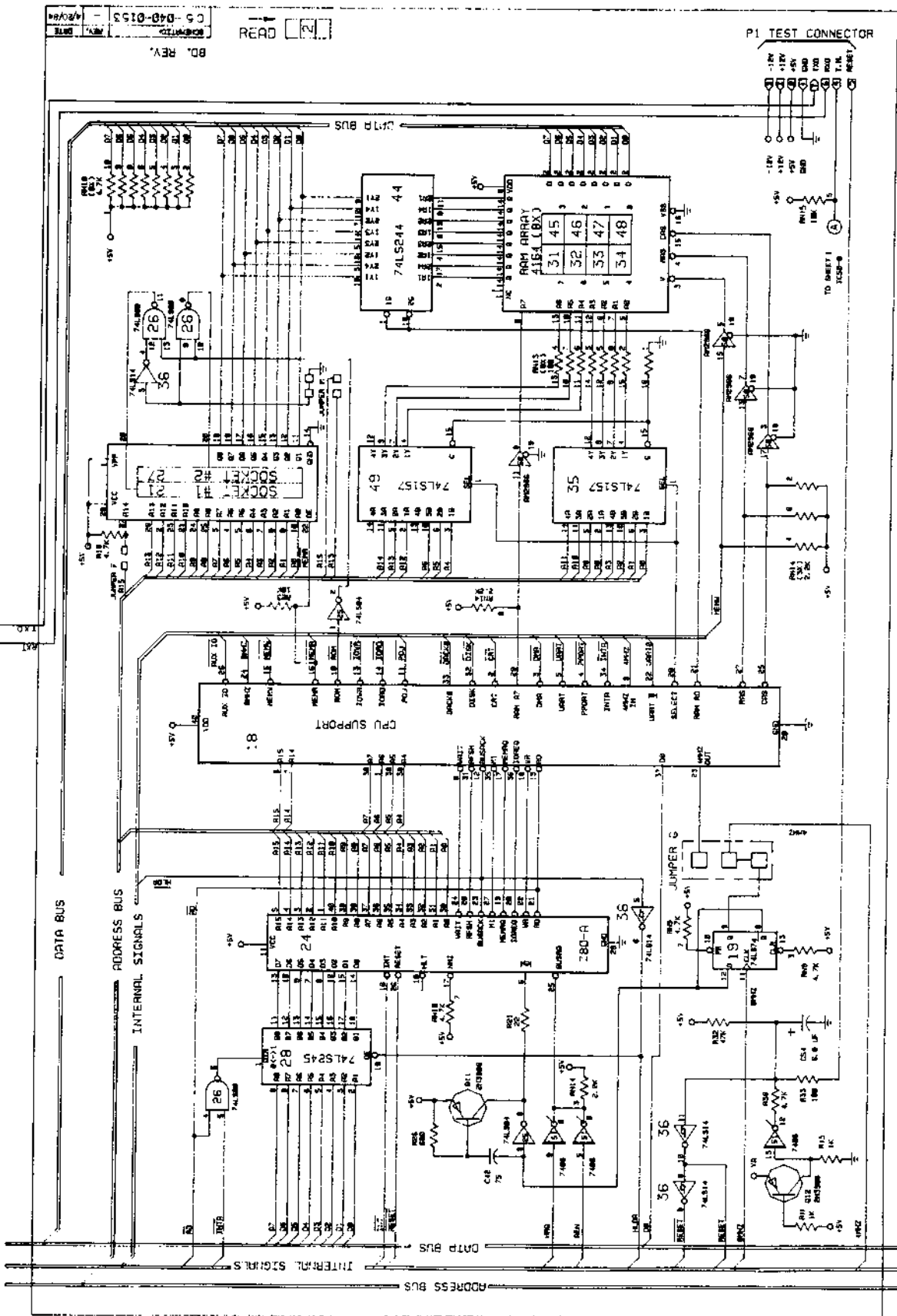
Designation	Cromemco Description	Part No.
L4	10 uH 5A rad	007-0026
L5	100 uH 10%	007-0023
L6	22 uH	007-0000
L7	100 uH 10%	007-0023
L8-9	10 uH 5A rad	007-0026
L10-15	22 uH	007-0000

Miscellaneous

Designation	Cromemco Description	Part No.
J1	PC BD modular jack	017-0296
J3	DB9 conn amp 207084-2	017-0337
J4	8 pin st hdr HLSS100-8	017-0338
J5	conn 10 pin st hdr	017-0255
Y1	crystal 13.028 MHz	026-0030
Y2	crystal 8 MHz	026-0001
	C-10 PCB	020-0115



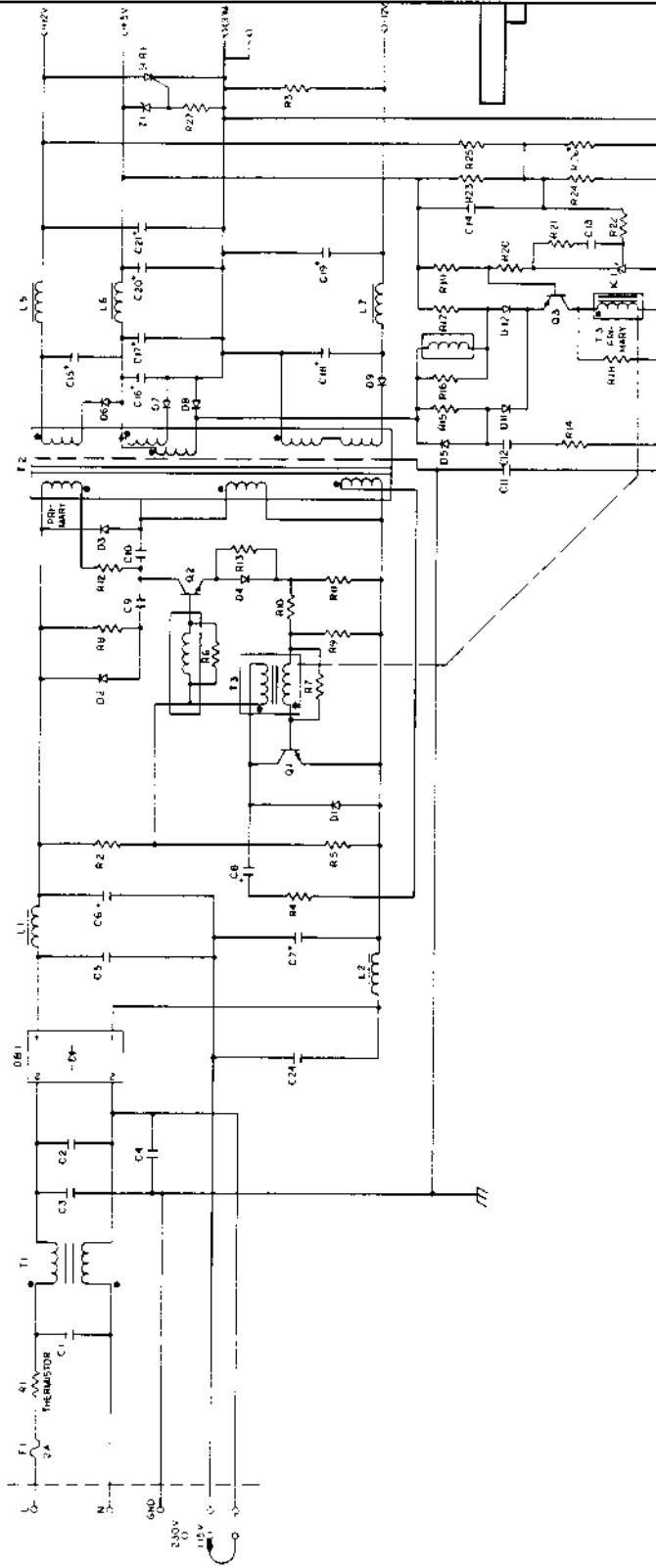
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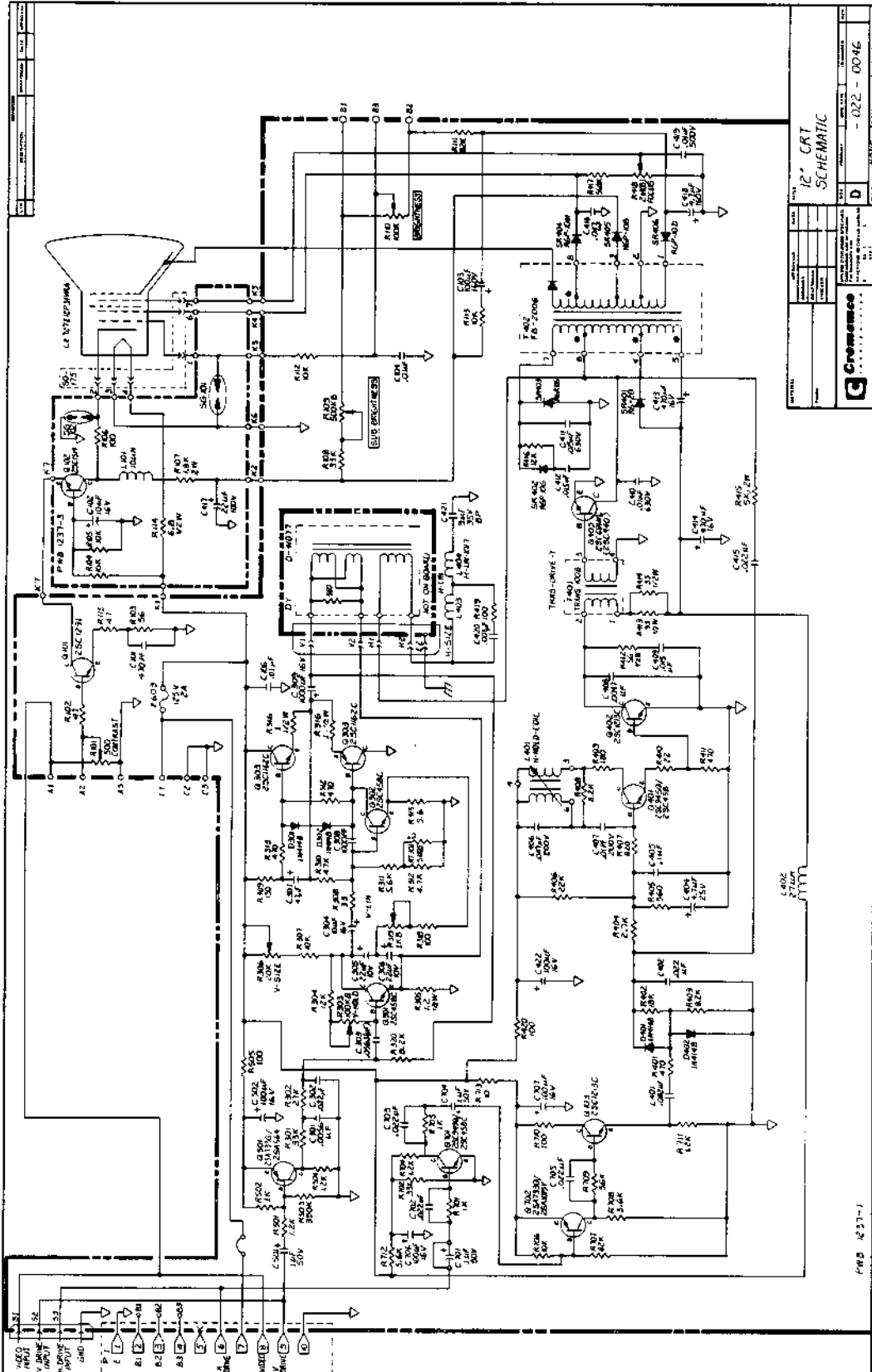
LEVEL 2

NOTE:
* R. K. S. UNIT - 4.5V OUTPUT ADJUST RESISTOR



Cromemco		POWER SUPPLY SCHEMATIC	
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CHECKED BY		DESIGNED BY	
APPROVED BY		TESTED BY	
DATE		REVISION	
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Cromemco A THORN EMI COMPANY			

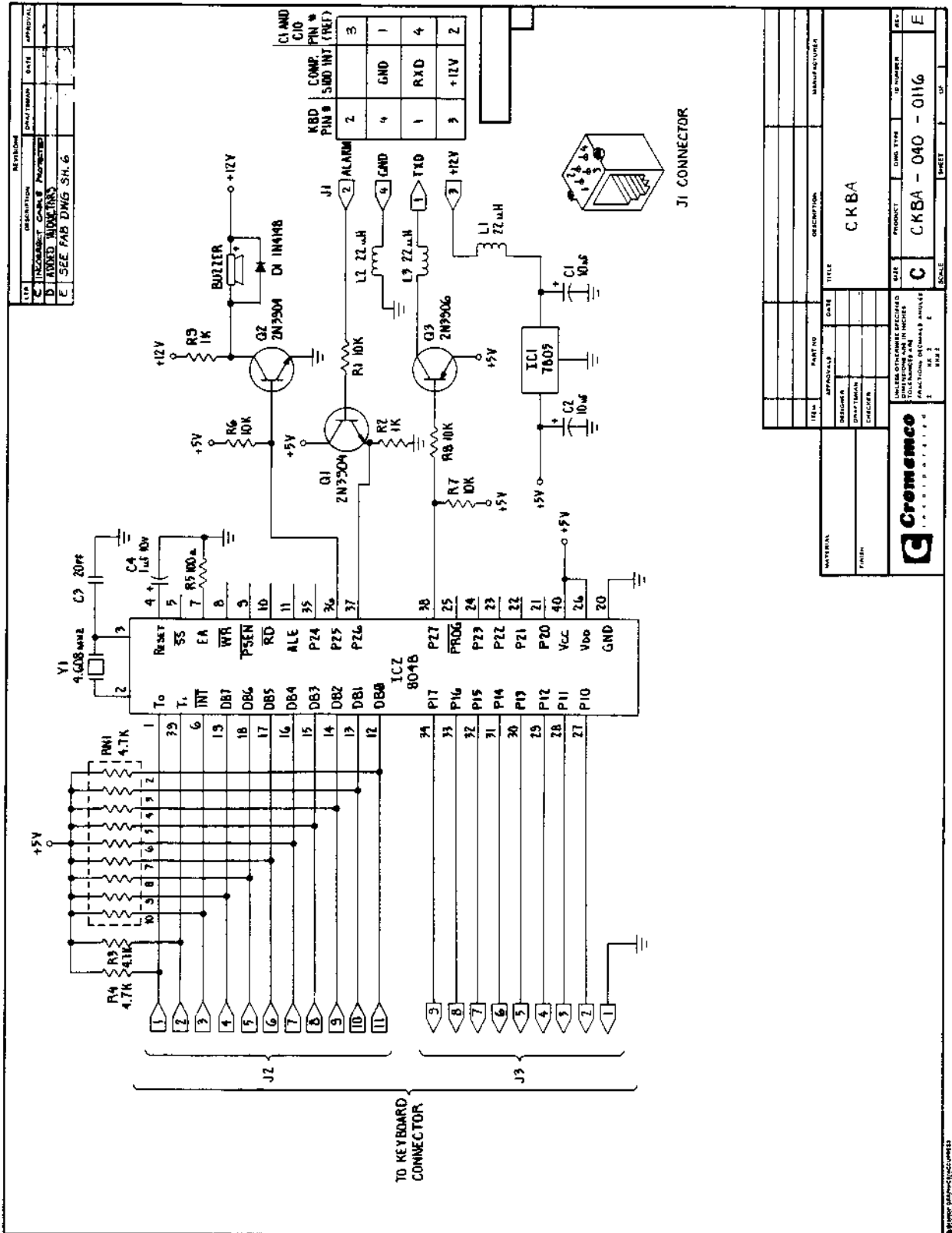
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Cromemco
 12" CRT
 SCHEMATIC
 - 022 - 0046
 D

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2. the return authorization number,
3. a description of the problem, and
4. proof of the date of retail purchase.

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