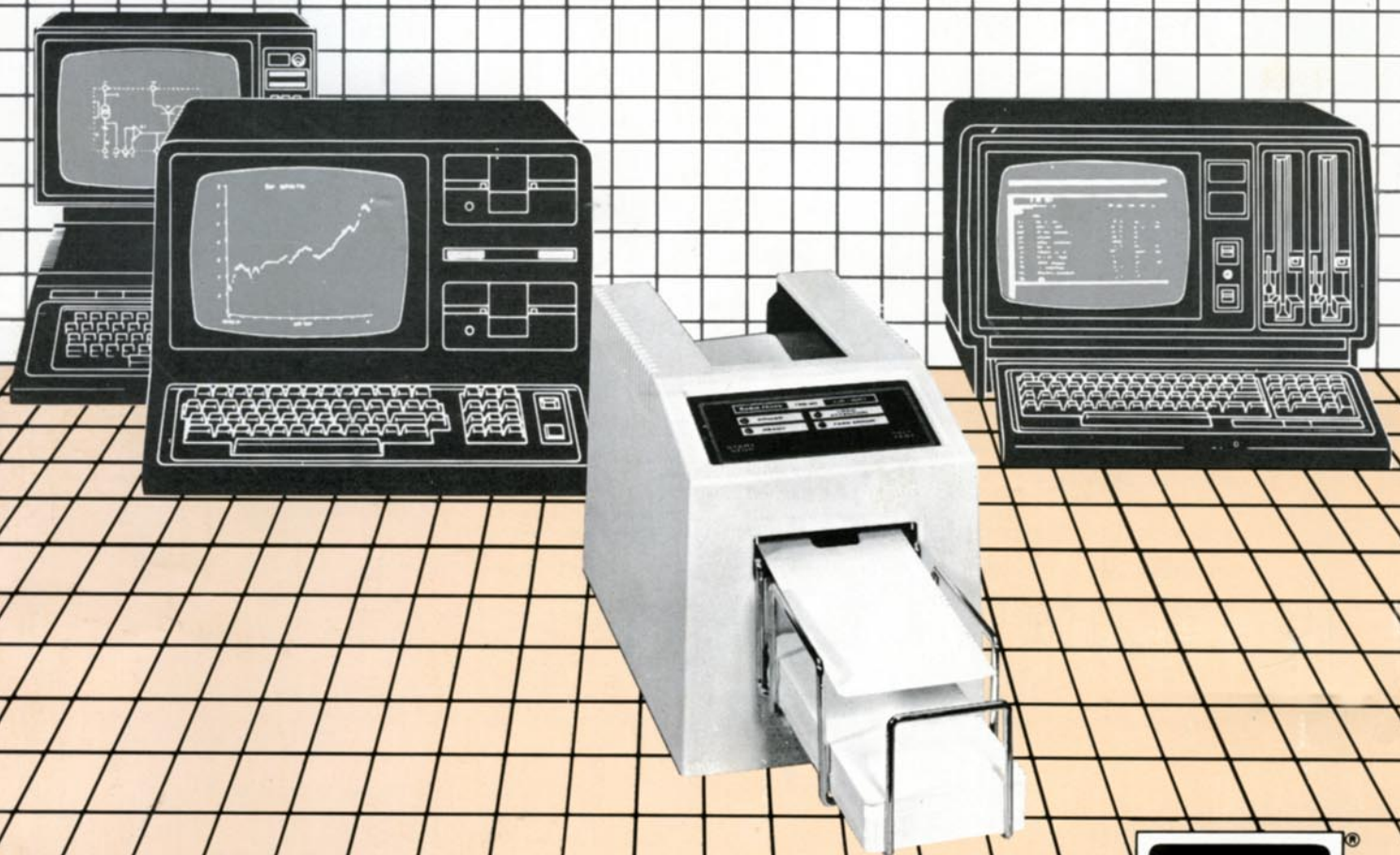
TRS-80®

CR-510

OPERATION MANUAL

Catalog Number 26-1266



Radio Shack®
TRS-80
COMPUTER PRODUCTS

CUSTOM MANUFACTURED IN USA FOR RADIO SHACK, A DIVISION OF TANDY CORPORATION

IMPORTANT INFORMATION

This equipment generates and uses radio frequency energy. If it is not installed and used properly, that is, in strict accordance with the manufacturer's instructions, it may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- reorient the receiving antenna
- relocate the computer with respect to the receiver
- move the computer away from the receiver
- plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: *How to Identify and Resolve Radio-TV Interference Problems.* This booklet is available from the United States Government Printing Office, Washington, DC 20402, Stock, No. 004-000-0035-4.

Warning: This equipment has been certified to comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of FCC Rules.

TRS-80® CR-S10 Operation Manual

Contents

Introduction

Congratulations on selecting the TRS-80 CR-510 Card Reader! With this Card Reader, a TRS-80 Computer, and standard marked or punched cards, you can:

- Automate data compilation.
- Evaluate surveys and polls.
- Correct multiple choice tests.

and more!

The CR-510 Card Reader is designed to connect directly to your TRS-80 Model I/II/III via the Computer's RS-232C connector.

The Card Reader can be controlled either manually via switches ("hardware") or through your program ("software") and can read cards that are at least 15.24 cm (6") in length. A General Purpose Standard Card designed for use with the CR-510 is available (26-1240) and, with the optional 14" Card Holder, cards up to 35.56 cm (14") in length can be read.

Note that the Card Reader requires a special "driver" routine to communicate with your Computer. This driver routine must be included in every program you write for the CR-510. (See Chapter 5 of this manual.) Radio Shack also provides applications software for the CR-510. Instructions for using these programs are supplied with the individual software packages.

Before doing anything else, carefully unpack the CR-510. Be sure the following accessories are included in the Card Reader package:

- Card Reader
- Metal Card Catcher
- Card Weight
- Blank Card Packet with 200 General Purpose Cards
- Owner's Manual
- Diagnostic Test Card
- Connection Test Card
- Power Cord
- Vial of Cleanser (for Read Head and Drive Roller cleaning)
- Cloth

Save the box and packing material for future shipping.

This section describes the various connectors, switches, and indicator lights on your CR-510.

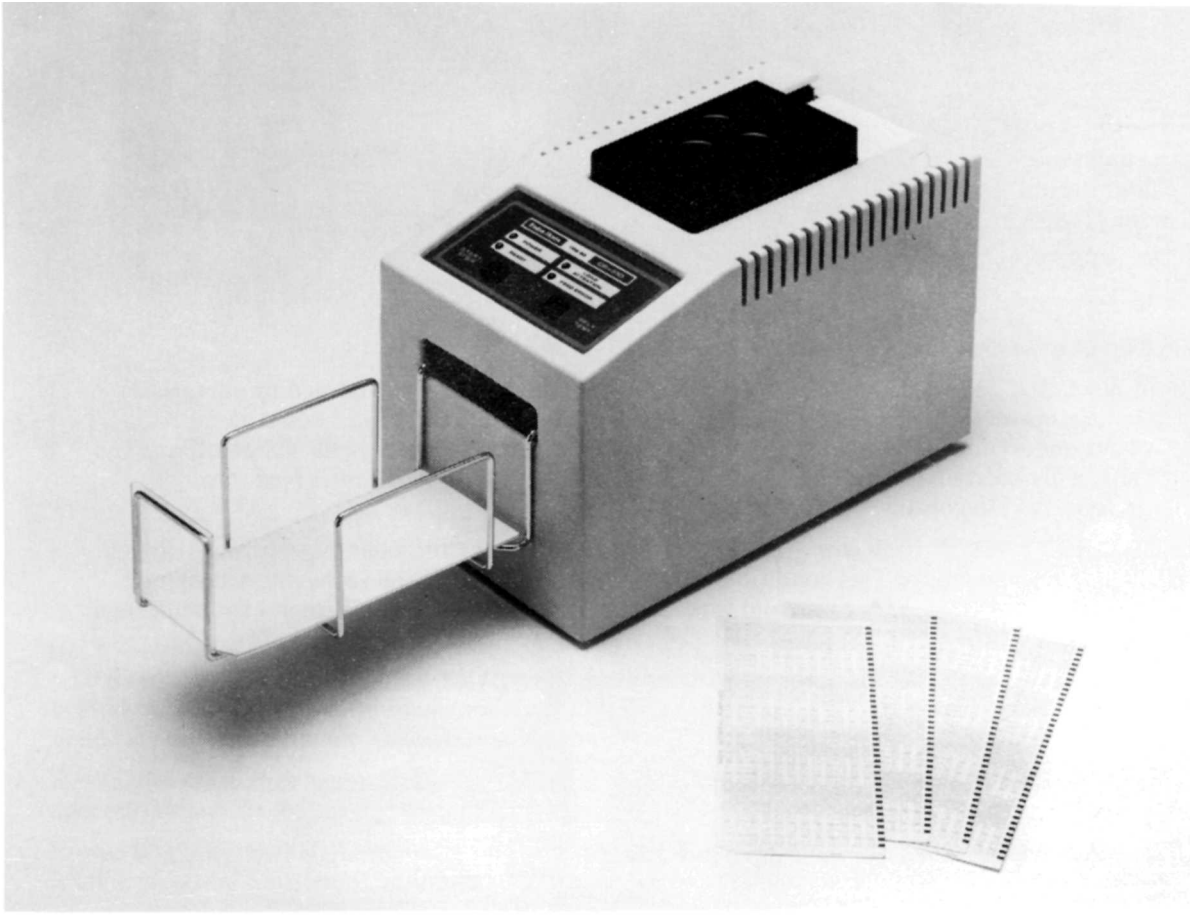


Figure 1. CR-510 Card Reader.

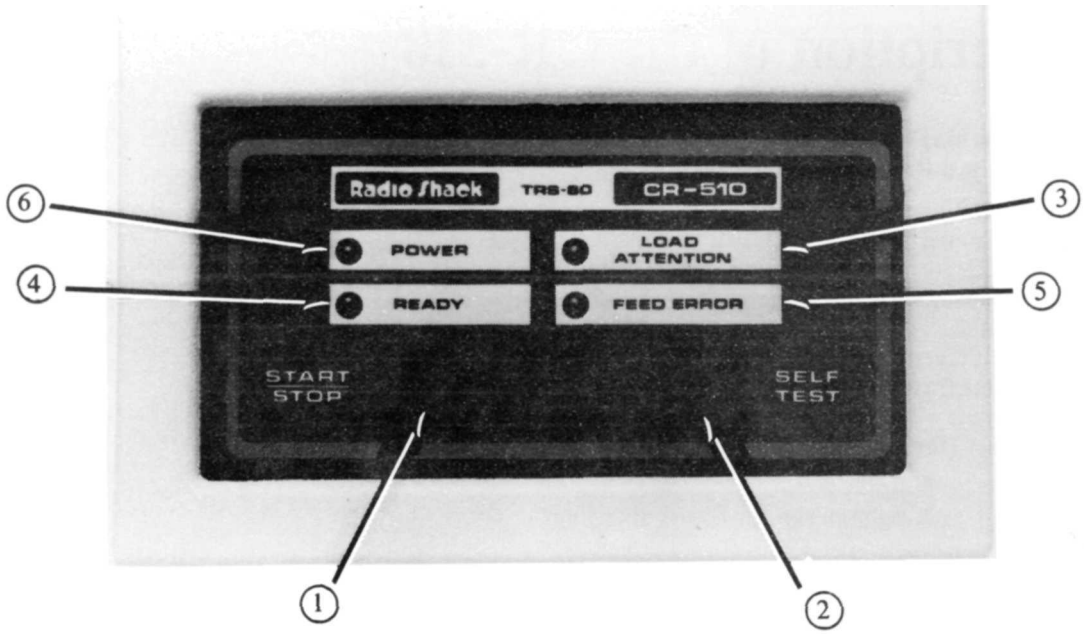


Figure 2. CR-510 (Front Panel)

(1) **START/STOP Button** Press this button to begin card reading. Press a second time to stop the unit once the current card has been read. Pressing START while in the Single-Feed Mode causes the unit to read one card. In the Continuous Feed Mode, press START to read cards in the Hopper.

(2) **SELF-TEST Button** Press this button to start the Self-Test.

There are two kinds of Self-Tests you can run:

- The *Diagnostic Self-Test* (described at the end of this section).
- A quick *Self-Test* with the Mechanical Feed Test. Place some cards (marked or unmarked) in the Hopper and press the Self-Test button. All Front Panel lights will come on for about one second. When the Self-Test is successfully completed, the lights will go off and the cards will quickly feed through. If the lights remain on, or the cards don't feed through, perform the Diagnostic Self-Test.

(3) **LOAD/ATTENTION Indicator** This light indicates that the Computer expects more cards, but the Hopper is empty. This condition can also be activated through software. A flashing lamp indicates that an ATN command was sent by the Computer. See Chapter 4 for additional information.

(4) **READY Indicator** This indicator illuminates when the START button has been pressed and the unit is ready to read cards. When it blinks, or lights up along with other indicators, an error condition exists.

(5) **FEED ERROR Indicator** When this indicator is illuminated, a mechanical failure of some kind has occurred.

(6) **Power Indicator** When the Card Reader is connected to an outlet and the power switch is set to ON, this indicator will illuminate.

(Note: When you first turn on the Card Reader, all of the Front Panel Lights will come on for about a second.)

A chart of error conditions associated with these lights appears in Appendix C.

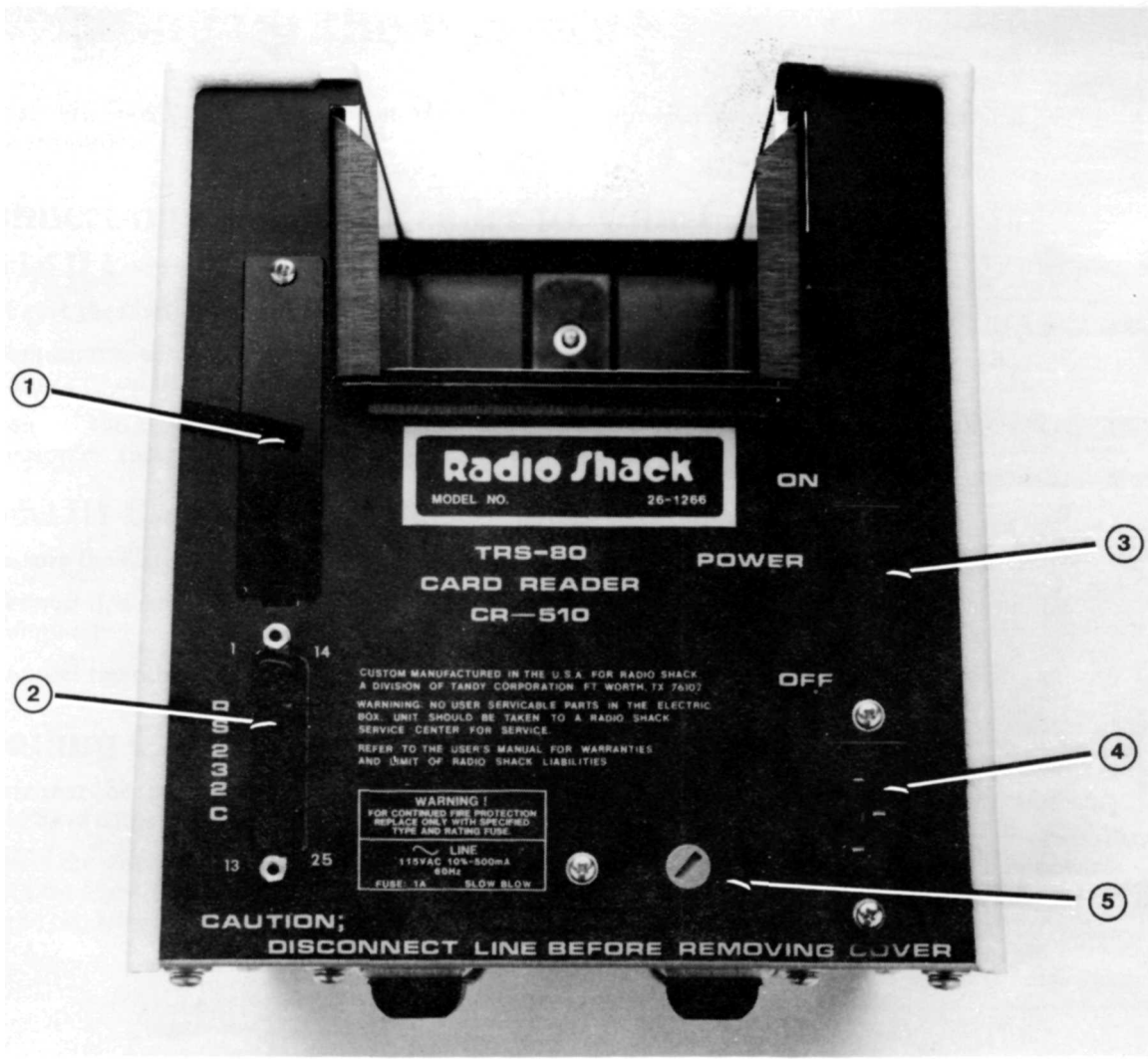


Figure 3. CR-510 (Rear View)

(1) **DIP Switches** Position the DIP Switches to set the baud rate. The DIP Switches are located behind the metal plate (see Figure 7 for details). The CR-5l0's baud rate must match the baud rate of the Computer. (See Setting Up the CR-510 for details.)

(2) **RS-232C Connector** Connect the CR-510 to the TRS-80 via this connector using the appropriate interface.

(3) **Power ON/OFF Switch** To turn the CR-510 power ON, set this switch to ON. (When power is applied, a unit Self-Test is automatically run.)

(4) **Power Cord Connector** Plug the AC Power cord included with package into this connector.

(5) **Fuse Holder** The fuse provides unit overload protection. Replace with a 1 amp slo-blo fuse for 110 VAC.

2/ Setting up the CR-510

Connect the Card Reader to a 110 Volt AC outlet or an approved power strip. Always use a 3-prong grounded outlet.

Connecting the Card Reader to Your Computer

Model II Users

1. Be sure the Card Reader's and Computer's power are Off.
2. Connect one of the DB-25 ends of the Model II RS-232C Cable (26-4408) to the RS-232C Connector on the CR-510.
3. Connect the other DB-25 end of the cable to either SERIAL CHANNEL A or B on the Computer. Insert a Terminal Plug into the other SERIAL Connector.

Model III Users

1. Be sure the Card Reader's and Computer's power are Off.
2. Connect one end of the Model III RS-232C Cable (26-1408) to the RS-232C Connector on the Computer.
3. Connect the other end of the cable to the RS-232C Connector on the CR-510.

Loading Cards

Be sure that the stack of cards to be read is packed so that all sides of the stack are even. No cards should have edges protruding from the stack.

1. Insert the stack of cards (not over 250 regular size cards or 100 long cards at one time) face down into the Card Hopper. The row of timing marks (black marks along the side of the card) should be to the left as you face the front panel of the CR-510.

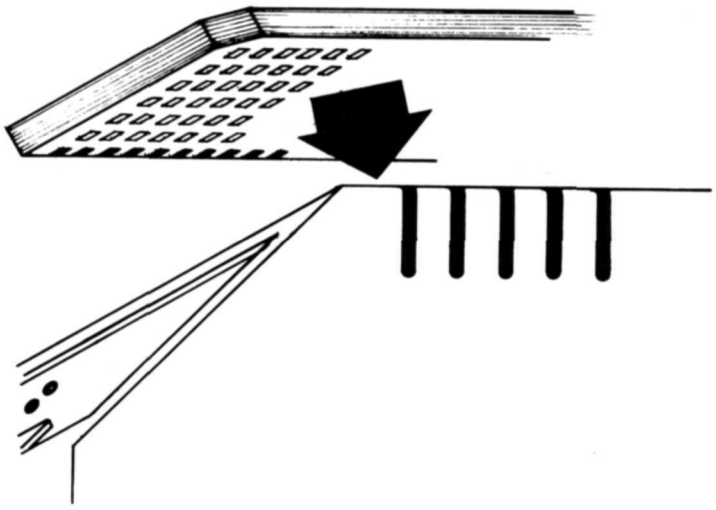


Figure 4. Inserting Cards into the Card Hopper

2. The Card Weight (see Figure 5) must be positioned on top of the card stack. The Card Weight slot must be positioned so that when the Hopper is empty, the slot is positioned over the micro-switch at the bottom of the Hopper.

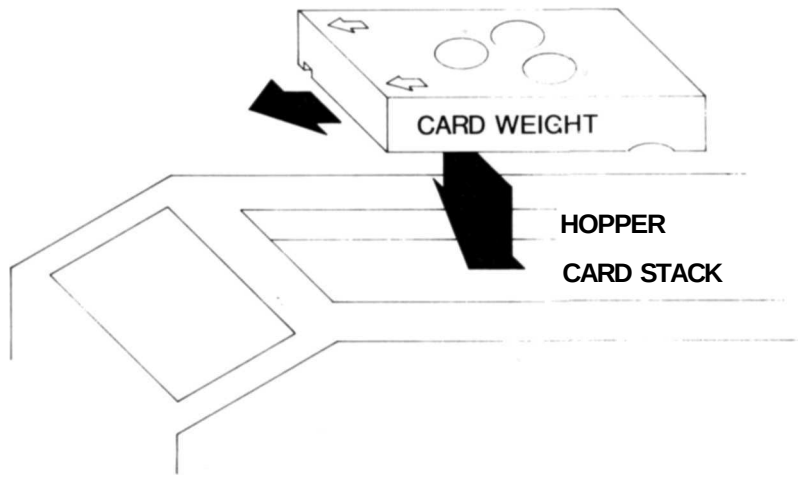


Figure 5. Card Weight Positioning

3. Attach the Card Catcher. See Figure 6 A.
4. Verify that the metal card retainer is installed in the slots at the rear of the hopper as shown in Figure 6B.

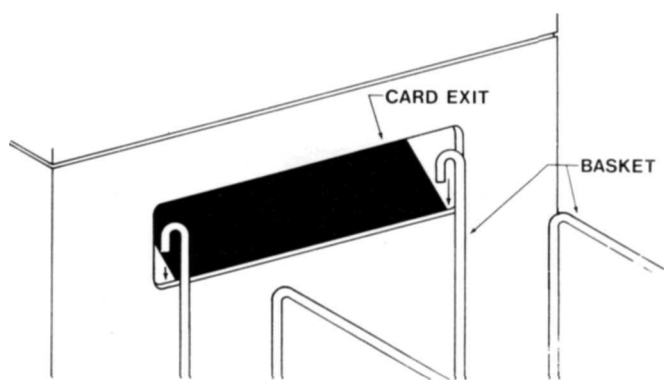


Figure 6A. Card Catcher

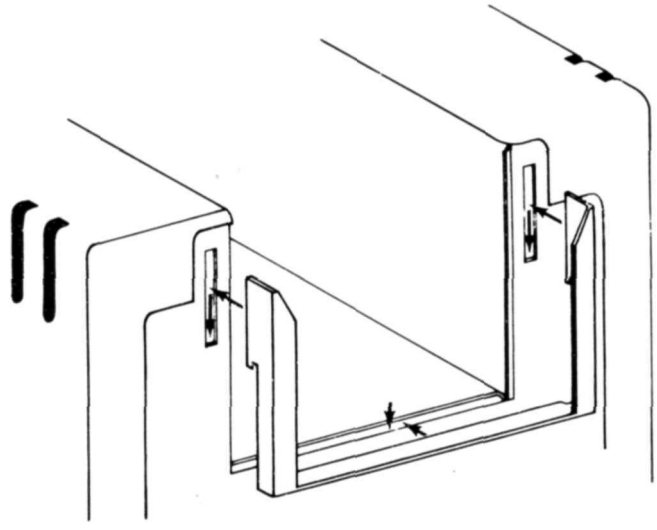


Figure 6B. Card Retainer Installation

Setting the DIP Switches

At the rear of the CR-510 are the DIP Switches which let you set the baud rate. The CR-510's baud rate must match that of the Computer it is connected to. For example, if you have set the baud rate of a TRS-80 Model III to 4800 baud, you must set the CR-510's DIP Switches to the 4800 baud setting.

There are four numbered DIP switches on the CR-510. The LEFT/RIGHT setting combination of the four switches determines the baud rate. Use a small screwdriver or a pair of tweezers to position the switches.

If all of the switches are set to the LEFT, for instance. 50 is the baud rate. If switches 1 and 4 are to the RIGHT and 2 and 3 are to the LEFT, 2000 is the baud rate, as shown in Figure 7. See Table 1.

Remember! 0= LEFT. 1 = RIGHT.

Table 1. Baud Rate Switch Settings

Switch				Baud
1	2	3	4	Rate
0	0	0	0	50
1	0	0	0	75
0	1	0	0	110
1	1	0	0	134.5
0	0	1	0	150
1	0	1	0	300
0	1	1	0	600
1	1	1	0	1200
0	0	0	1	1800
1	0	0	1	2000
0	1	0	1	2400
1	1	0	1	3600
0	0	1	1	4800
1	0	1	1	7200
0	1	1	1	9600
1	1	1	1	19200

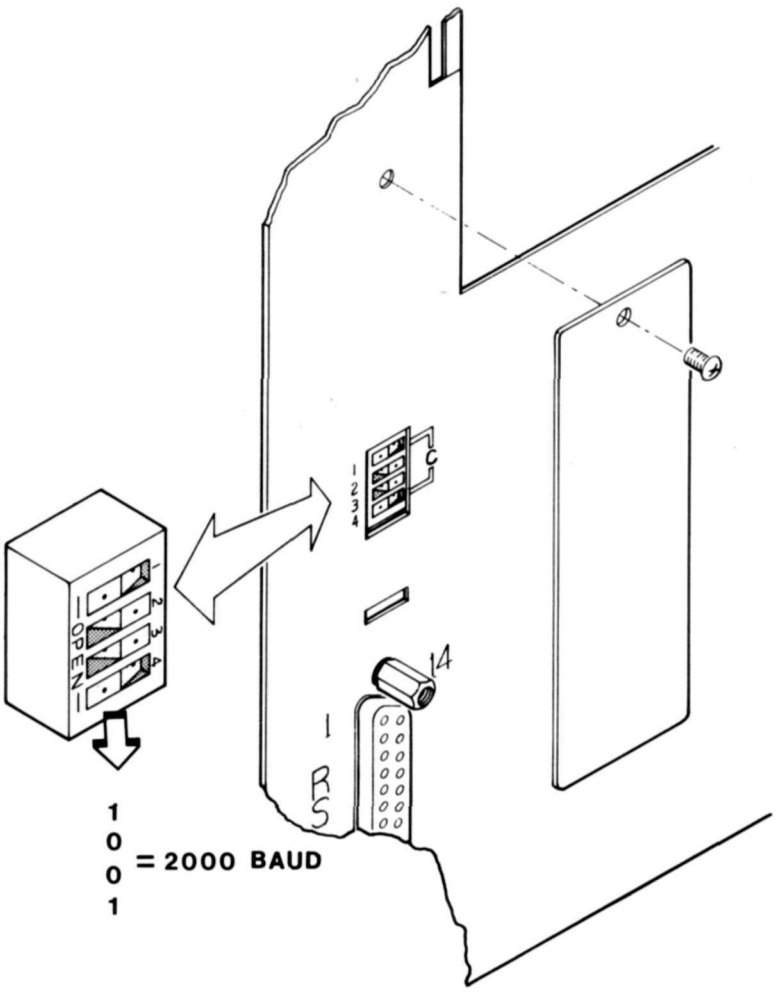


Figure 7. Baud Rate Switch Positions

Diagnostic Self-Test

Once the CR-510 is connected to a power source, you can perform the Self-Test to confirm that it is operating properly.

1. Be sure the unit is ON.
2. Set the Card Reader DIP Switches to 9600 baud.

   1 = LEFT
   2= RIGHT
   3= RIGHT
   4= RIGHT

3. Place the Diagnostic Test Card (Figure 8) face down into the Card Reader Hopper.
4. Press the SELF-TEST and START STOP Buttons simultaneously.
5. For the unit to pass the test, all Card Reader Front Panel lights (except power) will go off. A flashing lamp indicates a malfunction.

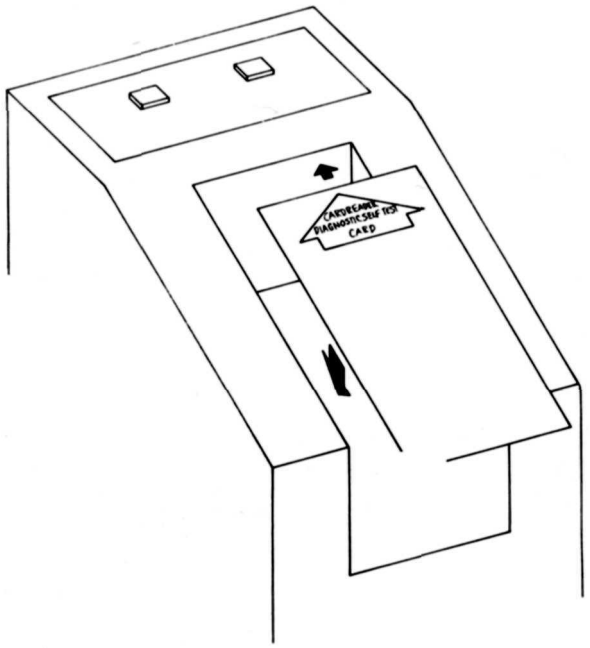
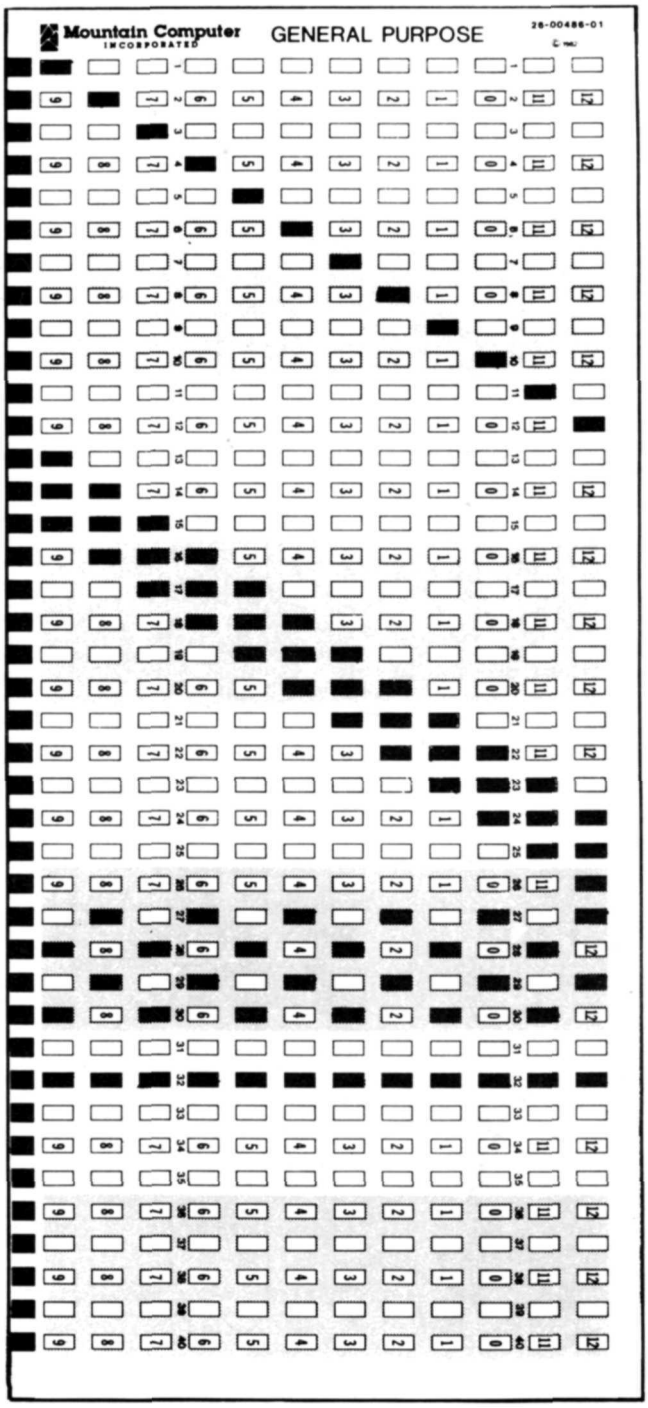


Figure 8. Inserting the Diagnostic Test Card

Card Left

Card Right



Card Trailing Edge ----------

Card Must Be Placed Face Down in the Card Reader Hopper

Figure 9. Card Reader Diagnostic Test Card

3/ General Information

Thus chapter will provide information on using card readers in general and the CR-510 in particular. This includes hints on marked or punched card characteristics and maintenance.

It also provides two test features that confirm the reliability of your CR-510 system.

Preparing, Handling and Maintaining Cards

Using card readers requires that you become familiar with the characteristics of cards and how to take care of them. For the Card Reader to read cards successfully, cards must be marked or punched properly and stored in a safe place. The equipment must be properly maintained and adjusted when necessary.

Marking and Punching the Cards

The CR-510 can be used to read "marked" or "punched" cards. However, there are a few "rules" that should be followed to effectively use the Card Reader.

Marked Cards For the Card Reader to read cards accurately, be sure that they are marked correctly. To mark a given "chad" (chads are the boxed-in areas on the card), fill the chad in completely. For example, note the following chad marks:

Most acceptable **Least acceptable**

Card marking may be done via any medium that will produce clear and legible marks that exhibit a maximum reflectance of 20%. To make sure that your cards are read, it is recommended that you use a #2 pencil.

For optimum accuracy, each marked card must be completely filled.

Punched Cards The Card Reader also reads punched cards. Cards must be punched (and designed) to produce holes that conform to standard punch equipment and USA standard X3.21-1967.

Storing and Handling the Cards

The Card Reader requires that cards be flat, otherwise the cards will jam up in the machine. Cards are subject to wear and tear when they are used a number of times. We recommend you not use the same card more than seven times. You can eliminate some slight distortions in the cards by lightly fanning the card deck.

The most common cause of card feed problems is "card warp." You can prevent this problem by handling the cards gently and storing them correctly. Cards should always be stored flat. Cartons of cards should be stored upright, off the floor, and not more than three cartons high. Keep the cards away from areas which may change temperature or humidity conditions abruptly, such as windows, air ducts, and radiators.

Card Stock

Card stock will conform to American National Standard ANSI X3. 11-1969 requirements, except for the following:

- A corner cut cannot be located on the timing mark side of the card.
- The length of the card can vary from 6 to 14 inches.

Most 9 pt. card stock will meet this requirement.

Card Reflectance

Cards shall have a minimum reflectance of 70% (measurements must be made at the near infra-red end of the spectrum).

Printing Ink

Card Body Ink may be any color (Sinclair and Valentine J6893 Red etc.) and it must maintain a minimum reflectance of 70%.

Timing Marks Ink must be non-reflective (PMS Black, etc.) and maintain a maximum reflectance of 20%.

Timing Marks

The Card Reader will read cards that have data aligned with the timing marks. Timing marks are positioned along the left side of the card (see Figure 10). For optimum chad-scan, the marks must be centered on the chad column and should be as wide as the chad boundaries.

Timing Mark Height — 0.120 ± 0.025 inches

Timing Mark Width Widths may vary from 0.024 to 0.25 inches. Best results are obtained when the timing mark width and the chad width are approximately the same.

Space Between Timing Marks must be a minimum of 0.070 inches.

First Timing Mark Location — 1st mark must be 0.077 inch (minimum) from the leading edge of the card.

Chad Location

The Chads (each row) must be centered at 0.25 inch intervals across the card from card edge to edge as shown in Figure 9.

The center of chad 12 and chad 9 must be 0.25 of an inch from the card edge.

Tolerance is ± .005 inches unless specified. This card and specifications are designed for reading during the timing marks.

How the Card Reader Works

The Card Reader reads the data by reflecting light from a lamp off of the cards and onto a series of photoelectric cells. The unit reads one column at a time, translates the data into a format (specified through software), and stores the data in a buffer.

When the card has been read, the data is sent byte-by-byte out the Serial I /O Port of the CR-510 into the Serial I/O Port of your computer.

Commands and echoed data are sent from your computer to the CR-510. You can instruct the Card Reader to transmit its current "status" along with the card data that is transmitted. The status is a two-byte ASCII string consisting of a status code followed by a comma.

If needed, you may instruct the Card Reader to expect an "echo" of the data it transmits to the computer. With this option, you can verify that what was received by your Computer was what was sent by the Card Reader.

Note: Your driver must echo the data back to the unit. (See Data Transmission Integrity.)

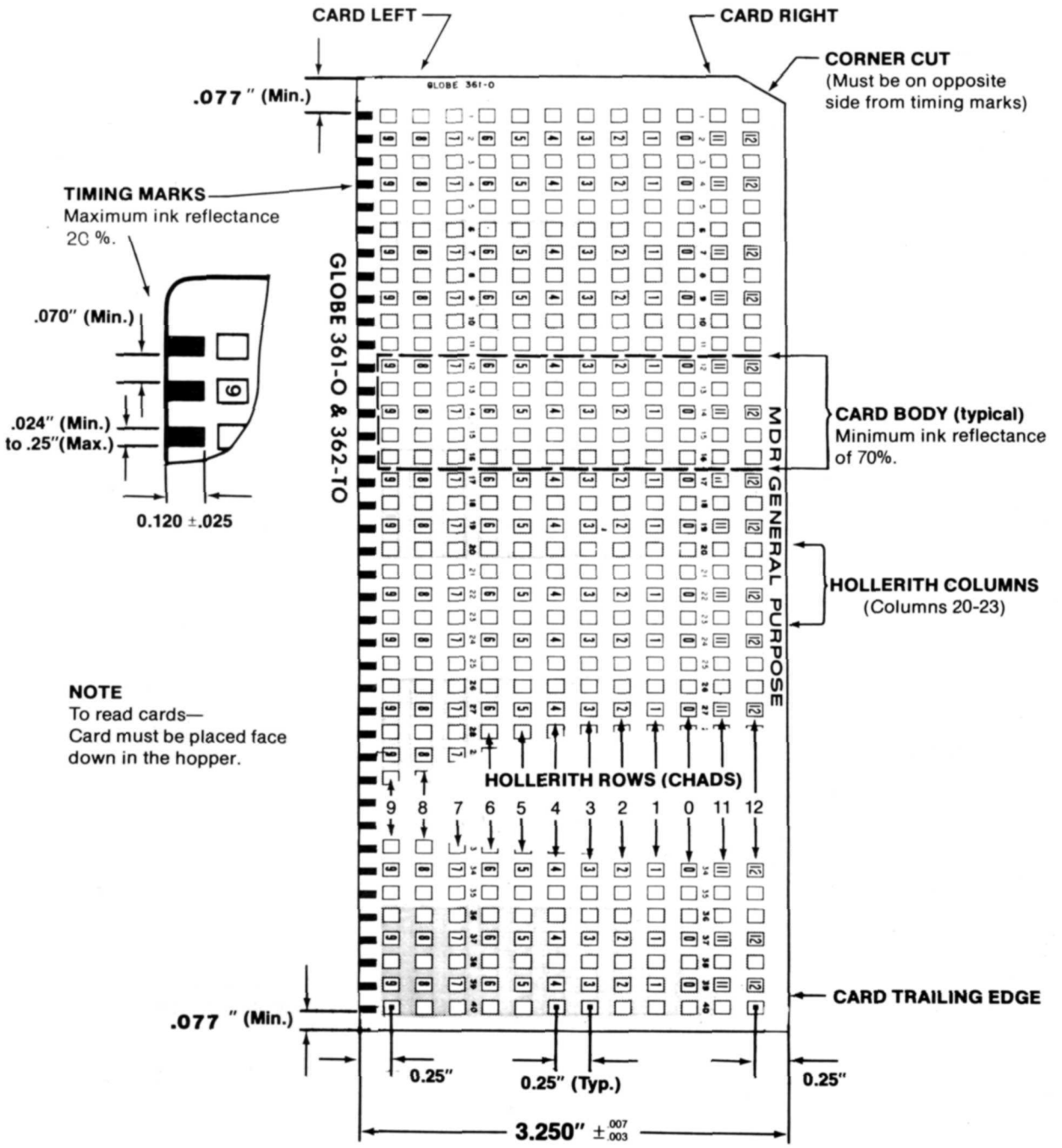


Figure 10. Card Specifications Chart

Card Feed Modes

The CR-510 can read cards in one of three modes:

- Single Feed
- Demand Feed
- Continuous Feed.

How to select these modes is outlined below.

Single Feed Mode

In this mode, the CR-510 reads a single card every time you press the START/STOP button. The READY lamp will illuminate, indicating that the CR-510 is ready to read a card. Press the START/STOP button to read a card. If the Card Hopper is empty, the LOAD ATTENTION Indicator will illuminate.

Demand Feed Mode

One card is read each time a PIK command is received from the Computer. The START/STOP Button must be pressed once to initiate the first read operation.

Note: If a card jam occurs during a read operation and status is disabled, the FEED ERROR Indicator will illuminate and no data will be sent. (The complete card must be read before data is sent.) The jammed card must be placed back at the bottom of the deck. (Removing the card deck will cause the LOAD ATTENTION Illuminator to light up.) Pressing the START/STOP button will resume the feed operation.

If a card jam occurs during a read operation and status is enabled, a status feed error will be sent to the TRS-80 Computer (the data will be a reverse slash indicating invalid data). The jammed card must be placed back at the bottom of the deck. Pressing the START/STOP Button will resume the feed operation.

Continuous Feed Operation

All of the cards in the Card Hopper will be read when the START/STOP Button is pressed.

Note: If the Card Hopper is emptied during the continuous feed operation, the unit will stop feed operations and the LOAD ATTENTION Indicator will illuminate. Press the START/STOP Button (after cards have been placed in the Hopper) to resume the continuous feed operation.

Adjusting the CR-510's Feed

If you notice that the Card Reader is either accepting more than one card at a time or rejecting all cards, chances are that a simple adjustment of the "stripper plate" will solve this problem. You can adjust it yourself.

To do this, all you need is a Phillips screwdriver and two blank General Purpose Cards. Use the following instructions to adjust the Card Reader:

1. Make sure the Card Reader's power is OFF.
2. Loosen the two screws that hold the stripper plate.
3. Take the two disposable cards and position them under the stripper plate. Push the stripper plate against the top card until it is as tight as you can get it. Then, retighten the screws.
4. Remove the cards (the top one might tear) and dispose of them if they have been damaged.

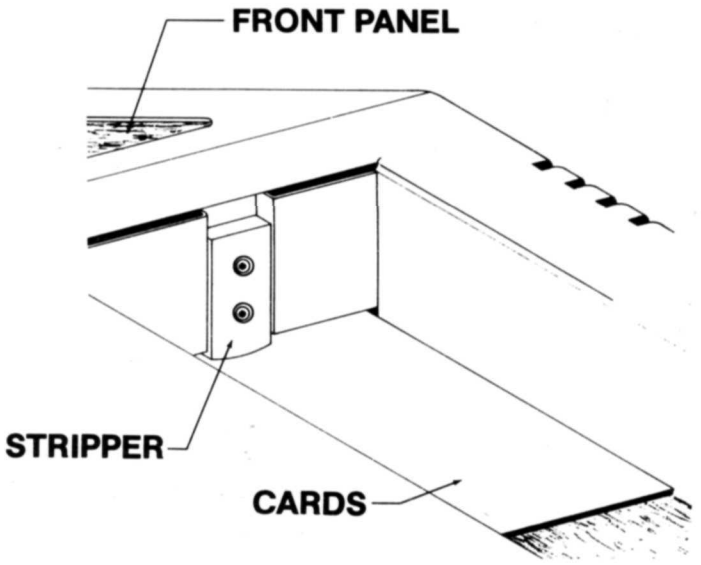


Figure 11. CR-510 Stripper Plate

Cleaning the Rubber Roller

Another condition that can inhibit the proper reading and feeding of cards is when the rubber roller (Figure 12) becomes contaminated by the graphite residue from previous card readings. We recommend periodic cleaning of the roller to insure proper frictional contact between cards and the roller. Also, by regularly cleaning the rubber roller, you can avoid the transfer of graphite from the roller to the next set of cards.

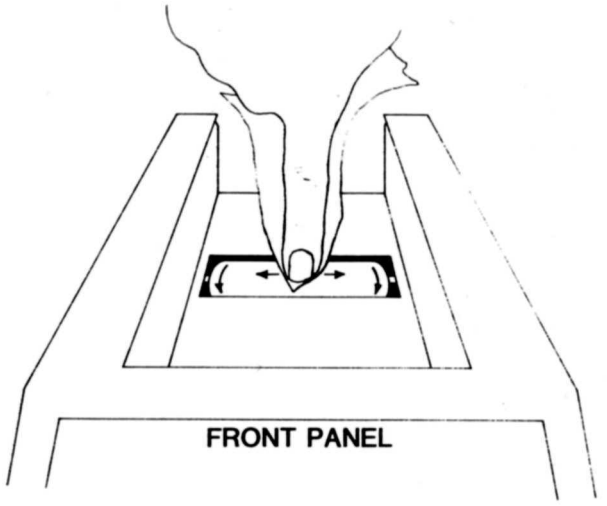


Figure 12. Cleaning the Rubber Roller

Included in the CR-510 package is a small vial of cleansing detergent and a soft cloth. These are specifically for cleaning the rubber roller and the read head assembly.

1. When cleaning the rubber roller, make sure that the unit is turned off and the power line is disconnected or unplugged.
2. Spray a small quantity of cleansing detergent onto the cloth.
3. With one hand, hold the cloth against the rubber roller. With the other hand turn the roller so that you are able to clean the entire area. Do not let any moisture from the cloth seep into the unit.

Note: Should you run out of the provided cleaner, you can use a liquid glass cleaner as a substitute. DO NOT use solvent-based cleaners or any cleaner that may leave a residue on the read head. Do not use full strength alcohol or ammonia.

Read Head Cleaning and Drive Lubrication

The read head assembly should be cleaned and the drive bearings lubricated after 500 hours of operation. To clean the read head and lubricate the bearings, perform the following steps:

1. Disconnect the I/O cable and the power cord from the rear of the unit. Remove the card weight, cards, and card catcher.
2. Remove the six screws that secure the housing to the bottom of the Card Reader as shown in Figure 13.

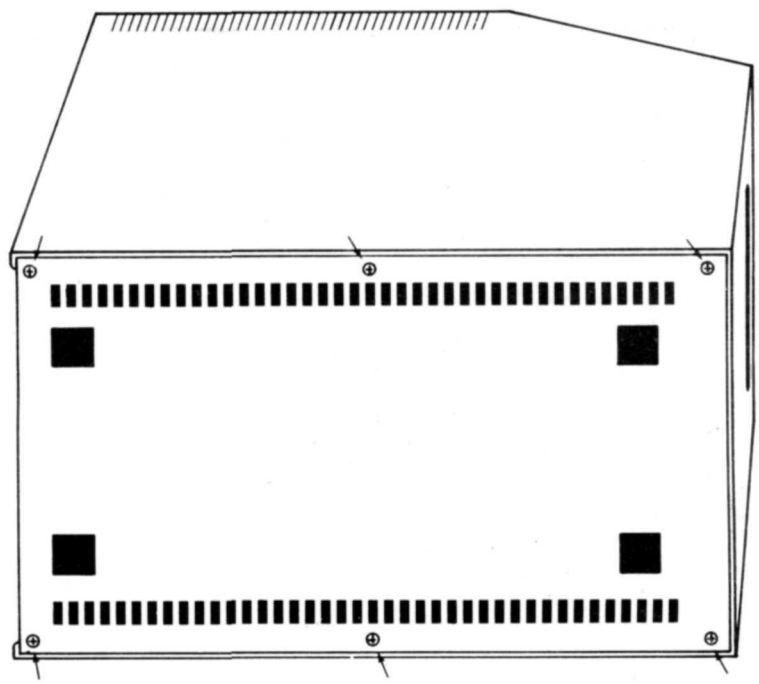


Figure 13. Screw Locations

3. Carefully lift the Card Reader housing up over the bucket and off the chassis as shown in Figure 14.

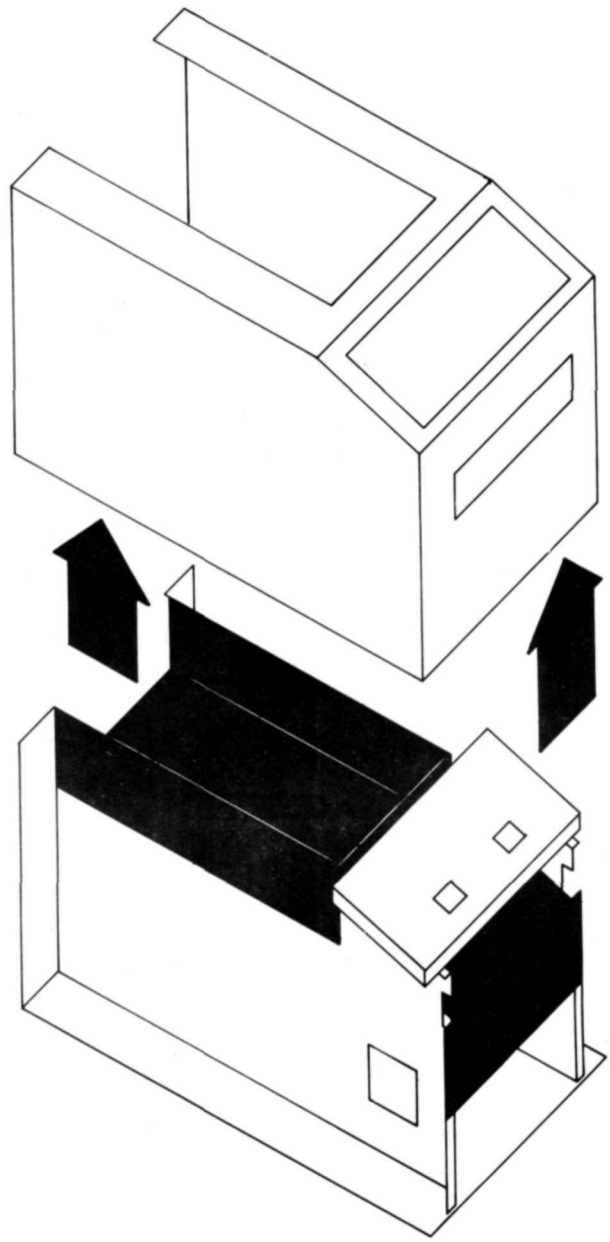


Figure 14. Removing the Housing

4. Lift the front panel assembly off the four positioning screws as shown in Figure 15.

5. Moisten a clean lint-free cloth with cleaner and clean the top front area of the read head as shown in Figure 16.

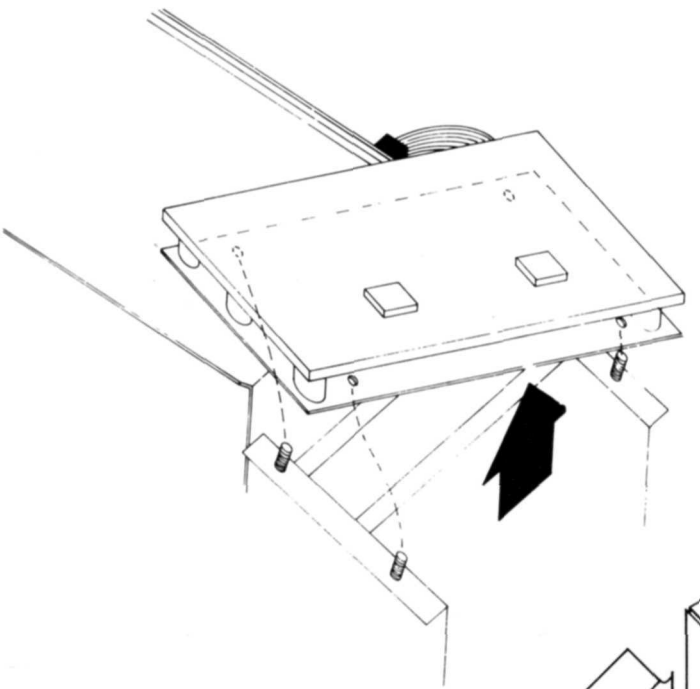


Figure 15. Removing the Front Panel

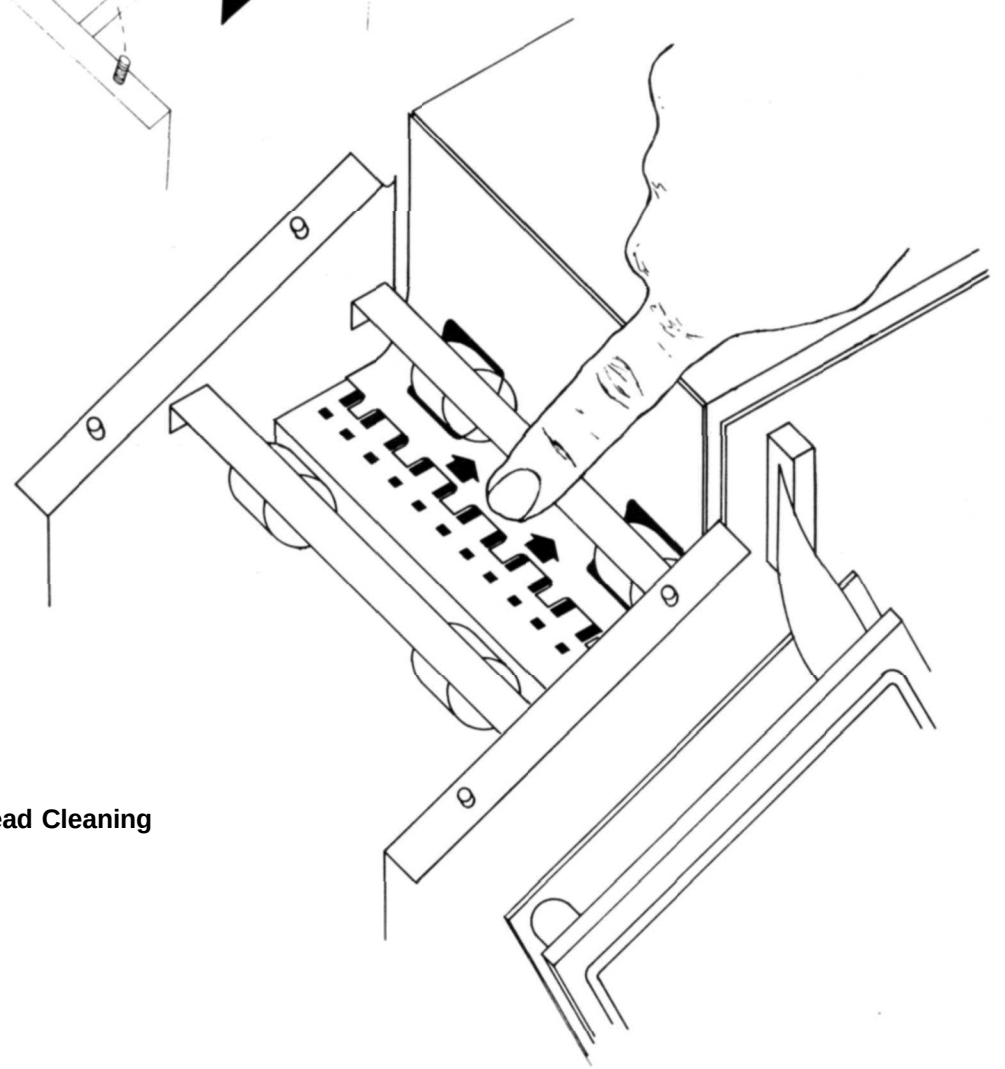


Figure 16. Read Head Cleaning

6. Add a drop of light oil to each of the exposed bearings on each side of the chassis.
7. Lubricate the drive roller bearings (Figure 17) using a pressurized oil can with an extension tube to reach the bearings surfaces.

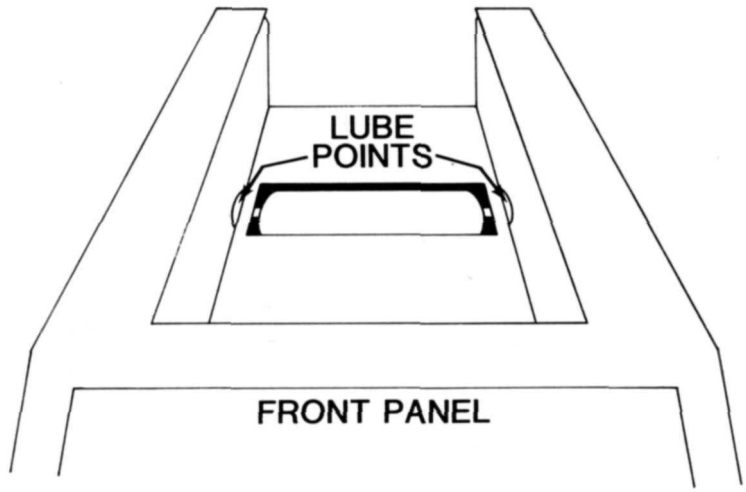


Figure 17. Drive Roller Bearings

8. Inspect the unit for excess oil and wipe clean if necessary.
9. Re-assemble the Card Reader by performing the preceding steps in reverse order.

Card Catcher Alignment

Improper alignment of the card catcher can also cause card jams or improper feed. Figure 6 A illustrates card catcher installation. Reposition if necessary.

4/ Using the CR-510

Many of the features of the CR-510 are software dependent. Switch settings and loading procedures depend on your particular application. However, there are certain aspects which are general to all applications. We will discuss these aspects in this section.

Programming the Card Reader

To use the Card Reader with your computer, you must have a driver routine which controls information flow to and from the unit. If you have pre-programmed software, you should not have to bother with learning the various program commands. Included in this manual are listings of the driver routines for the Model II and Model III systems. Detailed information about these routines can be found in Chapter 5 of this manual.

However, you may have a special need which requires a custom driver. This section shows you the commands that the Card Reader expects and the format of the information that the Card Reader returns to the computer.

Card Reader Command Structure

Commands from the computer to the Card Reader are sent in ASCII strings. Each command consists of three letters. When writing these commands into your custom software, separate each of the commands by either a single blank space or a semi-colon.. Terminate the string with an |ENTER| . For example, the following are legitimate command strings (in BASIC):

```
10 C1$ = "LF0;DFD;PIK" + CHR$(13)
20 C2$ = "STO ASC CFD" + CHR$(13)
```

(CHR$(13) generates the ASCII code for |ENTER| .)

Data Format

The data returned to the Computer by the Card Reader is of the general format:

*status data block carriage return linefeed**

status consists of one byte of information concerning the operational condition of the Card Reader, followed by a comma. You may disable the status transmission via a three-letter command in your software (refer to the STO and ST1 commands) in which case the first transmitted character will be part of the data block.

data block contains a stream of bytes which constitutes the data on the card. The number of bytes in the block depends on the format being used at the time.

The *data block* is followed by *carriage return* (ASCII code 13). Optionally, you can instruct the unit via software—(see the LFO and LF1 commands on page 27) to follow the carriage return with a *linefeed* instruction (ASCII code 10).

*Note: The Line Feed command is usually optional.

The Card Reader Commands

You can transmit commands to the unit at any time, except during the read operation in the Echo mode (see page 29 for a discussion of the Echo Mode).

When the Card Reader receives a complete command string (terminated with a carriage return) it first parses (breaks up) the string into individual commands. If any command is invalid, it returns a command error to the computer the next time the computer requests status.

In such a case, the READY light on the front panel will blink. To clear the error, the computer must first receive the status code (either as part of the normal transmitted data, or by requesting status with the STA command). It then must send a valid command to the Card Reader.

The following table contains a list of the commands that can be sent (via the TRS-80) to the CR-510. Each command is composed of three ASCII characters. The commands are executed in a first in/first out (FIFO) order.

Note: RTX (retransmit the last card data, in the buffer,) is an exception. It may be required to violate the FIFO order of execution. A command string that reads a card, changes the data format, then asks for a retransmit, must retransmit the previous card data in its original format. Then it will change the CR-510's format. For example,

ASC PIK BNI RTX PIK

will send ASCII data (1st PIK), ASCII data (RTX of 1st PIK), and Binary data (last PIK).

Command	Command Type	Function
ASC	Format	Convert to ASCII (1 byte)
BN1	Format	Binary I format (2 bytes)
BN2	Format	Binary II format (2 bytes)
HX1	Format	Hexadecimal I conversion (3 bytes)
HX2	Format	Hexadecimal II conversion (3 bytes)
NUM	Format	Numeric format (1 byte)
GR1	Format	Grader I Conversion (2 bytes)
GR2	Format	Grader II Conversion (2 bytes)
CFD	Feed Mode	Continuous Feed
DFD	Feed Mode	Demand Feed
SFD	Feed Mode	Single Feed
PIK	Transmit	Pick a card
STA	Transmit	Get unit status
RTX	Transmit	Retransmit last card
EC0	Unit Override	Character echo disabled
EC1	Unit Override	Character echo enabled
LF0	Unit Override	Line Feed after Carriage Return disabled
LF1	Unit Override	Line Feed after Carriage Return enabled
ST0	Unit Override	Unit status not returned with data
ST1	Unit Override	Unit status returned with data
ATN	Miscellaneous	Turn ATTENTION/LOAD light on (flashing)
LOD	Miscellaneous	Turn ATTENTION/LOAD light on
RES	Miscellaneous	Reset CR-510
11 (HEX)	ASCII	XON protocol (DC1 on some ASCII tables)
13 (HEX)	ASCII	XOFF protocol (DC3 on some ASCII tables)
13 14 (HEX)	ASCII	Hard Reset (DC3 DC4 on some ASCII tables)
08 (HEX)	ASCII	Backspace (BS on the ASCII table)

The Card Reader commands can be broken down into four categories: data format commands, feed mode commands, status/specification commands, and Hexadecimal commands.

Data Format Commands

Data Format commands instruct the CR-510 as to how it should interpret the data on the cards. Each card column consists of 12 rows. These rows were originally arranged to correspond to the "Hollerith" code, which is a system of coding similar to the ASCII code.

The rows are numbered using the Hollerith Code as follows:

left side									right side		
9	8	7	6	5	4	3	2	1	0	11	12

To make the Card Reader more versatile, you can specify a special format which retranslates the row marks on the cards into different fields. These fields are then translated into the actual bytes that will be transmitted by the Card Reader.

The format commands are:

ASC
ASCII

Converts the Hollerith card data into its ASCII equivalent. Each column translates into one byte of data. Data that lie outside of the ASCII range are converted to a reverse slash (ASCII code 92). See Appendix A for the Hollerith-to-ASCII conversion format.

BN1
BiNary 1

BNl is a binary representation of the card image. It separates the 12-chad/column (Hollerith format) card image into two 6-bit bytes, reading the card from right to left, as follows:

	row
Field One:	12 (least significant row)
	11
	0
	1
	2
	3
Field Two:	4 (least significant row)
	5
	6
	7
	8
	9

Field One represents the first byte and Field Two represents the second byte. The least significant row of each field (rows 12 and 4) corresponds to bit 0 of each byte. In addition, to fill out each byte, bit 6 is set to 1, and bit 7 is set to 0. This provides a character range of 64 through 127 (HEX 40 to 7F).

BN2
BiNary 2

BN2 is a binary representation of the card image. It separates the 12-chad/column Hollerith card data into two 6-bit fields, reading from left to right, as follows:

	row
Field One:	9 (least significant row)
	8
	7
	6
	5
	4
Field Two:	3 (least significant row)
	2
	1
	0
	11
	12

Field One represents the first byte and Field Two represents the second byte. The least significant row of each field (row 9 and row 3) correspond to bit 0 of each byte. In addition, to fill out each byte, bit 6 is set to 1, and bit 7 is set to 0. This provides a character range of codes 64 through 127.

HX1
HeXadecimal 1

HXl separates the 12-chad/column Hollerith card data into three fields, from right to left as follows:

	row
Field One:	12 (least significant row)
	11
	0
	1
Field Two:	2 (least significant row)
	3
	4
	5
Field Three:	6 (least significant row)
	7
	8
	9

Field One represents byte 1, Field Two represents byte 2, and Field Three represents byte 3. Each byte consists of the ASCII code of the hexadecimal number in the corresponding field. For example, marking rows 1 and 11 signifies a binary value of 1010 (X'0A), so byte 1 is a 41'X (the ASCII code for "A").

HX2
HeXadecimal 2

HX2 separates the 12-chad/column Hollerith card image into three 4-bit bytes, from left to right as follows:

Field One:	9 (least significant row)
	8
	7
	6
Field Two:	5 (least significant row)
	4
	3
	2
Field Three:	1 (least significant row)
	0
	11
	12

Field one represents byte 1, Field Two represents byte 2, and Field Three represents byte 3. Each byte consists of the ASCII code of the hexadecimal number in the corresponding field. For example, marking rows 1 and 11 signifies a binary value of 0101 (X'05), so byte 3 is a 35'X (the ASCII code for "5").

NUM
NUMeric

Converts rows 0 through 9 to ASCII values "0" through "9". Each column represents one byte. Rows 11 and 12 combine to have the following special meanings:

Row 11	12	Meaning
■		Minus sign
	■	Decimal point
■	■	E (Scientific Notation)
		Space

(•means the row is marked.) Marking more than one 0-9 row in a given column will result in a reverse slash.

GR1
GRader 1

Converts the data into two 6-bit fields, reading from right to left, as follows:

	Row	Represents
Field One:	12	"@"
	11	"A"
	0	"B"
	1	"C"
	2	"D"
	3	"E"
Field Two:	4	"@"
	5	"A"
	6	"B"
	7	"C"
	8	"D"
	9	"E"

Under this format, the Card Reader expects one marking per field. Byte 1 consists of the ASCII code of the character represented by the marked row of Field One. Byte 2 consists of the ASCII code of the character represented by the marked row of Field Two. For example if Row 0 is marked, then Byte 1 is equal to 66 (the ASCII code for "B").

If there are no row markings in a field, then the corresponding byte equals 63 (the ASCII code for "?'). If there is more than one row marking in a field, the Card Reader looks for the most dominant marking. If it cannot determine which is dominant, then the corresponding byte is returned as 62 (the ASCII code for ">").

Note: GR1 and GR2 are recommended for multiple-choice test scoring program development.

GR2
GRader 2

Converts the data into two 6-bit fields, reading from right to left, as follows:

	Row	Represents
Field One:	9	"@"
	8	"A"
	7	"B"
	6	"C"
	5	"D"
	4	"E"
Field Two:	3	"@"
	2	"A"
	1	"B"
	0	"C"
	11	"D"
	12	"E"

Under this format, the Card Reader expects one marking per field. Byte 1 consists of the ASCII code of the character represented by the marked row of Field One. Byte 2 consists of the ASCII code of the character represented by the marked row of Field Two. For example if Row 0 is marked, then Byte 2 is equal to 67 (the ASCII code for "C").

If there are no row markings in a field, then the corresponding byte equals 63 (the ASCII code for "?'). If there is more than one row marking in a field, the Card Reader looks for the most dominant marking. If it cannot determine which is dominant, then the corresponding byte is returned as 62 (the ASCII code for ">").

Feed Mode Commands

CFD
Continuous FeeD)

Puts the Card Reader into the Continuous Feed Mode.

DFD
Demand FeeD

Puts the Card Reader into the Demand Feed Mode.

SFD
Single FeeD

Puts the Card Reader into the Single Feed Mode.

PIK
PIcK card

Initiates a card read operation (when in the demand feed mode).

Status/Specification Commands

STA
STAtus

Sends the Card Reader Status to the Computer. Before sending the status, the Card Reader delays 90 milliseconds so that the computer can prepare to receive the incoming data.

RTX
ReTransmit

Retransmits the data from the last card read, regardless of any new commands (for example, a change of format is NOT reflected in the new data). Before sending the data, the Card Reader delays 90 milliseconds so that the computer can prepare to receive the incoming data.

ECO
ECho Off

Disables the echo mode of operation. That is, characters sent to the computer are not echoed back to the CR-510.

EC1
ECho On

Enables the echo mode of operation. All characters sent to the computer must be echoed (transmitted) back to the CR-510. If echoed data are not received by the CR-510 within 4 seconds after transmission, an "echo error' will occur.

LFO
Line Feed Off

Disables line feed after the carriage return (no line feed is sent after each card is read).

LF1
Line Feed On

Enables transmission of a line feed character (ASCII code 10) following the carriage return.

ST0

Unit Status is not returned with data.

ST1

Unit Status is returned with data.

ATN
ATteNtion

Causes the Card Reader LOAD ATTENTION lamp to flash. The unit will stop reading cards once the current card is read.

LOD
LOaD Attention

Causes the LOAD ATTENTION lamp to light. If a LOD command is sent and cards are in the hopper, the Card Reader will ignore the command.

RES
RESet Unit

Resets the Card Reader to the following default operating parameters: Continuous Feed, Eight Bits, Parity Off, One Stop Bit, LF Off, Echo Off, ASCII Mode, and Status Off. If a card read operation is in progress, this command will not be executed until it is completed. Any commands that follow the RES in a command string will not be lost.

Hexadecimal Commands

11
XON

The CR-510 supports the XON/XOFF protocol. The hexadecimal value 11 is the XON ASCII character. An XON command is the only command that will allow card data transmission to resume once an XOFF command has been issued.

13
XOFF

The Hexadecimal value 13 is the XOFF ASCII character. The XOFF command will cause an immediate interruption in the transmission of data from the CR-510 to the computer.

13 14
Clear and Reset

The Hexadecimal value 13 followed by a Hex 14 will cause the unit to clear all error conditions and reset to the following default operation parameters: Demand Feed, Eight Bits, Parity Off, One Stop Bit, LF Off, Echo Off, ASCII Mode and Status Off. If a card read operation is in progress, this command will terminate it immediately (a hard reset). All commands and data resident in the CR-510 memory prior to receipt of the Hard Reset will be flushed. (Also, referred to as DC3 and DC4.)

08

Erase Previous Character

The Hexadecimal value 08 (ASCII BS) will cause the previous character sent to the CR-510 to be erased. If it is the first character in a command string, it will be treated as a no-op.

Status

The following table lists the status conditions that can be returned to the computer if status is enabled (ST1) or an STA command is sent.

Card Reader Status

UNIT STATUS

ASCII CHARACTER	HEX VALUE	REPORTED CONDITION
0	30	Unit Ready to Read Cards
1	31	Echo error*
2	32	Unit card hopper is empty
3	33	Echo error* and hopper empty
4	34	Unit not ready to read cards**
5	35	Echo error* and not ready to read cards
6	36	Command error***
7	37	Echo error* and command error***
8	38	Unit feed error
9	39	Echo* and feed error

* The echo error status will reset once status has been sent to the TRS-80 and an RTX or PIK command is received.

** Indicates one of the following:

- Unit START button was not pressed.
- The Card Reader is currently performing the Self-Test or Diagnostic Self-Test.
- Unit STOP button was pressed.

*** An invalid command string was received. Requesting status and sending a valid command string will clear the error condition. RES or a hard reset will also clear the error.

For information on how to prevent and remedy feed errors, refer to Adjusting the CR-510's Feed.

CR-510 Communications Overview

The following section provides an overview of potential communications problems and their solutions.

Command Errors

The CR-510 provides status, when requested, and in most instances will return a reverse slash if valid data cannot be transmitted to the computer.

For example, suppose the CR-510 received the following command strings issued from a computer program:

ASC LFO STO ECO DFD PIK PIK (Carriage Return)
HX3 PIK (Carriage Return)
PIK (Carriage Return)

In this hypothetical situation, there are three cards in the hopper. When the START/STOP button is pressed, the first command string will place the Card Reader in the demand feed mode (ASCII format), line feed off, with status and echo disabled. Next, it will read the first card and transmit the

ASCII data. Then, it will read the second card and transmit the ASCII data. The HX3 command (second string) will cause a command error and the front panel READY lamp will blink (since line two has an invalid command the PIK that follows HX3 will be ignored). The last PIK command (line 3) will return a reverse slash in lieu of data (the last card will remain in the hopper). Requesting status and sending a valid command string will clear the error condition.

Note: an RES command or a DC3 DC4 (13 and 14 HEX) command pair (Hard Reset) will also clear the error condition. They also reset the Card Reader to its default parameters.

If status had been enabled (ST1), the Card Reader would have transmitted the following:

0,ASCII DATA Carriage Return — Card 1
0,ASCII DATA Carriage Return — Card 2
6,\ Last card remains in the hopper
READY lamp is blinking

A valid command string would clear the error condition.

TRS-80 Microprocessor Input Buffer Management

The XON/XOFF protocol (via 11 HEX and 13 HEX commands to the CR-510) provides an effective way to control the supply of data to the TRS-80 input buffer.

An XOFF command will cause an immediate interruption in the transmission of data from the Card Reader to the computer. This command should be used by the TRS-80 to indicate that its buffer is full (suspend card data transmission).
Note: the XON and XOFF characters are also referred to as DC1 and DC3 on some ASCII tables.

An XON command is the only command that will allow card data transmission to resume once an XOFF command has been issued. The balance of the data in the CR-510 buffer (remaining card data interrupted by the XOFF command etc.) will be sent.

Caution: If XOFF is sent during a card read operation with echo enabled, it may be integrated into the return data string, causing an echo error. If this occurs, an RTX command should be issued to re-transmit the card data.

Data Transmission Integrity (Echo On)

The return of CR-510 data (from the computer to the CR-510) is an effective method for assuring data transmission integrity. This is accomplished by turning echo on (EC1 command).

Note: The TRS-80 must echo back the received character (including CR, LF, and Status) before the Card Reader will transmit the next character.

Every character must be returned to the Card Reader, but only invalid data (not status or carriage return, etc.) will cause an echo error condition.

If a character is not echoed within 4 seconds, the Card Reader will time-out, initiating an echo error. The Card Reader will terminate this data transmission with a Carriage Return.

The echo error condition will prevent future card read operations until the error is cleared (as described below) or until a reset is sent. This provides the TRS-80 with the option of retransmitting the previous card data (RES or DC3 DC4 flushes the previous card data). An echo error condition can be cleared by meeting one of the following conditions:

1. TRS-80 computer receives status via: status returned with the card data (ST1), or by requesting status with an STA command. Then, the computer sends an RTX or PIK command.
2. The Computer sends an RES. The RES will be executed after the current card is read. It will reset the Card Reader to its default parameters. The CR-510 will be placed in the NOT READY state. Commands following RES in a string are not lost.
3. The Computer sends a DC3 DC4 command pair. This "hard reset" will be executed immediately (if a card is halfway through the read head, it will be left there). It will reset the Card Reader to its default parameters and will be placed in the NOT READY state. All card data in the buffer will be flushed.

5/ Using the Card Reader Demonstration Software

A Model III diskettte and a Model II diskette accompany this package. Each diskette contains a demonstration in BASIC and a demonstration in COBOL of the software components used to read cards. Use of these programs is outlined below.

Running a Demonstration

BASIC Card Reader Program When the message "TRSDOS Ready" appears:

- If you are using a TRS-80 Model III 48K system, type DO BCARD48 [ENTER] .
- If you are using a TRS-80 Model III 32K system, type DO BCARD32 [ENTER] .
- If you are using a TRS-80 Model II 64K system, type DO BCARD64 [ENTER] .

You'll then see a series of initializing messages. Next, you'll see a paragraph that introduces the demonstration. Read the paragraph. Below it, the message:

When the card hopper is loaded and the CR-510 is ready,
press [ENTER] to continue, or press [X] to exit.

will appear.

Ready the CR-510 and fill the Hopper with some marked cards, according to the general instructions in Chapter 2 of this manual. Then press [ENTER] . You'll see the message:

The card reader is initialized.
Press [START] on the CR-510 to begin reading cards.

Press the START/STOP button on the CR-510. The green "READY" light on the CR-510 will come on, and your cards will be read as they are fed through the machine one at a time. As they are read, you'll see whatever data was marked on the cards displayed on the computer screen. When all of the cards have been read, you'll see the message:

The card hopper is empty.

When the card hopper is loaded and the CR-510 is ready,
press [ENTER] to continue, or press [X] to exit.

At this point, you can end the demonstration by pressing [X] or you can reload the Card Hopper and repeat the demonstration.

COBOL Card Reader Program

To run the COBOL demonstration program, you need the COBOL Run-Time diskette (Model II, 26-4704; Model III, 26-2207). If you have a two-drive system, place the Card Reader Demonstration Software diskette in Drive 0 and the COBOL Run-Time diskette in Drive 1. If you have a single-drive system, copy the following Card Reader Software files onto their Run-Time diskette, as specified for the computer you're using:

- Model III 48K system: CCARD48/BLD, C48/DRV, CCR48/COB
- Model III 32K system: CCARD32/BLD, C32/DRV, CCR32/COB
- Model II 64K system: CCARD64, C64/DRV, CCR/COB

- If you are using a TRS-80 Model III 48K system, type DO CCARD48 [ENTER] .
- If you are using a TRS-80 Model III 32K system, type DO CCARD32 [ENTER] .
- If you are using a TRS-80 Model II 64K system, type DO CCARD64 [ENTER] .

You will see the series of prompting messages that were described above under "BASIC Card Reader Program." The only apparent difference between the way the BASIC and the COBOL programs run is that the COBOL program reads cards much faster.

How to Run Demonstration Programs Without the "DO" Files

Model II

Serial Channel A should be disabled. To find out if the channel is enabled or disabled, when TRSDOS READY is displayed, type SETCOM ENTER . The status of ports A and B will be displayed. If port A is enabled, type SETCOM A=OFF and press ENTER .

BASIC Demonstration

I. Insert the Card Reader Demonstration Software Diskette into Drive 0. At the TRSDOS READY message, type:

SETCOM A=(9600,8,N,1) ENTER .

2. Type: LOAD C64/DRV ENTER .

3. Finally, type: BASIC BCR -M:60927 ENTER and the demonstration program will begin.

COBOL Demonstration

1. Insert the Card Reader Demonstration Software Diskette into Drive 0 and the COBOL Run-Time Diskette into Drive 1. (Or use only the Run-Time Diskette with the appropriate files copied onto it, as described on page 31.) When TRSDOS READY is displayed, type:

SETCOM A=(9600, 8,N,1) ENTER .

2. Next, type: RUNCOBOL CCR T=EDFF ENTER
and the demonstration program will begin.

MODEL III

BASIC Demonstration

I. Insert the Card Reader Software Diskette into Drive 0. When TRSDOS READY is displayed, type:

SETCOM (WORD=8,BAUD=9600,STOP=1,PARITY=3,NOWAIT) ENTER

2. Load the routine:

- 48K users, type: LOAD C48/DRV ENTER
- 32K users, type: LOAD C32/DRV ENTER

3. Finally:

- 48K users type: BASIC BCR48 -M:64767 ENTER
- 32K users type: BASIC BCR32 -M:48380 ENTER

and the demonstration program will begin.

COBOL Demonstration

1. Insert the Card Reader Software Diskette into Drive 0, and the COBOL Run-Time Diskette into Drive 1. (Or use only the Run-Time Diskette with the appropriate files copied onto it, as described on page 31.) When TRSDOS READY is displayed, type:

SETCOM (WORD=8,BAUD=9600,STOP=1,PARITY=3,NOWAIT) ENTER

2. Load the routine:

- 48K users, type: LOAD C48/DRV ENTER
- 32K users, type: LOAD C32/DRV ENTER

3. Finally, type:

- 48K users: RUNCOBOL CCR48 T=0FD00 ENTER
- 32K users: RUNCOBOL CCR32 T=0BD00 ENTER

and the demonstration program will begin.

Programmers' Guide

The following information is included to help you adapt this software for use with your own card reader application. Chapter 4 of this manual contains complete information on the commands recognized by the CR-510.

The files that are included on the enclosed diskettes are listed and described below. Some guidelines for using these drivers with your own applications are also given.

Model II 64K	Model III 32K	Model III 48K	Description
C64/MAC (*)	C32/SRC	C48/SRC (*)	Source file for Assembly language driver.
C64/DRV	C32/DRV	C48/DRV	Object file for Assembly language driver. This file is in "Dump" format as required by COBOL—that is, it was created using the TRSDOS DUMP command.
	C32/CMD	C48/CMD	Object file for Assembly language driver.
BCR64	BCR32	BCR48	BASIC Program that calls the Assembly language driver, handles user input, and prints output to the screen.
BCRNOTES (*)		BCRNOTES (*)	Annotated versions of BCR64 and BCR48. The purposes of the various routines in the program are described. Differences in the 32K program are noted.
BCARD64	BCARD32/BLD	BCARD48/BLD	"DO" files to initialize the RS-232 port, load the Assembly language driver, set top of memory, and execute the BASIC card reader software.
CCR/CBL (*)	CCR32/CBL	CCR48/CBL (*)	Source file for the COBOL program that calls the Assembly language driver, handles user input, and prints output to the screen. Comments explaining the various sections of the Procedure Division are included.
CCR/COB	CCR32/COB	CCR48/COB	Object file for CCRxx/CBL.
CCARD	CCARD32/BLD	CCARD48/BLD	"DO" files to initialize the RS-232 port, load the assembly language driver, set top of memory and execute the COBOL card reader software.

(*) Listings of the files marked with an asterisk appear at the end of this section.

First, you should familiarize yourself with the annotated versions of the files for your model number and memory size TRS-80 computer (BCRNOTES, CCR/CBL, CCR32/CBL, or CCR48/CBL).

The Assembly language program is a general purpose driver for the CR-510. It can be used with cards in any format. If your application uses 40 column general purpose cards, like those included with this CR-510, then the BASIC and COBOL programs can be used as they are. The information returned by the card reader to the TRS-80 microcomputer is contained in "A$" in the BASIC program, or in "COLS" in the COBOL program (see annotated version for details). These

demonstration programs merely print the text of the card to the screen (after peeling off the status information) through the COBOL statement "DISPLAY COLS, CARD-EOL" or the BASIC statement "PRINT MID$(A$,3,L)". (Use of disk files will require the addition of a file description (FD) section in COBOL and OPEN, FIELD, etc. statements in BASIC. Refer to the COBOL or BASIC language manual for details.)

If your application uses a special format card, you'll need to make some changes to the BASIC and COBOL programs. In the COBOL program, you'll need to change the 77 level descriptions and the 01 CARD descriptions in the Working-Storage section of the Data Division. In the BASIC program, you'll need to change the defined value of "CL" (card length). Also, see Chapter 4 of this manual for details on special formats that the CR-S10 will read.

```
00100   ;Subroutine for Model II - CR-510 Intelligent Card Reader.
00110   ;11/10/82
00120           ENTRY   C64
00130           ASEG
00140           ORG     06E00H
00150   ;                       ;COBOL entry point
00160   C64::   JP      COBOL   ;COBOL ENTRY POINT
00170           JP      BASIC   ;BASIC ENTRY POINT
00180   ;
00190   COBOL:  LD      L,(IX+2)
00200           LD      H,(IX+3)
00210           INC     HL      ;?
00220           LD      A,(HL)  ;string length (assume low byte only!)
00230           LD      (COUNT),A ;temp storage
00240           LD      L,(IX+4) ;lo byte, string address
00250           LD      H,(IX+5) ;hi byte, string address
00260           JR      BEGIN
00270   ;                       ;BASIC entry point
00280   BASIC:  LD      A,(DE)  ;string length
00290           LD      (COUNT),A ;temp storage
00300           INC     DE      ;point to LSB of string address
00310           LD      A,(DE)
00320           LD      L,A     ;LSB --> L
00330           INC     DE      ;point to MSB of string address
00340           LD      A,(DE)
00350           LD      H,A     ;MSB --> H
00360   ;
00370   BEGIN:  LD      (STRING),HL
00380           LD      A,(HL)  ;first byte of string
00390           CP      0
00400           JR      Z,FIRST ;zero means INPUT
00410           CP      ' '     ;blank also implies input
00420           JR      NZ,XMITER ;else something to XMIT
00430   FIRST:  LD      A,96    ;SVC call, port A recieve
00440           RST     8
00450           JR      C,ERROR ;quit if no carrier
00460           JR      Z,NEXT4 ;got one!
00470           JR      FIRST   ;else try again...
00480   NEXT0:  LD      DE,01F00H ;for count down
00490   NEXT2:  LD      A,96
00500           RST     8
00510           JR      C,ERROR
00520           JR      Z,NEXT4
00530           DEC     DE      ;time-out counter
00540           LD      A,D
00550           OR      E
00560           JR      NZ,NEXT2
00570           LD      B,13    ;timed out!!
00580           LD      (HL),B
00590           RET
00600   NEXT4:  AND     078H
```

```
00610           JR      NZ,ERROR
00620           LD      (HL),B
00630           INC     HL
00640           LD      A,(COUNT) ;preserved string length
00650           DEC     A
00660           LD      (COUNT),A
00670           OR      A
00680           JR      NZ,NEXT0
00690           RET
00700           PAGE
00710   XMITER: LD      HL,(STRING)
00720           INC     HL
00730           INC     HL
00731           LD      A,(COUNT)
00732           ADD     A,-2
00733           LD      (COUNT),A
00740   XMIT0:  LD      A,(HL)
00750           CALL    XMIT2
00760           INC     HL
00770           LD      A,(COUNT)
00780           DEC     A
00790           LD      (COUNT),A
00800           OR      A
00810           JR      NZ,XMIT0
00820           LD      A,13    ;return via xmit after CR
00830   XMIT2:  LD      B,A     ;character to be xmitted
00840           LD      DE,0FFFFH
00850   XMIT4:  LD      A,97    ;SVC call, port A transmit
00860           RST     8
00870           JR      C,ERROR
00880           RET     Z       ;return if character transmitted
00890           BIT     0,A     ;check CLEAR TO SEND status bit
00900           JR      NZ,ERROR
00910           LD      A,D
00920           OR      E
00930           DEC     DE
00940           JR      NZ,XMIT4
00950   ERR:    LD      HL,(STRING) ;restore to error word
00960           LD      A,'E'   ;show error
00970           LD      (HL),A
00980           POP     BC      ;for stack clean-up
00985           XOR     A       ;CLR A
00990           RET
01000   ERROR:  CALL    ERR     ;to make the stack work right
01010   ;
01020   STRING: DEFW    0
01030   COUNT:  DEFB    0
01050           END
```

```
000100 IDENTIFICATION DIVISION.
000110   PROGRAM-ID.                    CCR.
000120   AUTHOR.                        B.PERRY.
000130   DATE-WRITTEN.                  JAN 12 1983.
000140 ENVIRONMENT DIVISION.
000150  CONFIGURATION SECTION.
000160   SOURCE-COMPUTER.         MODELII.
000170   OBJECT-COMPUTER.         MODELII-64K.
000180 DATA DIVISION.
000190  WORKING-STORAGE SECTION.
000200   77  DRIVER          PIC A(7); VALUE IS "C64/DRV".
000205*        LEN0 IS FOR INIT
000210   77  LEN0            PIC 99;   USAGE IS COMP-1 VALUE IS 17.
000215*      LEN1 IS FOR PIK
000220   77  LEN1            PIC 99;   USAGE IS COMP-1 VALUE IS 5.
000225*      LEN2 IS FOR CARD
000230   77  LEN2            PIC 99;   USAGE IS COMP-1 VALUE IS 43.
000240   77  ANS             PIC A(1).
000250 01  PIK.
000260     02  PIKER         PIC A(2).
000270     02  FILLER        PIC A(3); VALUE IS "PIK".
000280 01  INIT.
000290     02  INITR         PIC A(2).
000300     02  FILLER        PIC A(4); VALUE IS "RES ".
000310     02  FILLER        PIC A(4); VALUE IS "EC0 ".
000320     02  FILLER        PIC A(4); VALUE IS "ST1 ".
000330     02  FILLER        PIC A(3); VALUE IS "DFD".
000340 01  CARD.
000350     02  STAT          PIC A(2).
000360     02  COLS          PIC X(40).
000370     02  CARD-EOL      PIC X(1).
000380 PROCEDURE DIVISION.
000390   A005-INIT.
000400     DISPLAY"TRS-80 CR-510 Card Reader Demonstration"
000410        LINE 5 POSITION 20 ERASE.
000420     DISPLAY" ".
000430     DISPLAY" ".
000440     DISPLAY"This program illustrates the software comp"
000450     "onents used to read cards".
000460     DISPLAY"with the TRS-80 CR-510 Card Reader and the"
000470     " TRS-80 Model II microcomputer. ".
000480     DISPLAY"For listings of the program source files involved,"
000490     " refer to the CR-510 Owner's  Manual.".
000500   A007-INIT.
000510*       RETURN HERE AFTER ERROR OR WHEN OUT OF CARDS IN THE HOPPER
000520     DISPLAY" ".
000530     DISPLAY" ".
000540     DISPLAY"              When the card hopper is loaded and "
000550     "the CR-510 is ready,".
000560     DISPLAY"               press < ENTER > to continue, or "
000570     "press < X > to exit.".
```

```
000580      ACCEPT ANS, SIZE 1.
000590      IF ANS IS EQUAL TO "X"; GO TO A999-THRU.
000600*     INITIALIZE CARD READER
000610      MOVE "X," TO INITR.
000620      CALL DRIVER USING LEN0, INIT.
000630      IF INITR IS NOT EQUAL TO "X,"; GO TO A005-INIT.
000640      DISPLAY" ".
000650      DISPLAY" ".
000660      DISPLAY"The card reader is initialized." POSITION 25.
000670      DISPLAY"              Press < START > on the CR-510 to "
000680-     "begin reading cards."
000690      DISPLAY" ".
000700    A010-NEXT.
000710*     READ CARDS
000720      MOVE "X," TO PIKER.
000730      CALL DRIVER USING LEN1, PIK.
000740      MOVE SPACES TO STAT.
000750      CALL DRIVER USING LEN2, CARD.
000760*     STAT = 0 MEANS READER IS READY, =2 MEANS CARD HOPPER IS
              EMPTY
000770*          = 4 MEANS READER IS NOT READY
000780      IF STAT IS EQUAL TO "4,"; GO TO A010-NEXT.
000790      IF STAT IS EQUAL TO "2,"; GO TO A040-EMPTY.
000800*     DISPLAY CONTENTS OF THE CARD ON THE SCREEN
000810      DISPLAY COLS, CARD-EOL.
000820      IF STAT IS EQUAL TO "0,"; GO TO A010-NEXT.
000830*     ERROR TRAPPING ROUTINE
000840      DISPLAY"              ERROR "STAT" has occurred.".
000850      DISPLAY"              Refer to the CR-510 Owner's Manual"
000860      " for error descriptions.".
000870      GO TO A007-INIT.
000880    A999-THRU.
000890      STOP RUN.
000900    A040-EMPTY.
000910      DISPLAY"The card hopper is empty." POSITION 27 ERASE
            LINE 1.
000920      GO TO A007-INIT.
000930 END PROGRAM.
```

```
5  'BCRNOTES:   BASIC Card Reader Program (with comments)
10 'TRS-80 Model II - CR-510 Intelligent Card Reader Demonstration  1/13/8
3
11 'Copyright TANDY CORPORATION 1983
12 '
18 '
19 ' Clear string space and initialize variables
20 CLEAR 500: DEFINT A-Z
22 '
23 '
24 ' Define beginning address of assembly language card reader driver
25 DEFUSR0=&HEE03
29 ' Define card reader control string character
30 ZZ$=CHR$(0)
34 ' Define carriage return (CR$) and card length (CL)
35 CR$=CHR$(13): CL=40
37 '
38 '
39 'Clear screen and begin demonstration
40 CLS : PRINT TAB(20) "TRS-80 CR-510 Card Reader Demonstration" : PRINT :
 PRINT : PRINT "This program illustrates the software components used to r
ead cards " : PRINT"with the TRS-80 CR-510 Card Reader and the TRS-80 Mode
l II microcomputer. "
50 PRINT "For listings of the program source files involved, refer to the
CR-510 Owner's  Manual." : PRINT : PRINT
60 PRINT TAB(13) "When the card hopper is loaded and the CR-510 is ready,"
 : PRINT TAB(14) "press < ENTER > to continue, or press < X > to exit."; :
 QQ$=INKEY$
67 '
68 '
69 ' Wait for 'X' or 'x' to exit, or ENTER to continue
70 QQ$ = INKEY$ : IF (QQ$ = CHR$(88) OR QQ$ = CHR$(120)) THEN END ELSE IF
QQ$ <> CHR$(13) THEN 70
77 '
78 '
79 ' Initialize card reader
80 T1$ = "X,RES EC0 ST1 DFD" : X$=USR0(T1$)
90 PRINT : PRINT : PRINT TAB(25) "The card reader is initialized." : PRINT
 TAB(14) "Press < START > on the CR-510 to begin reading cards." : PRINT
97 '
98 '
99 ' Read cards
100 T0$ = "X,PIK" : X$=USR0(T0$)
110 A$ = ZZ$+STRING$(2+CL+1,"-") : A$=USR0(A$)
117 '
118 '
119 ' Get reader status (S$) - first character in string returned by CR-51
0.          "4" means reader not ready
120 S$ = MID$(A$,1,1) : IF S$="4" THEN 100
127 '
```

```
128 '
129 ' Status value 0 means reader is ready; 2 means hopper is empty
130 IF (S$="0" OR S$="2")=0 THEN PRINT "ERROR "S$" has occurred. Refer to
the CR-510 Owner's Manual for error descriptions.": GOTO 60
137 '
138 '
139 'Get length of text on card and print to screen (ignore status and fol
lowing comma; start at character 3 in string returned by card reader: this
 corresponds to column 1 on card)
140 L=INSTR(3,A$,CR$)-3: PRINT MID$(A$,3,L)
147 '
148 '
149 ' Status value 2 means card hopper is empty
150 IF S$="2" THEN CLS:PRINTTAB(28) "The card hopper is empty.": GOTO 60 E
LSE 100
999 END
```

```
00100 ;SUBROUTINE FOR CR-510 INTELLIGENT CARD READER
00110 ;12/17/82
00120 ;>>>>>MODEL III
00130 RSTX     EQU     055H     ;RS-232-C OUTPUT
00140 RSRCV    EQU     050H     ;RS-232-C INPUT
00150 RSINIT   EQU     05AH     ;RS-232-C INITIALIZE
00160 KBBRK    EQU     028DH
00170 VDLINE   EQU     021BH
00180 VDCHAR   EQU     033H
00190 TRSDOS   EQU     402DH    ;"TRSDOS READY...
00200          ORG     0FD00H
00210 C48      JP      COBOL    ;COBOL ENTRY POINT
00220          JP      BASIC    ;BASIC ENTRY POINT
00230 ;
00240 COBOL    LD      L,(IX+2)
00250          LD      H,(IX+3)
00260          INC     HL       ;?
00270          LD      A,(HL)   ;STRING LENGTH (ASSUME LOW BYTE)
00280          LD      (CC),A
00290          LD      L,(IX+4) ;LO BYTE, STRING ASDDRESS
00300          LD      H,(IX+5) ;HI BYTE
00310          JR      BEGIN
00320 ;
00330 BASIC    CALL    0A7FH    ;RETRIEVE STRING POINTER
00340          EX      DE,HL    ;TO DE, FOR PROCESSING
00350          LD      A,(DE)   ;STRING LENGTH
00360          LD      (CC),A
00370          INC     DE
00380          LD      A,(DE)
00390          LD      L,A      ;LSB --> L
00400          INC     DE
00410          LD      A,(DE)
00420          LD      H,A      ;MSB --> H
00430 ;
00440 BEGIN    LD      A,(INITED) ;INITIALIZATION INDICATION
00450          OR      A
00460          JR      NZ,BEGIN2
00470          INC     A
00480          LD      (INITED),A
00490          CALL    RSINIT   ;DO IT
00500 BEGIN2   LD      (STRING),HL
00510          LD      A,(HL)   ;FIRST BYTE OF STRING
00520          CP      0
00530          JR      Z,FIRST  ;ZERO MEANS INPUT
00540          CP      ' '
00550          JR      NZ,XMITER ;ALSO IMPLIES XMIT!
00560 FIRST    CALL    RSRCV    ;INPUT ('NO-WAIT' ASSUMED)
00570          LD      DE,16872 ;CHAR. INPUT BUFFER
00580          LD      A,(DE)
00590          CP      0
00600          JR      NZ,NEXT4 ;GOT ONE!
00610          CALL    KBBRK    ;CHECK FOR 'BREAK' KEY
00620          JR      Z,FIRST
00630          JR      TOUT     ;...ELSE LIKE TIME-OUT
00640 NEXT0    LD      BC,01F00H ;FOR COUNT DOWN
00650 NEXT2    CALL    RSRCV    ;...THE INPUT CHECK
00660          LD      A,(16872)
00670          CP      0
00680          JR      NZ,NEXT4 ;GOT ANOTHER ONE!
00690          DEC     BC
00700          LD      A,B
```

```
00710           OR      C
00720           JR      NZ,NEXT2
00730 TOUT      LD      B,13    ;TIMED OUT!
00740           LD      (HL),B
00745           LD      A,00            ;CLEAN RETURN FOR COBOL
00750           RET
00760 NEXT4     AND     07FH    ;ASSURE CLEAR PARITY
00770           LD      (HL),A
00780           INC     HL
00790           LD      A,(CC)  ;PRESERVED STRING LENGTH
00800           DEC     A
00810           LD      (CC),A
00820           OR      A
00830           JR      NZ,NEXT0
00835           LD      A,00    ;CLEAN RETURN FOR COBOL
00840           RET
00850 XMITER    LD      A,(CC)
00860           ADD     A,-2    ;ADJUST FOR STATUS WORD
00870           LD      (CC),A
00880           LD      HL,(STRING)
00890           INC     HL
00900           INC     HL
00910 XMIT0     LD      A,(HL)
00920           CALL    XMIT2
00930           INC     HL
00940           LD      A,(CC)
00950           DEC     A
00960           LD      (CC),A
00970           OR      A
00980           JR      NZ,XMIT0
00990           LD      A,13    ;ALWAYS TERMINATE W/ CR
01000 XMIT2     LD      (16880),A
01010           LD      B,A
01030           CALL    RSTX    ;>>>>THE OUTPUT
01035           LD      A,00
01040           RET     NZ
01050           LD      A,B
01060           JR      XMIT2   ;ELSE TRY AGAIN!
01070 ERROR     LD      (HL),00
01080           LD      HL,MSG
01090           CALL    VDLINE
01095           LD      A,00
01100 THRU      RET
01110 CC        DEFB    0
01120 STRING    DEFW    0
01130 INITED    DEFB    0
01140 MSG       DEFM    'RS-232-C ERROR'
01145           DEFB    0DH
01150           END     TRSDOS
```

```
000100 IDENTIFICATION DIVISION.
000110   PROGRAM-ID.          CCR48.
000120   AUTHOR.              B.PERRY.
000130   DATE-WRITTEN.        JAN 11 83.
000140 ENVIRONMENT DIVISION.
000150  CONFIGURATION SECTION.
000160   SOURCE-COMPUTER.   MODELIII.
000170   OBJECT-COMPUTER.   MODELIII-48K.
000180 DATA DIVISION.
000190  WORKING-STORAGE SECTION.
000200   77 DRIVER      PIC A(7); VALUE IS "C48/DRV".
000205*     LEN0 IS FOR INIT
000210   77 LEN0        PIC 99;   USAGE COMP-1 VALUE IS 17.
000215*     LEN1 IS FOR PIK
000220   77 LEN1        PIC 99;   USAGE COMP-1 VALUE IS 5.
000225*     LEN2 IS FOR CARD
000230   77 LEN2        PIC 99;   USAGE COMP-1 VALUE IS 43.
000240   77 ANS         PIC A(1).
000250 01  PIK.
000260     02 PIKER     PIC A(2).
000270     02 FILLER    PIC A(3); VALUE IS "PIK".
000280 01  INIT.
000290     02 INITR     PIC A(2).
000300     02 FILLER    PIC A(4); VALUE IS "RES ".
000310     02 FILLER    PIC A(4); VALUE IS "EC0 ".
000320     02 FILLER    PIC A(4); VALUE IS "ST1 ".
000330     02 FILLER    PIC A(4); VALUE IS "DFD".
000340 01  CARD.
000350     02 STAT      PIC A(2).
000360     02 COLS      PIC X(40).
000370     02 CARD-EOL  PIC X(1).
000380 PROCEDURE DIVISION.
000390   A005-INIT.
000400     DISPLAY "TRS-80 CR-510 Card Reader Demonstration"
000410         LINE 1 POSITION 12 ERASE.
000420     DISPLAY" "
000430     DISPLAY" ".
000440     DISPLAY"This program illustrates the software comp"
000450     "onents used to read   cards with the TRS-80 CR-510"
000460     " Card Reader and the TRS-80".
000470     DISPLAY "Model III microcomputer.".
000480     DISPLAY"For listings of the program source files "
000490     "involved, refer to the CR-510 Owner's Manual.".
000500   A007-INIT.
000510*    RETURN HERE ON ERROR OR WHEN OUT OF CARDS IN THE HOPPER
000520     DISPLAY" "
000530     DISPLAY" ".
000540     DISPLAY"       When the card hopper is loaded and "
000550     "the CR-510 is ready,".
000560     DISPLAY"        press < ENTER > to continue, or "
```

```
000570      "press < X > to exit.".
000580      ACCEPT ANS, SIZE 1.
000590      IF ANS IS EQUAL TO "X"; GO TO A999-THRU.
000600*     INITIALIZE CARD READER
000610      MOVE "X," TO INITR.
000620      CALL DRIVER USING LEN0, INIT.
000630      IF INITR IS NOT EQUAL TO "X,"; GO TO A005-INIT.
000640      DISPLAY" ".
000650      DISPLAY" ".
000660      DISPLAY"The card reader is initialized." POSITION 18.
000670      DISPLAY"       Press < START > on the CR-510 to "
000680      "begin reading cards.".
000690      DISPLAY" ".
000700*     READ CARDS
000710    A010-NEXT.
000720      MOVE "X," TO PIKER.
000730      CALL DRIVER USING LEN1, PIK.
000740      MOVE SPACES TO STAT.
000750      CALL DRIVER USING LEN2, CARD.
000760*     STAT = 0 MEANS READER IS READY
000770*          = 2 MEANS CARD HOPPER IS EMPTY
000780*          = 4 MEANS READER IS NOT READY
000790      IF STAT IS EQUAL TO "4,"; GO TO A010-NEXT.
000800      IF STAT IS EQUAL TO "2,"; GO TO A040-EMPTY.
000810      DISPLAY COLS, CARD-EOL.
000820      IF STAT IS EQUAL TO "0,"; GO TO A010-NEXT.
000830      DISPLAY"       ERROR "STAT" has occurred.".
000840      DISPLAY"       Refer to the CR-510 Owner's Manual"
000850      " for error descriptions.".
000860      GO TO A007-INIT.
000870    A040-EMPTY.
000880      DISPLAY"The card hopper is empty." POSITION 20 LINE 1 ERASE.
000890      GO TO A007-INIT.
000900    A999-THRU.
000910      STOP RUN.
000920 END PROGRAM.
```

```
10 'BCRNOTES: BASIC Card Reader program (with comments)
20 'TRS-80 Model III - CR-510 Intelligent Card Reader Demonstration  1
/12/83
30 "Copyright TANDY CORPORATION 1983


40 'Clear string space, initialize variables, set up error trap
50 CLEAR 500: DEFINT A-Z : ON ERROR GOTO 340


60 ' Define beginning address of assembly language card reader driver
NOTE: The only difference between BCR32 and BCR48
      is this beginning address
70 DEFUSR0=&HFD03
75 '


80 'Define carriage return (CR$), card reader control string character
 (ZZ$), card length (CL), and initialize variable values
90 CR$=CHR$(13): ZZ$=CHR$(0): CL=40: T0$="X,PIK": TX$="X,"
100 A$=ZZ$+STRING$(2+CL+1,"-"): S$=" ": X=0


110 'Clear screen and begin demonstration
120 CLS: PRINTTAB(10)"TRS-80 CR-510 Card Reader Demonstration":PRINT:P
RINT:
PRINT"This program illustrates the software components used to read
cards with the TRS-80 CR-510 Card Reader and the TRS-80
Model III microcomputer."
130 PRINT"For listings of the program source files involved, refer to
the CR-510 Owner's Manual.":PRINT
140 PRINTTAB(5)"When the card hopper is loaded and the CR-510 is ready
,":
PRINTTAB(6)"press < ENTER > to continue, or press < X > to exit.": QQ$
=INKEY$


150 'Wait for 'X' or 'x' to exit or ENTER to continue
160 QQ$=INKEY$: IF (QQ$="X" OR QQ$="x") THEN END ELSE IF QQ$<>CHR$(13)
 THEN 160


170 ' Initialize card reader
180 T1$="X,RES ASC EC0 ST1 DFD": X=VARPTR(Tl$): X=USR0(X)

190 PRINT:PRINT:PRINTTAB(15)"The card reader is initialized.":
PRINTTAB<6)"Press < START > on the CR-510 to begin reading cards.":PRI
NT

200 ' Read cards
210 MID$(T0$,l,2)=TX$: X=VARPTR(T0$): X=USR0(X)
220 MID$(A$,1,1)=ZZ$: X=VARPTR(A$): X=USR0<X)
```

```
230 ' Get card reader status (S$) — first character in string returned
 by CR-310
240 ' "4" means not reader is not ready
280 S$=MID$(A$,1,1): IF S$="4" THEN 210


330 'Status "0" means reader is not ready, "2" means hopper is empty
340 IF (S$="0" OR S$="2")=0 THEN PRINTTAB(5)"ERROR "S$" has occurred."
:
PRINTTAB(5)"Refer to the CR-310 Owner's Manual for error descriptions.

PRINT:GOTO 140


350 'Get length of text on card and print to screen (ignore status and
 following
comma, start at character 3 in string returned by card reader: this co
rresponds
to column 1 on card)
360 L=INSTR(3,A$,CR$)-3: PRINT MID$(A$,3,L)


370 'Status value "2" means card hopper is empty
380 IF S$="2" THEN CLS: PRINTTAB(20) "The card hopper is empty.":GOTO
140 ELSE 210


390 "Trap unexpected errors and go back to read again.
400 PRINTTAB(5)"ERROR "ERR/2+1" has occurred.":
PRINTTAB(5)"Refer to the Model III BASIC Language Reference Manual
      for error descriptions.":
PRINT: RESUME 140
999 END
```

Appendix A/ Hollerith-to-ASCII Conversions

Table A1. Binary to ASCII Character Matrix

Binary to ASCII Character Matrix

BIT 4	BIT 3	BIT 2	BIT 1	0 0 0 0 1 1 1 1 BIT 7	0 0 1 1 0 0 1 1 BIT 6	0 1 0 1 0 1 0 1 BIT 5							
0	0	0	0	NUL	DLE	SP	0	@	P	'	p		
0	0	0	1	SOH	XON	!	1	A	Q	a	q		
0	0	1	0	STX	DC2	"	2	B	R	b	r		
0	0	1	1	ETX	XOFF	#	3	C	S	c	s		
0	1	0	0	EOT	DC4	$	4	D	T	d	t		
0	1	0	1	ENQ	NAK	%	5	E	U	e	u		
0	1	1	0	ACK	SYN	&	6	F	V	f	v		
0	1	1	1	BEL	ETB	'	7	G	W	g	w		
1	0	0	0	BS	CAN	(	8	H	X	h	x		
1	0	0	1	HT	EM	)	9	I	Y	i	y		
1	0	1	0	LF	SUB	*	:	J	Z	j	z		
1	0	1	1	VT	ESC	+	;	K	[	k	{		
1	1	0	0	FF	FS	,	<	L	\	l	¦		
1	1	0	1	CR	GS	-	=	M	]	m	}		
1	1	1	0	SO	RS	.	>	N	^	n	~		
1	1	1	1	SI	US	/	?	O	-	o	DEL		
BIT 4	BIT 3	BIT 2	BIT 1	(LSB)									

Table A2. ASC11 to Hollerith Matrix

ASCII to Hollerith Matrix

ASCII CHAR.	HOLLERITH 9	8	7	6	5	4	3	2	1	0	11	12
NUL	X	X							X	X		X
SOH	X								X			X
STX	X							X				X
ETX	X						X					X
EOT	X		X									
ENQ	X	X			X					X		
ACK	X	X		X						X		
BEL	X	X	X							X		
BS	X			X							X	
HT	X				X							X
LF	X				X					X		
VT	X	X					X					X
FF	X	X				X						X
CR	X	X			X							X
SO	X	X		X								X
SI	X	X	X									X
DLE	X	X							X		X	X
XON	X								X		X	
DC2	X							X			X	
XOFF	X						X				X	
DC4	X	X				X						

ASCII	HOLLERITH											
CHAR.	9	8	7	6	5	4	3	2	1	0	11	12
NAK	X	X			X							
SYN	X							X				
ETB	X			X						X		
CAN	X	X									X	
EM	X	X							X		X	
SUB	X	X	X									
ESC	X		X							X		
FS	X	X				X					X	
GS	X	X			X						X	
RS	X	X		X							X	
US	X	X	X								X	
SP												
!		X	X									X
"		X	X									
#		X					X					
$		X					X				X	
%		X				X				X		
&												X
'		X			X							
(		X			X							X
)		X			X						X	
*		X				X					X	
+		X		X								X
,		X					X			X		
-											X	
.		X					X					X
/									X	X		
0										X		
1									X			
2								X				
3							X					
4						X						
5					X							
6				X								
7			X									
8		X										
9	X											
:		X						X				
;		X		X							X	
<		X				X						X
=		X		X								
>		X		X						X		
?		X	X							X		
@		X				X						
A									X			X
B								X				X
C							X					X
D						X						X
E					X							X
F				X								X
G			X									X
H		X										X
I	X											X
ASCII	HOLLERITH											
CHAR.	9	8	7	6	5	4	3	2	1	0	11	12

ASCII CHAR.	HOLLERITH 9	8	7	6	5	4	3	2	1	0	11	12
J									X		X	
K								X			X	
L							X				X	
M						X					X	
N					X						X	
O				X							X	
P			X								X	
Q		X									X	
R	X										X	
S								X		X		
T							X			X		
U						X				X		
V					X					X		
W				X						X		
X			X							X		
Y		X								X		
Z	X									X		
[		X						X				X
\		X						X		X		
]		X						X			X	
^		X	X								X	
—		X			X					X		

ASCII CHAR.	HOLLERITH 9	8	7	6	5	4	3	2	1	0	11	12
		X							X			
a									X	X		X
b								X		X		X
c							X			X		X
d						X				X		X
e					X					X		X
f				X						X		X
g			X							X		X
h		X								X		X
i	X									X		X
j									X		X	X
k								X			X	X
l							X				X	X
m						X					X	X
n					X						X	X
o				X							X	X
p			X								X	X
q		X									X	X
r	X										X	X
s								X		X	X	
t							X			X	X	
u						X				X	X	
v					X					X	X	
w				X						X	X	
x			X							X	X	
y		X								X	X	
z	X									X	X	
{										X		X
|											X	X
}										X	X	
~									X	X	X	
DEL	X		X									X

Appendix B / Card Specification

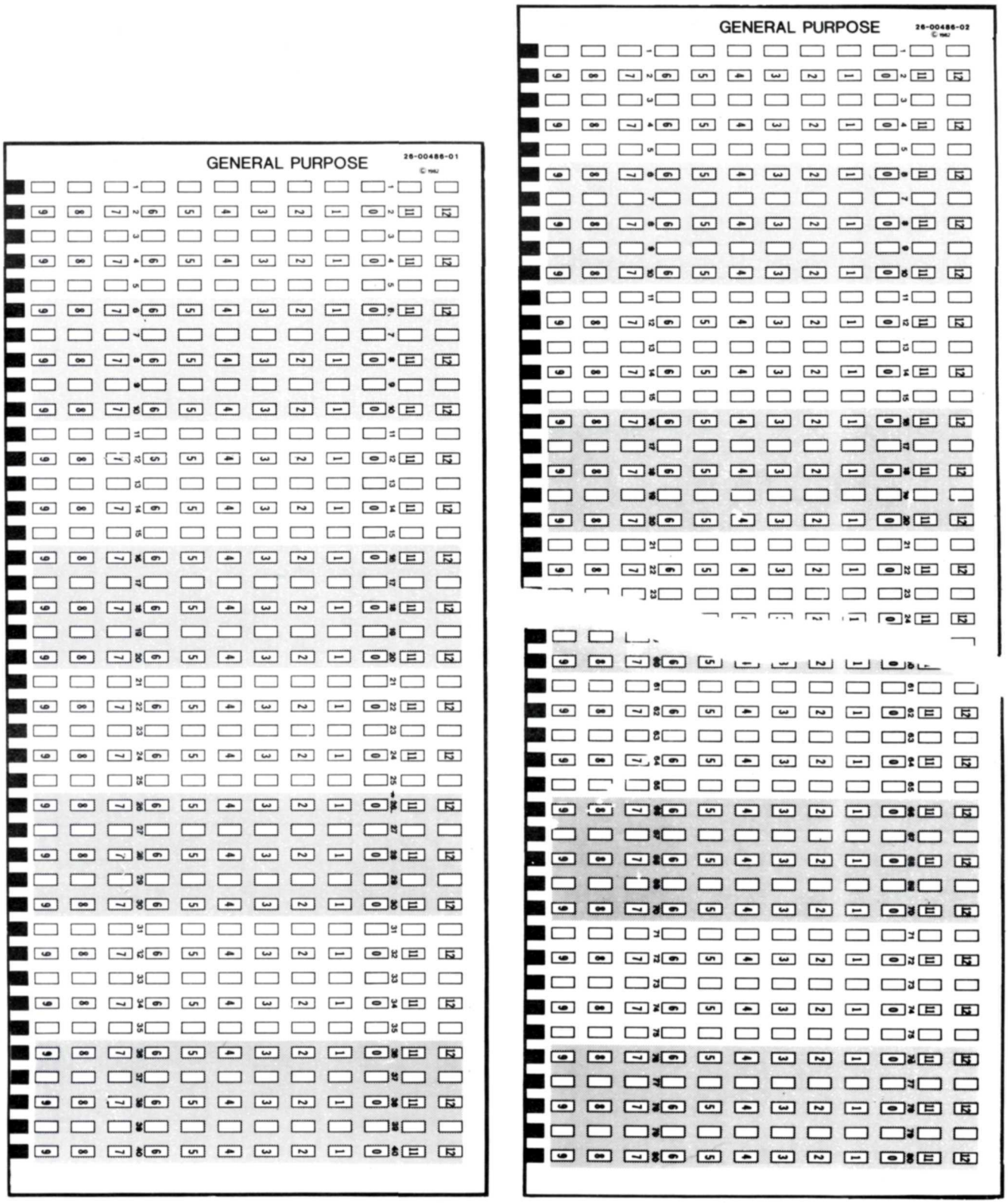


Figure B1. General Purpose Card.

Appendix C/ Troubleshooting

A blinking light on the front panel of your Card Reader may indicate that some problem has arisen. Often, you can diagnose problems should your Card Reader fail to operate simply by looking at which light is blinking.

CR-510 Blinking Front Panel Lights

Load/Attn	Ready	Feed Error	Indication
X			The Host Computer has sent the Card Reader an Attention command (ATN). This is NOT an error.
	X		USART (Universal Synchronous/Asynchronous Receive Transmit chip) failed during Self-Test. Take your Card Reader to an authorized Repair Center.
	X		Either the Card Reader received an invalid command or else it received an "echoed" character. See Chapter 4 for details.
		X	The Card Reader has a mechanical feed problem, such as a jammed card.
X	X		A ROM chip within the Card Reader failed during Self-Test. Take your Card Reader to an authorized Repair Center.
X		X	The Card Reader didn't correctly read the Diagnostic Self-Test card. Take your Card Reader to an authorized Repair Center.
	X	X	A RAM chip within the Card Reader failed during the Self-Test. Take your Card Reader to an authorized Repair Center.

Appendix D/ System Test

The Model III System Test

Once the CR-510 is connected to a Computer, it's possible to run the System Test which verifies that the Computer and CR-510 are connected and set-up properly.

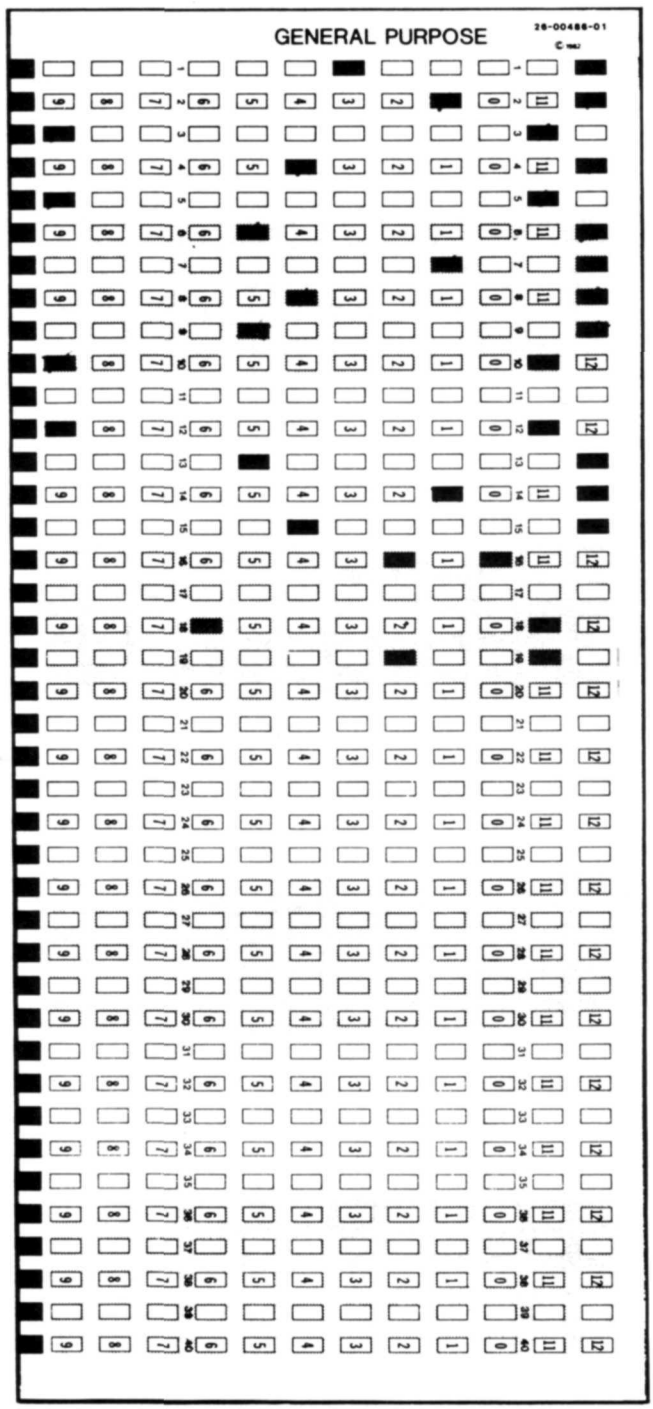
The following test is for TRS-80 Model Ill's only and requires that you use the System Test Card (the punched card).

1. Load the System Test Card (Figure El) face down into the Card Reader Hopper.
2. Place the Card Weight on top of the System Test Card.
3. Load BASIC and type in the following program:

```
I' *** MODEL III ONLY ***
5 CLEAR 160
10 GOSUB l000;REM INITIALIZE READING AND WRITING TO READER
20 A$="RES ASC ECO STO DFD PIK"
30 GOSUB 2000:REM OUTPUT STRING A$ TO READER
40 GOSUB 3000:REM READ A CARD INTO RESULT%
50 C$=" ":REM BUILD A STRING FROM THE RESULT
60 FOR J%=0 TO LNG%-l: C$=C$+CHR$(RESULT%(J%))  NEXT J%
70 PRINT C$
80 END
1000 REM INITIALIZE THE CARD READER FOR INPUT AND OUTPUT
1002 REM AT 9600 BAUD, 8 BITS, 1 STOP BIT, NO PARITY
1005 DEFUSR2=&H005A
1006 POKE 16890,1
1007 POKE 16888, 238
1008 POKE I6889, 108
1010 X=USR2(0)
1020 DIM RESULT%(79): REM ARRAY FOR CHARACTERS READ.
1030 DIM CODE% (17): REM MACHINE LANGUAGE ROUTINE
1040 FOR I%= 0 TO 17: READ CODE%(I%): NEXT I%
1050 DEFUSRl=&H0055: REM SET OUTPUT VECTOR USR1
1060 CH%= 16880: REM SET OUTPUT VECTOR USR1
1070 RETURN
1075 REM MACHINE LANGUAGE INPUT ROUTINE PLACED IN CODE%
ARRAY
1080 DATA 32717,4362,0, -10779,20685, -12032
1090 DATA 15073,16872,10423, -269,10253,30472
1100 DATA 8979,54,6179, -5145, -25917,10
2000 REM OUTPUT THE STRING IN A$
2010 FOR I%=1 TO LEN(A$)
2020 POKE CH%,ASC(MID$(A$,I%,1))
2030 X=USRl(0): REM SENDTHE CHARACTER
2040 NEXT I%
2050 POKE CH%,13:X=USR1(0):REM SEND CARRIAGE RETURN
2060 RETURN
3000 REM INPUT DATA FROM CARD INTO INTEGER ARRAY RESULT%
3010 REM LNG% WILL EQUAL THE NUMBER OF CHARACTERS READ
3020 DEFUSR0= VARPTR(CODE%(0))
3030 LNG%= USR0(VARPTR(RESULT%(0))):REM READ A CARD
3040 RETURN
```

4. Press the Card Reader START/STOP button and verify that the System Test card is read and CARD READER READS OK is displayed on the TRS-80 screen.

Card Left **Card Right**



Card Trailing Edge ----------

Card Must Be Placed Face Down
In the Card Hopper

Appendix E / Specifications

Power Requirements . . . . . 115 Vac @ 2 amperes

Physical Requirements

Size . . . . . $7\frac{3}{4}$" (H) x $6\frac{7}{8}$" (W) x 12" (L)
19.7 cm (H) x 17.4 cm (W) x 30.5 cm (L)

Weight . . . . . 16.5 Lb.
7.48 Kg.

Environmental Requirements

Temperature

Storage . . . . . -40 to 160° F
-40to71°C

Operating . . . . . 32 to 110° F
0 to 43° C

Humidity

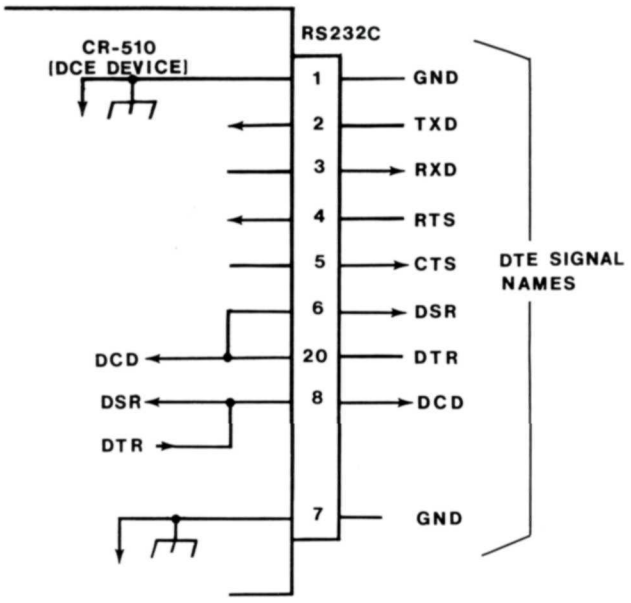
Storage . . . . . 10 to 90%

Operating . . . . . 30 to 80%

For information regarding timing, voltage, and schematics refer to the CR-510 Service Manual.

RS-232C Interface Requirements: refer to Figure E-1.

RS-232C Interface Signals



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