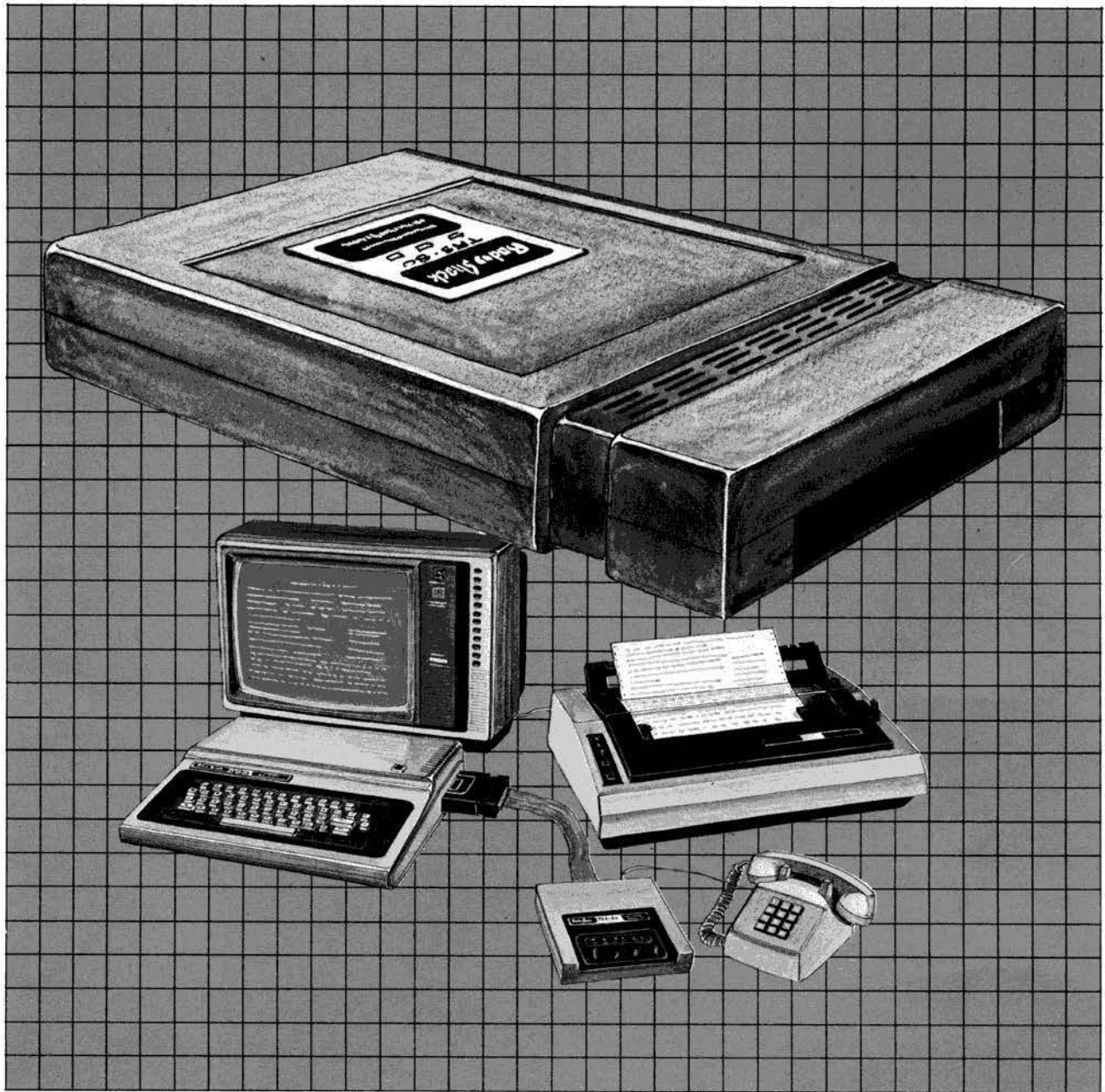


Deluxe RS-232 Program Pak[™] Operation Manual

for the
TRS-80[®] Color Computer



Radio Shack[®]

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TRS-80® Deluxe RS-232 Program Pak™ Owner's Manual

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Table of Contents

Introduction	1
1/Setting Up the Deluxe RS-232 Program Pak System.....	3
Connecting a Modem	3
Connecting a Cassette Recorder.....	3
Connecting a Printer	4
2/Using the Deluxe RS-232 Program Pak.....	5
Changing Communications Settings	5
3/A Sample Log-On Session.....	11
4/Technical Information	13
5/Specifications	21

Introduction

The **Deluxe RS-232 Program Pak™** is a TRS-80® Color Computer communications package designed to increase your computer-to-computer communications ability. This Program Pak is equipped with built-in software that lets you communicate with information services. With this cartridge, you can simultaneously connect a serial printer and modem to your Color Computer. This means that while host-to-computer communications is in progress, you can print out the received information.

Its other special features include:

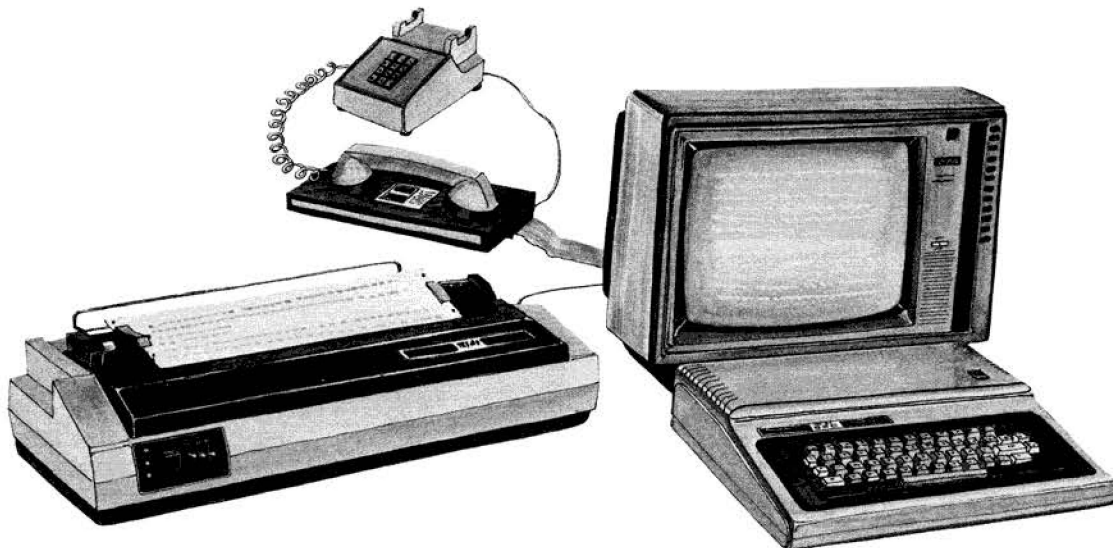
- Programmable Baud Rate capability
- Full- or Half-Duplex capability
- Selectable 7- or 8-Bit Word Length
- 1 or 2 Stop Bit Selection
- The ability to transmit and receive BASIC and machine-language programs

This manual will show you how to:

- Set up your equipment when using the Deluxe RS-232 Program Pak
- Use the Deluxe RS-232 Program Pak's options to connect with a particular host
- Transmit and receive BASIC programs
- Transmit and receive machine-language programs
- Save and load information stored in Memory (the RAM Buffer)

To use the Deluxe RS-232 Program Pak, you'll need a:

- Telephone
- TRS-80 Color Computer with at least 16K of RAM and Extended Color BASIC and a Color TV. (We suggest Radio Shack's 16-230.)
- A modem which allows your Computer to communicate with other computers over telephone lines. Radio Shack provides several of these. For example, the **Modem I** (26-1172), the **Modem II** (26-1173), the **Telephone Interface II** (26-1171), the **Acoustic Coupler** (26-1174), and the **DC-1200 High Speed Modem** (26-1002).
- Serial printer (optional) that is compatible with your Color Computer. Printers available include the **DMP-100** (26-1253), **DMP-200** (26-1254), and the **DMP-400** (26-1251).



1/Setting Up the Deluxe RS-232 Program Pak System

To insert the Deluxe RS-232 Program Pak into your Color Computer, follow these steps:

1. Be sure your Color Computer is turned OFF.
2. Connect the television to the Color Computer.
(Make sure the television is tuned to Channel 3 or 4 and that the computer and television are set at the same channel.)
3. Insert the Deluxe RS-232 Program Pak into the slot on the right side of the Computer. See Figure 1.

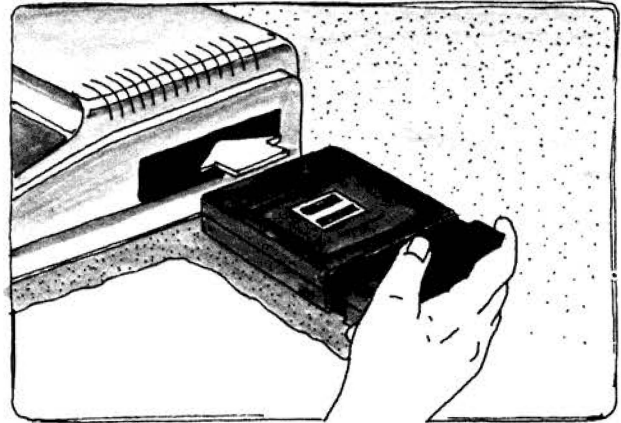
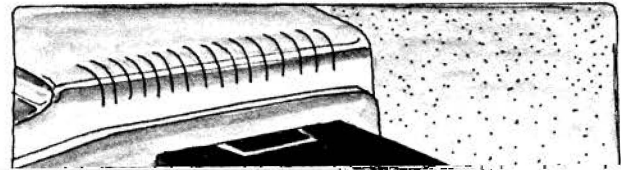


Figure 1. Inserting the RS-232 Program Pak

Connecting a Modem

All equipment should be turned OFF. Connect your modem to the Deluxe RS-232 Program Pak using a **Model III RS-232C Cable** (26-1408).

1. Make sure your RS-232C cable is properly connected to the modem.



2. Plug the other end of the RS-232C cable into the Deluxe RS-232 Program Pak's RS-232C connector. See Figure 2.

Note: When using a Null Modem Adapter for computer-to-computer connection, do not be alarmed that the adapter will not fit tightly to the Deluxe RS-232 Program Pak's RS-232C connector.

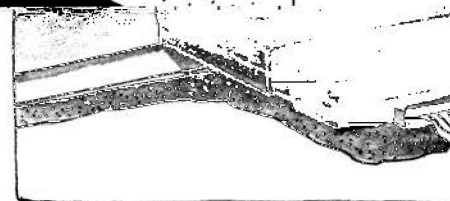


Figure 2. Connecting a Modem to the RS-232 Program Pak

Connecting a Cassette Recorder

To transmit a previously written BASIC or assembled machine-language program, you will need to load the program into the Color Computer's memory from a cassette recorder, such as the **CCR-81** (26-1208). (See "Transmitting and Receiving Programs" later in this manual for details.)

1. Connect the short cable (DIN plug on one end and three plugs on the other) to the **CASSETTE** jack on the back of the Color Computer.
2. The three plugs on the other end of this cable are for connecting to the recorder. Consult your **Color Computer Operation Manual** and the cassette recorder owner's manual for instructions connecting these three plugs to a cassette recorder.

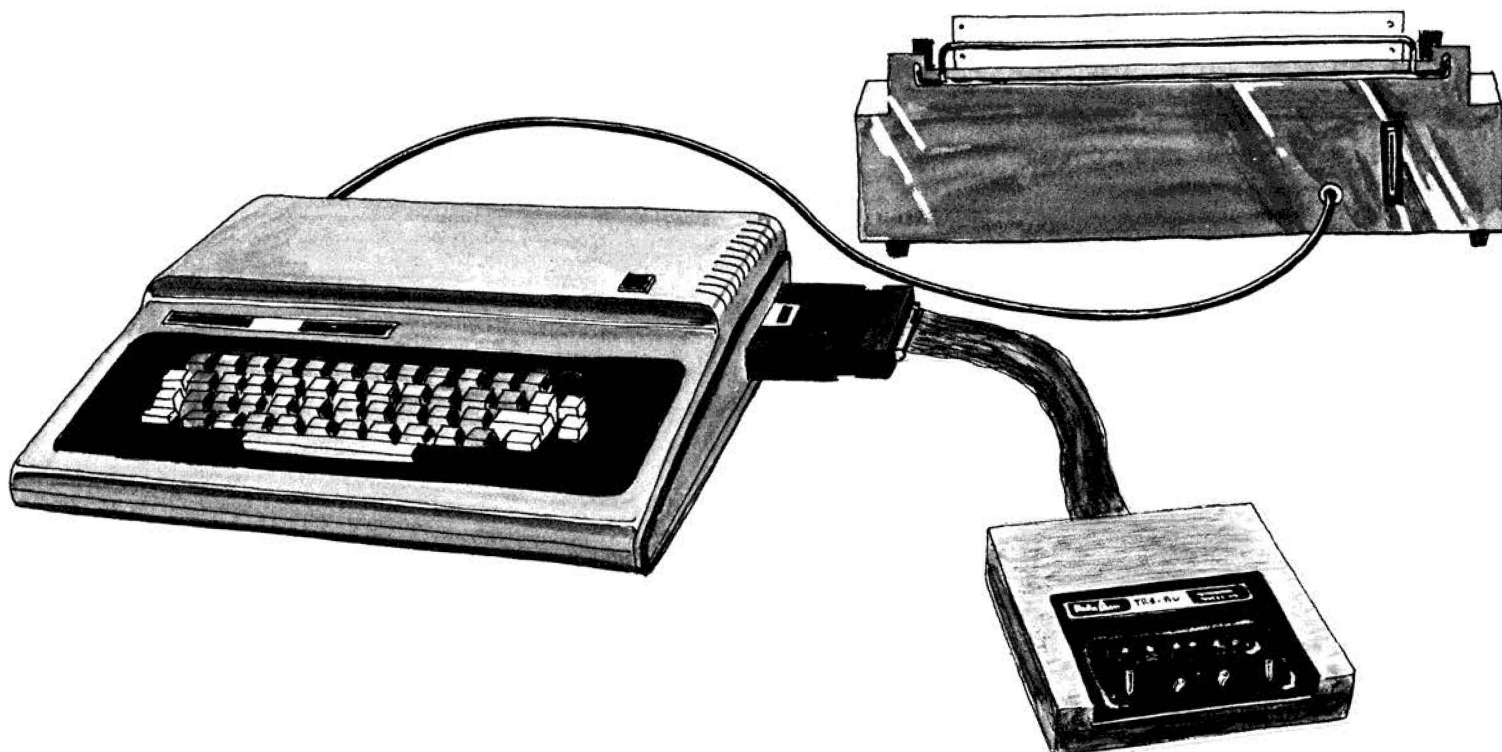


Figure 3. Connecting a Printer to the Color Computer

Connecting a Printer

You can simultaneously connect a modem and a serial printer to your Color Computer. To connect the Color Computer to a printer, you will need a **4-Pin DIN to a 4-Pin DIN Cable** (26-3020).

1. Connect one end of the cable to the **Serial I/O Connector** at the rear of the Computer.
2. Connect the other end of the cable to the printer.
3. Consult your printer owner's manual for operating instructions.
4. After connecting the printer, press **▶(CLEAR)** to print the received information.

Note: To avoid losing characters, printers may need an additional time delay after receiving a carriage return. If your print-outs have excessive characters, see your information/time-sharing service to obtain the proper configurations. To avoid losing characters, the DMP-100 requires that you communicate at 110 or 75 baud.

2/Using the Deluxe RS-232 Program Pak

Follow this procedure to power up your system:

1. Turn the Color Computer and television ON.

The OK prompt should appear on the Screen. If OK does not appear on the Screen, press RESET.

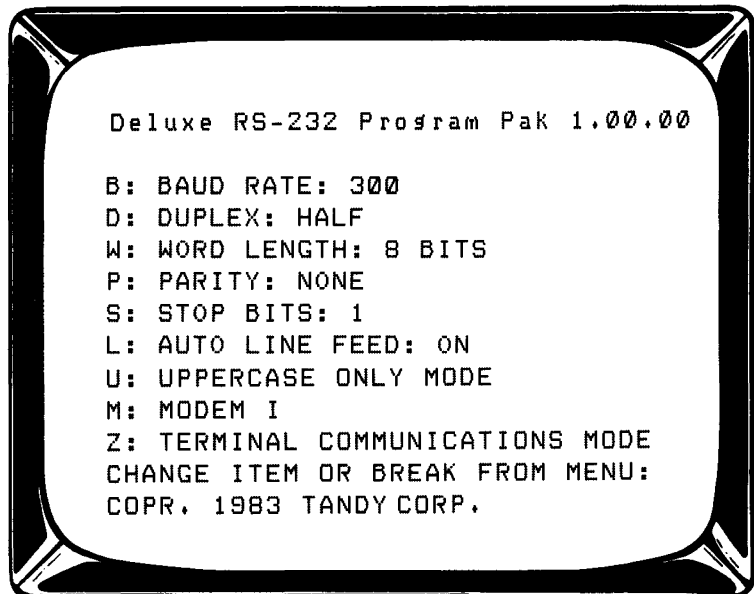
2. Once the OK prompt is displayed, type:

EXEC &HC000 (ENTER)

or

EXEC 49152 (ENTER)

The "Protocol Menu" will then appear:



On power-up, the Protocol Menu will always show these settings. If your information service communicates at 300 baud, half-duplex, 8-bit word length, no parity, 1 stop bit, auto line feed ON, uppercase, and is using a Modem I (non-auto dialing modem), you only need to press (BREAK) to begin communications.

Changing Communications Settings

Communications settings are changed by pressing the alphabetic key which precedes a specific option on a line of the Protocol Menu. For example, press (W) to change the Word Length. The program will provide the available options. You will not have to type in a specific value.

After you have satisfactorily set up your communications requirements, press (BREAK) to proceed. If, after establishing communications, you discover that a setting was not correct, you can return to the Protocol Menu by pressing (BREAK). Then correct the error without disconnecting the communications.

The following is an explanation of all Settings Options:

B

Baud Rate (75, 110, 300, 600, 1200, 2400, 4800, 9600, 19200)

Press and release (B) to advance to the next option. If you do not specify a baud rate, the baud setting is 300. After 19200, the next displayed baud rate setting is 75.

The maximum baud rate which will dependably transmit BASIC programs from one Color Computer to another is 1200 baud. Assembly language programs can be transferred at up to 19200 baud.

After you have made your selection, either change another setting option or press **(BREAK)** to begin communications.

Note: To avoid losing characters when communicating at 4800, 9600, or 19200 baud, the host may have to pause after every carriage return and restrict lines to 32 characters.

D **Duplex (Half or Full)**

Press **(D)** to change the Duplex setting. Your options are either Full (for simultaneous two-way communication), or Half (for one-way communication). The default protocol is Half-Duplex. (If Full-Duplex is selected, you may need to "reselect" Full-Duplex after establishing contact with the database.)

When you decide on the Duplex setting, press another letter key for the next desired option line.

W **Word Length (7 or 8 Bits)**

Press **(W)** to change the Word Length setting. There are two options — 7 Bits and 8 Bits. Press **(W)** to display the desired option. Select another option or press **(BREAK)** to begin communications.

P **Parity (None, Odd, Even, or Ignored)**

Press **(P)** to change the Parity option. Your options are None, Odd, Even, or Ignored. (If you select Ignored Parity, the Parity Bit will be accepted, but no Parity faults will be recognized.) Press **(P)** and release until the Parity option you need appears. Select another option or press **(BREAK)** to begin communications.

S **Stop Bits (1 or 2)**

Press **(S)** to change the Stop Bit. The option is either 1 or 2. Press and release **(S)** until the specific setting appears. Then, either make another selection or press **(BREAK)** to begin communications.

L **Auto Line Feed (On or Off)**

This option lets you select whether carriage returns will be interpreted as carriage return/line feed (referred to as "Automatic Carriage Return"), or carriage return only. Press **(L)** to turn the Auto Carriage Return ON or OFF.

U **Uppercase Only Mode**

This option lets you communicate in either Uppercase only, or Upper and Lowercase option. Press and release **(U)** for Uppercase only, or for Upper/Lowercase. Then either make another selection or press **(BREAK)** to begin communications.

M Modem Type

The Deluxe RS-232 Program Pak provides you with the flexibility of a manual or automatic dialing modem. The options available are MODEM I and MODEM II.

The **MODEM I** option is for non-auto-dialing modems and can be applied to Acoustic Couplers.

The **MODEM II** option is designed for automatic dialing modems, but gives you the flexibility to ignore the automatic dialing capability.

To change the modem type, press and release **(M)** for the required option.

Modem I (manual dialing) Users . . .

If you want the **MODEM I** (or manual dialing modem) option, proceed when the option appears. Then make another selection or press **(BREAK)** to proceed with communications.

Modem II (auto-dialing) Users . . .

When the **MODEM II** option is displayed, you have the option to enter the telephone number to be dialed automatically when you are ready to proceed with communications.

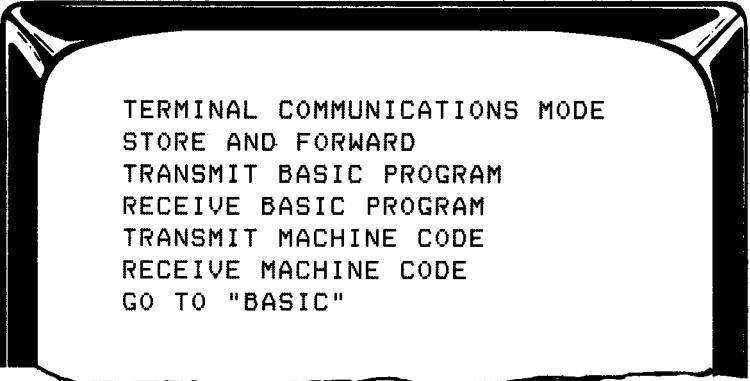
- For **PHONE #**, type the telephone number (up to 19 digits) and press **(ENTER)**.

Note: To provide a two-second pause between numbers, insert an **(*)**. This is especially useful if you need to get an outside line to a telephone number. For example, the number 9*1234567 would tell the modem to dial 9 and wait for an outside line (*); then dial the telephone number.

- For **PHONE #**, press **(BREAK)** to ignore the automatic dialing option.

Z Communications Modes

Pressing **(Z)** will display the following communications modes:



```

  TERMINAL COMMUNICATIONS MODE
  STORE AND FORWARD
  TRANSMIT BASIC PROGRAM
  RECEIVE BASIC PROGRAM
  TRANSMIT MACHINE CODE
  RECEIVE MACHINE CODE
  GO TO "BASIC"

```

TERMINAL COMMUNICATIONS MODE Selecting this mode lets you use your Color Computer as an interactive terminal with a host system. Most information services can be contacted via this mode.

Before using the Terminal Communications Mode, make sure that all of your settings are in agreement with the host you are contacting. Make sure your modem is properly connected to the Deluxe RS-232 Program Pak.

Auto Dialing Modem Users . . .

If you are using an auto-dial modem (Modem II), the number is dialed automatically as specified in the MODEM II option. After the carrier is established with the host system, you should proceed with the log-on protocol as outlined by that host system.

1. If you are using an auto-dial modem, be sure your modem is on and set for auto-dial and originate. If you have a Modem II, the DTR switch should be OFF.
2. Press **(BREAK)** and the host's number will be dialed. With the Modem II, the CD light will go ON when the host answers the telephone.
3. When the CD light goes ON, send the character prescribed by the particular information service. For example, a commonly used response is ^C, which is initiated by pressing **(C)**. After sending your response, you should receive the next prompt from the host.

Manual Dialing Modem Users . . .

If you are using a manual dial modem, check your communications settings which should be in agreement with those of the host system.

1. Press **(BREAK)** and dial the host's telephone number.
2. When the phone has been answered, you will hear a high-pitched tone.
 - If you have a Modem I, set it to **ORIG**. When the tone changes to a lower tone, gently hang up the phone.
 - If you have a DC-1200 High Speed Modem, press the **ORG** button. Release it when the **OH** indicator illuminates. Then, gently hang up the phone.
 - If you are using a Modem II, the **DTR Switch** (at the rear of the modem) must be in the **OFF** position. The **POWER** switch should be **ON**. The **MODE** switches should be set at **MAN/ORIG**. When you hear the tone, gently hang up the phone.
3. Proceed with the log-on.

STORE AND FORWARD Select this mode if the host system uses store and forward (advanced storage) protocol.

1. At the Protocol Menu, press **(BREAK)**.
2. If you are using a Modem I or II, turn the DTR switch ON.
3. Type the prescribed log-on information and press **(BREAK)**. The following prompt appears:

PLACE CALL

(If you are using a Modem II, the telephone number will automatically be dialed at this point. Modem II users should proceed to step 5.)

4. Dial the host's telephone number. When the phone is answered, you will hear a high-pitched tone. When the low-pitched tone is added to the high-pitched tone, gently hang up the phone.

5. The Store and Forward information service should then load up to eight pages. The Deluxe RS-232 Program Pak enters the page scrolling mode when carrier is lost (CD light on modem). You can also enter this mode by typing **SHIFT** **;**. To scroll through the stored pages, use the **◀** and **▶** keys. Press **BREAK** to exit the scrolling mode and return to Terminal Communications mode.
6. If you have a serial printer, press **◀** **CLEAR** to print the received information. The printer will automatically stop when all pages in memory have been printed, or when you press any key to stop the printing.

TRANSMIT BASIC PROGRAM You can transmit or receive BASIC or Machine-Language programs. Any program transmitted must be stored in memory prior to transmission.

Transmitting a BASIC Program . . .

1. Power-up the system, making sure the cassette recorder is properly connected to the Color Computer.
2. When the Protocol Menu appears, press **7** until the **GO TO BASIC** setting appears. Press **BREAK**.
3. Type **NEW** **ENTER** to clear out any existing program.
4. Be sure the tape is completely rewound and the plugs are all in place.
5. Push the **PLAY** button down until it locks.
6. Type the **CLOAD** command with the name of your program. For example: **CLOAD "NAME" ENTER**
7. After the program has loaded, you will need to return to the Protocol Menu to transmit your program. To return to the Protocol Menu, type:

EXEC &HC000 ENTER

or

EXEC 49152 ENTER

Note: If you are using an auto-dial modem, enter the phone number of the computer with which you are going to communicate by following the standard dialing sequence.

8. Make sure your communications settings are the same as the other Deluxe RS-232 Program Pak user. Press **7** until the **TRANSMIT BASIC PROGRAM** message appears.
9. Press **BREAK** to begin transmission.

Note: If the program you load exceeds the memory capacity of your Color Computer, you will receive an **O/M** (out of memory) error message. To check the available memory at the BASIC screen, type **?MEM ENTER**.

Transmitting a Machine-Language Program . . .

1. Power-Up the system, making sure the cassette recorder is properly connected to the Color Computer.
2. When the Protocol Menu appears, press the **7** key six times until the **GO TO BASIC** message appears. Press **BREAK**.
3. Type **NEW** **ENTER** to clear out any existing program.
4. Be sure the tape is completely rewound and the plugs are all in place.
5. Push the **PLAY** button down until it locks.
6. Type the **CLOADM** command with the name of your program. For example: **CLOADM "PROGRAM" ENTER**.
7. After the program has loaded, you will need to return to the Protocol Menu to transmit your program. To return to the Protocol Menu, type:

EXEC &HC000 ENTER

or

EXEC 49152 ENTER

Note: If you are using an auto-dial modem, enter the phone number of the computer with which you are going to communicate by following the standard dialing sequence.

8. Be sure your communications settings are the same as the other Deluxe RS-232 Program Pak user. Press the **(Z)** key four times. At TRANSMIT MACHINE CODE you must enter the starting and ending address of the program (using decimal numbers).

9. Type the starting address and press **(ENTER)**. Type the ending address and press **(ENTER)**.

10. Press **(BREAK)**.

Note: If the program you load exceeds the memory capacity of your Color Computer, you will receive an O/M (out of memory) error message. To check the available memory, type ?MEM **(ENTER)** when the OK prompt is displayed.

RECEIVE BASIC PROGRAMS To receive a BASIC Program:

1. At the Protocol Menu, select the RECEIVE BASIC PROGRAM communications mode. Press **(BREAK)**.

2. The received program will appear on the Screen line-by-line. Press any key to stop the process and return to the Protocol Menu.

3. After the entire program has been received, return to the Protocol Menu by typing EXEC &HC000 **(ENTER)**.

4. At the Protocol Menu, press and release **(Z)** until GO TO BASIC appears. Then, press **(BREAK)**.

5. Type LIST **(ENTER)** and the received program will be displayed.

The program can now be saved onto tape using CSAVE.

RECEIVE MACHINE CODE

1. At the Protocol Menu, select the RECEIVE MACHINE CODE communications mode. The following prompt appears:

STARTING ADDRESS?

2. Type the starting address of the machine-language program to be received (in decimal numbers) and press **(ENTER)**.

3. Press **(BREAK)**.

4. The program is received one byte at a time, and each byte appears on the Screen to show that data transfer is in progress.

5. At the Protocol Menu, press and release **(Z)** until the GO TO BASIC message appears. Then press **(BREAK)**.

6. Save the machine-language program on cassette using the CSAVE command.

Saving a BASIC or Machine-Language Program onto Cassette Tape . . .

1. Insert a blank cassette into the recorder.

2. Press the recorder's PLAY and RECORD buttons at the same time until they lock.

3. Type:

CSAVE "filename" **(ENTER)**

where *filename* is any sequence of eight or fewer characters.

4. When the program has been saved, OK will appear on the Screen and the recorder's motor will automatically shut off.

5. Type EXEC &HC000 **(ENTER)** or EXEC 49152 **(ENTER)** to return to the Protocol Menu.

3/ Sample Log-On Session

This sample session will use an example to show you how to use the Terminal Communications Mode of the Deluxe RS-232 Program Pak.

During the sample session, you will be shown how to make selections from the Deluxe RS-232 Program Pak Setting Menu and how to contact a host once you have selected your settings.

Let's suppose that you are using a Modem II (automatic dialing) and you want to contact a host that uses the following settings:

300 Baud Rate
Full-Duplex
8-Bit Word Length
No Parity
1 Stop Bit
Auto Line Feed On
Upper and Lowercase

To establish communications with this host, you would need to:

1. Power-up the System. Be sure all peripherals are properly connected.
2. Type EXEC &HC0000 (ENTER) or EXEC 49152 (ENTER) to display the Protocol Menu.
3. When the Protocol Menu appears, compare the default settings (those shown on the initial Protocol Menu) with those required by the host.
4. The only settings for the host that need to be changed are:
 - Duplex
 - Word Length
 - Upper and Lowercase
 - Modem Type
5. To change these settings:
 - Press (D) to change the Duplex setting to Full-Duplex.
 - Press (U) to change the Uppercase setting to Upper and Lowercase.
 - Press (M) to change the modem setting to Modem II. Then, type the telephone number and press (ENTER).
6. Set the modem to **ON** and **AUTO/ORIG**.
7. Press (BREAK). The number will be automatically dialed.

4/Technical Information

Special Characters			
Key/s	Function	ASCII	Visible Character
CTL			NONE
CTL 7		7B	
CTL 8		5B	
CTL 9		5D	
CTL 0		7D	
CTL -		7C	
CTL :		7E	
CTL @		1B	NONE
CTL ↓		7F	
CTL ,		5F	
CTL .		5E	
CTL /		5C	
CTL CLEAR	Printer toggle		NONE
CTL BREAK	RS-232C Break*		NONE

*Note: The RS-232 Break is an interrupt and its use depends on the host system.

The heart of the Deluxe RS-232 Program Pak is the Synertek 6551 ASCII. It has an on-chip baud rate generator, programmable interrupts and status register for ease of operation, false start bit detection, and echo mode.

This ASCII board is memory mapped to addresses FF68 to FF6B (Hex).

The 6551 uses 4 memory addresses for the following functions:

Address	Write	Read
FF68	Transmit Data Register	Receiver Data Register
FF69	Soft Reset	Status Register
FF6A		Command Register
FF6B		Control Register

This table shows that only the Command and Control registers are bidirectional. The Soft Reset operation clears the 6551 internal registers but does not cause any data transfer. Therefore, the data written is a "don't care." A RES* from the bus will clear all registers in the 6551, while a Soft Reset will only disable interrupts and transmitter, turn off the echo mode, and clear the Overrun Error flag.

The following shows the Status, Command, and Control Registers and gives programming examples for each:

STATUS REGISTER

The Status Register is used to indicate to the processor the status of various SY6551 functions.

7	6	5	4	3	2	1	0
---	---	---	---	---	---	---	---

STATUS	SET BY	CLEARED BY
Parity Error*	0 = No Error 1 = Error	Self Clearing**
Framing Error*	0 = No Error 1 = Error	Self Clearing**
Overrun*	0 = No Error 1 = Error	Self Clearing**
Receive Data Register Full	0 = Not Full 1 = Full	Read Receive Data Register
Transmit Data Register Empty	0 = Not Empty 1 = Empty	Write Transmit Data Register
DCD	0 = $\overline{\text{DCD}}$ Low 1 = $\overline{\text{DCD}}$ High	Not Reusable Reflects $\overline{\text{DCD}}$ State
DSR	0 = $\overline{\text{DSR}}$ Low 1 = $\overline{\text{DSR}}$ Low	Not Reusable Reflects $\overline{\text{DSR}}$ State
IRQ	0 = No Interrupt 1 = Interrupt	Read Status Register

*NO INTERRUPT GENERATED FOR THESE CONDITIONS.
 **CLEARED AUTOMATICALLY AFTER A READ OF RDR AND THE NEXT ERROR-FREE RECEIPT OF DATA.

	7	6	5	4	3	2	1	0
HARDWARE RESET	0	-	-	1	0	0	0	0
PROGRAM RESET	-	-	-	-	-	0	-	-

COMMAND REGISTER

The Command Register is used to control Specific Transmit/Receive functions.

COMMAND REGISTER

7	6	5	4	3	2	1	0
---	---	---	---	---	---	---	---

PARITY CHECK CONTROLS

BIT			OPERATION
7	6	5	
—	—	0	Parity Disabled - No Parity Bit Generated - No Parity Bit Received
0	0	1	Odd Parity Receiver and Transmitter
0	1	1	Even Parity Receiver and Transmitter
1	0	1	Mark Parity Bit Transmitted, Parity Check Disabled
1	1	1	Space Parity Bit Transmitted, Parity Check Disabled

NORMAL ECHO MODE FOR RECEIVER

0 = Normal
1 = Echo (Bits 2 and 3 must be "0")

DATA TERMINAL READY

0 = Disable Receiver and All Interrupts (DTR high)
1 = Enable Receiver and All Interrupts (DTR low)

RECEIVER INTERRUPT ENABLE

0 = $\overline{\text{IRQ}}$ Interrupt Enabled from Bit 3 of Status Register
1 = $\overline{\text{IRQ}}$ Interrupt Disabled

TRANSMITTER CONTROLS

BIT		TRANSMIT INTERRUPT	RTS LEVEL	TRANSMITTER
3	2			
0	0	Disabled	High	Off
0	1	Enabled	Low	On
1	0	Disabled	Low	On
1	1	Disabled	Low	Transmit BRK

HARDWARE RESET
PROGRAM RESET

7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0
—	—	—	0	0	0	0	0

Command Register Format

CONTROL REGISTER

The Control Register is used to select the desired mode for the SY6551. The word length, number of stop bits, and clock controls are all determined by the Control Register.

CONTROL REGISTER

7	6	5	4	3	2	1	0
---	---	---	---	---	---	---	---

STOP BITS

0 = 1 Stop Bit
1 = 2 Stop Bits
1 Stop Bit if Word Length = 8 Bits and Parity*
1½ Stop Bits if Word Length = 5 Bits and No Parity.

WORD LENGTH

BIT	DATA WORD LENGTH
6 5	
0 0	8
0 1	7
1 0	6
1 1	5

RECEIVER CLOCK SOURCE

0 = External Receiver Clock
1 = Baud Rate Generator

*This allows for 9-bit transmission (8 data bits plus parity).

BAUD RATE GENERATOR

0	0	0	0	16x EXTERNAL CLOCK
0	0	0	1	50 BAUD
0	0	1	0	75
0	0	1	1	109.92
0	1	0	0	134.58
0	1	0	1	150
0	1	1	0	300
0	1	1	1	600
1	0	0	0	1200
1	0	0	1	1800
1	0	1	0	2400
1	0	1	1	3600
1	1	0	0	4800
1	1	0	1	7200
1	1	1	0	9600
1	1	1	1	19,200

HARDWARE RESET
PROGRAM RESET

7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-

Control Register Format

Programming Examples (Machine-Language)

Desired Configuration

Baud Rate = 300, Word Length = 7 Bits, Stop = 2 Bits, Parity = Even

Instruction			Comment
Control Register			
CLRA			
ORA	#\$80		2 Stop Bits
ORA	#\$20		7-Bit Word
ORA	#\$10		Receiver Clock = Baud Rate Gen.
ORA	#\$06		300 baud rate
STA	\$FF6B		Write it to Control Register
Command Register			
CLRA			
ORA	#\$60		Even Parity
ORA	#\$00		MODE = Normal
ORA	#\$08		Tx. Int. Disabled, RTS Active Tx. On
ORA	#\$01		IRQ Int. Disabled
ORA	#\$01		Rx Enabled and All Int.
STA	\$FF6A		Write it to Command Register

Status Register

To Check Modem Status (DSR):			
CKMDM	LDA	\$FF6A	Load Command Byte
	ORA	#\$01	Insure that DTR Bit is active
	STA	\$FF6A	Output to Command Register
	LDA	\$FF69	Read Status Register
	ANDA	#\$40	Check DSR Status
	BNE	CKMDM	Not Ready
	BRA	MREADY	Modem is ready (powered-up)
To Check the Carrier Status (DCD):			
	LDA	\$FF69	
	ANDA	#\$20	
	BNE	CAROFF	Carrier is not present
	BRA	CARON	Carrier is present
To Transmit a Data Byte:			
TXDT	LDA	\$FF69	Check Tx-Register Status
	ANDA	#\$10	If empty or not
	BEQ	TXDT	Not empty, wait Tx Data
	LDA	DATA	Get data byte from RAM
	STA	\$FF68	Write it to data register

To Receive a Data Byte:

RXDT	LDA	\$FF69	Read Status Register
	TFR	A,B	Save Status
	ANDA	#\$08	Check if received any data
	BEQ	RXDT	Not received yet
	ANDB	#\$07	Received, check any error
	BEQ	RXDATA	No error, good data
	LSRB		Error, check type of error
	BCS	PARERR	Parity error
	LSRB		
	BCS	FRAERR	Framing error
	BRA	OVRERR	Overrun error

***Note:** These example programs are applicable when interrupts are disabled.

Programming Examples (BASIC)

Desired Configuration:

Baud Rate = 300, Word Length = 7 Bits, Stop = 2 Bits, Even Parity

Instruction	Comment
To Program the Control Register:	
10 X = 182	This is a B6 (HEX)
	300 baud, 7-bit word, 2 stop bits
20 POKE 65387,X	Write to Control Register FF6B (HEX)
To Program the Command Register:	
30 Y = 107	This is 6B (HEX); Even Parity, Normal Receive, Trans. Int. Disabled, RTS Active, IRQ Disabled, Receiver Enabled.
40 POKE 65386,Y	Write to Command Register FF6A (HEX)
To Check Modem Status:	
50 A = PEEK(65386)	Get current command Byte
60 A = A OR 1	OR in DTR enable BIT
65 B = POKE 65386,A	Output new Command Byte
70 B = PEEK(65385)	Read Status
75 B = B AND 64	Check only DSR Status
80 IF B = 0 THEN 100	If B=0, Modem is ready
90 PRINT"MODEM IS NOT READY"	B>0, Modem is not ready
95 END	
100 PRINT"MODEM IS READY"	

To Check Carrier Status:

```
110 Z = PEEK(65385)
120 Z = Z AND 32
130 IF Z = 0 THEN 160
140 PRINT "NO CARRIER"
150 END
160 PRINT "GOT CARRIER!"
```

Mask off all but DCD Status

If Z=0, then we have carrier; otherwise, we do not

To Transmit a Data Byte:

```
200 A = PEEK(65385)
210 A = A AND 16
220 IF A = 0 THEN 200
230 POKE 65384,D
```

FF69(HEX)

Transmit Holding Register empty?

Not empty

D has data byte

To Receive a Data Byte:

```
300 A = PEEK(65385)
310 B = A AND 8
320 IF B = 0 THEN 300
330 E = A AND 7
340 IF E = 0 THEN 400
350 IF E = 1 THEN 370
355 IF E = 2 THEN 380
360 PRINT "OVERRUN ERROR!"
365 END
370 PRINT "PARITY ERROR!"
375 END
380 PRINT "FRAMING ERROR!"
390 END
400 D = PEEK(65384)
410 PRINT "BYTE RECEIVED WAS";D
```

Read status register

Receive register full?

No data yet

Check for errors

No errors

Parity error

Framing error

Must be overrun error

Got data byte in D

5/Specifications

Dimensions

Length	6.6" (16.5 cm)
Width	4.4" (11 cm)
Height	1" (2.5 cm)
Weight	6.5 oz. (182 g)

Environmentals

Temperature

Operating	41° to 104° F. (5° to 40° C.)
Storage	– 40° to 160° F. (– 40° to 71° C.)

Humidity

Operating	40% to 80% non-condensing
Storage	20% to 90% non-condensing

RS-232C Pin Description

Pin Number	Signal
1	Frame Ground
2	Transmit Data
3	Receive Data
4	Request to Send
5	Clear to Send
6	Data Set Ready
7	Signal Ground
8	Carrier Detect
20	Data Terminal Ready

All other pins not used.

CARTRIDGE CONNECTOR SIGNALS

PIN #	Signal Name	Description
1	NC	Not Connected
2	NC	Not Connected
3	HALT*	Halt Input to the CPU
4	NMI*	Non-Maskable Interrupt to the CPU*
5	RESET*	Main Reset and Power-Up Clear Signal to the System
6	E	Main CPU Clock (0.89 MHz)
7	Q	Quadrature Clock Signal Which Leads E
8	CART*	Interrupt Input for Cartridge Detection
9	+5V	+ 5 Volts (300 MA)
10	D0	CPU Data Bit 0
11	D1	CPU Data Bit 1
12	D2	CPU Data Bit 2
13	D3	CPU Data Bit 3
14	D4	CPU Data Bit 4
15	D5	CPU Data Bit 5
16	D6	CPU Data Bit 6
17	D7	CPU Data Bit 7
18	R/W*	CPU Read — Write Signal
19	A0	CPU Address Bit 0
20	A1	CPU Address Bit 1
21	A2	CPU Address Bit 2
22	A3	CPU Address Bit 3
23	A4	CPU Address Bit 4
24	A5	CPU Address Bit 5
25	A6	CPU Address Bit 6
26	A7	CPU Address Bit 7
27	A8	CPU Address Bit 8
28	A9	CPU Address Bit 9
29	A10	CPU Address Bit 10
30	A11	CPU Address Bit 11
31	A12	CPU Address Bit 12
32	CTS*	Cartridge Select Signal
33	GND	Signal Ground
34	GND	Signal Ground
35	SND	Sound Input
36	SCS*	Spare Select Signal
37	A13	CPU Address Bit 13
38	A14	CPU Address Bit 14
39	A15	CPU Address Bit 15
40	SLENB*	Input to Disable the Select

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Radio Shack's nationwide network of service facilities provides quick, convenient, and reliable repair services for all of its computer products, in most instances. Warranty service will be performed in accordance with Radio Shack's Limited Warranty. Non-warranty service will be provided at reasonable parts and labor costs.

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