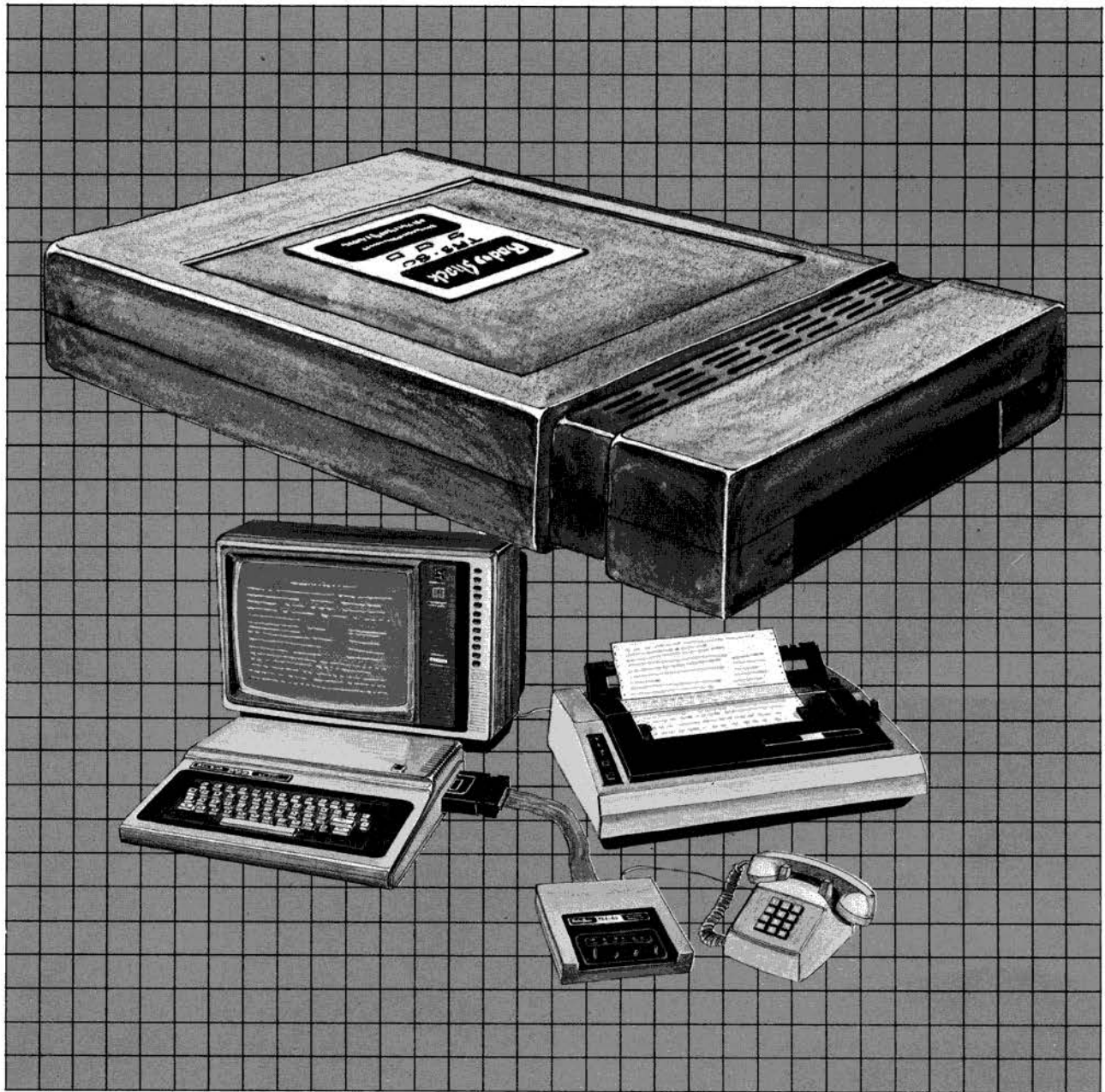


# Deluxe RS-232 Program Pak™ Operation Manual

for the  
TRS-80® Color Computer



**Radio Shack®**

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# Introduction

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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:

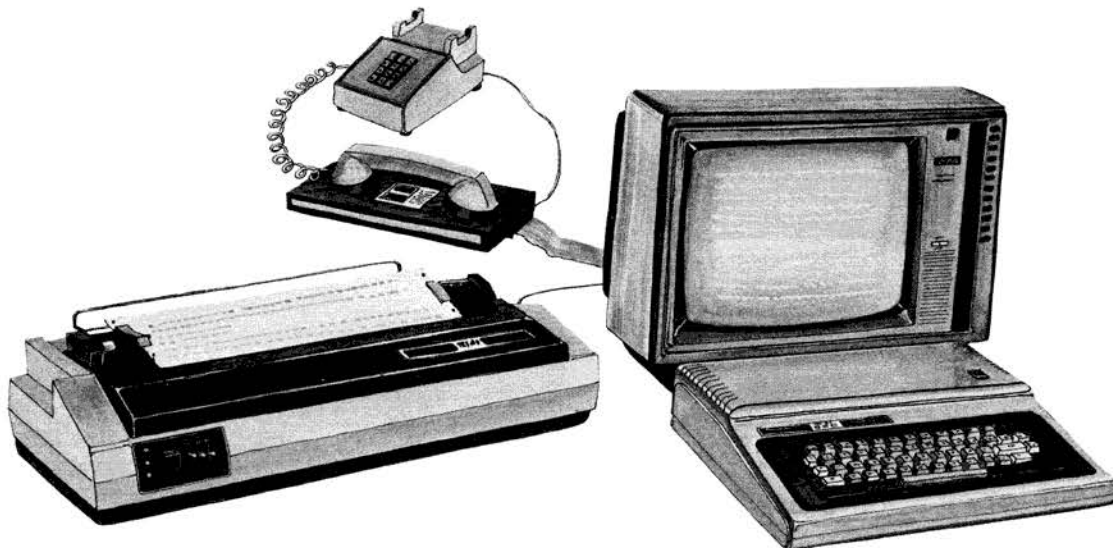
- Programmable Baud Rate capability
- Full- or Half-Duplex capability
- Selectable 7- or 8-Bit Word Length
- 1 or 2 Stop Bit Selection
- The ability to transmit and receive BASIC and machine-language programs

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.

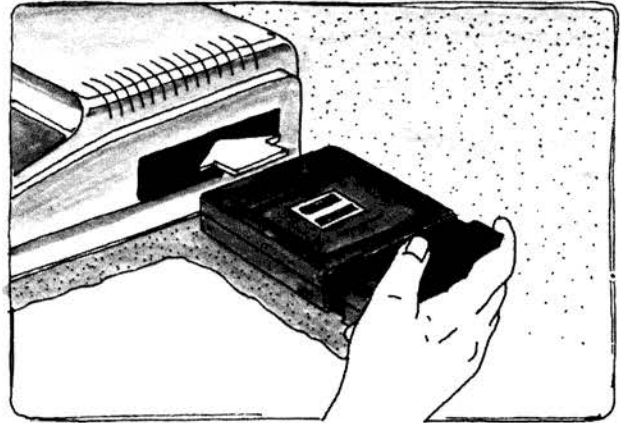


Figure 1. Inserting the RS-232 Program Pak

## 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.

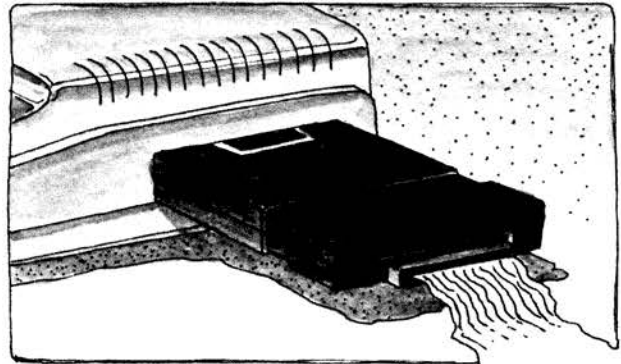
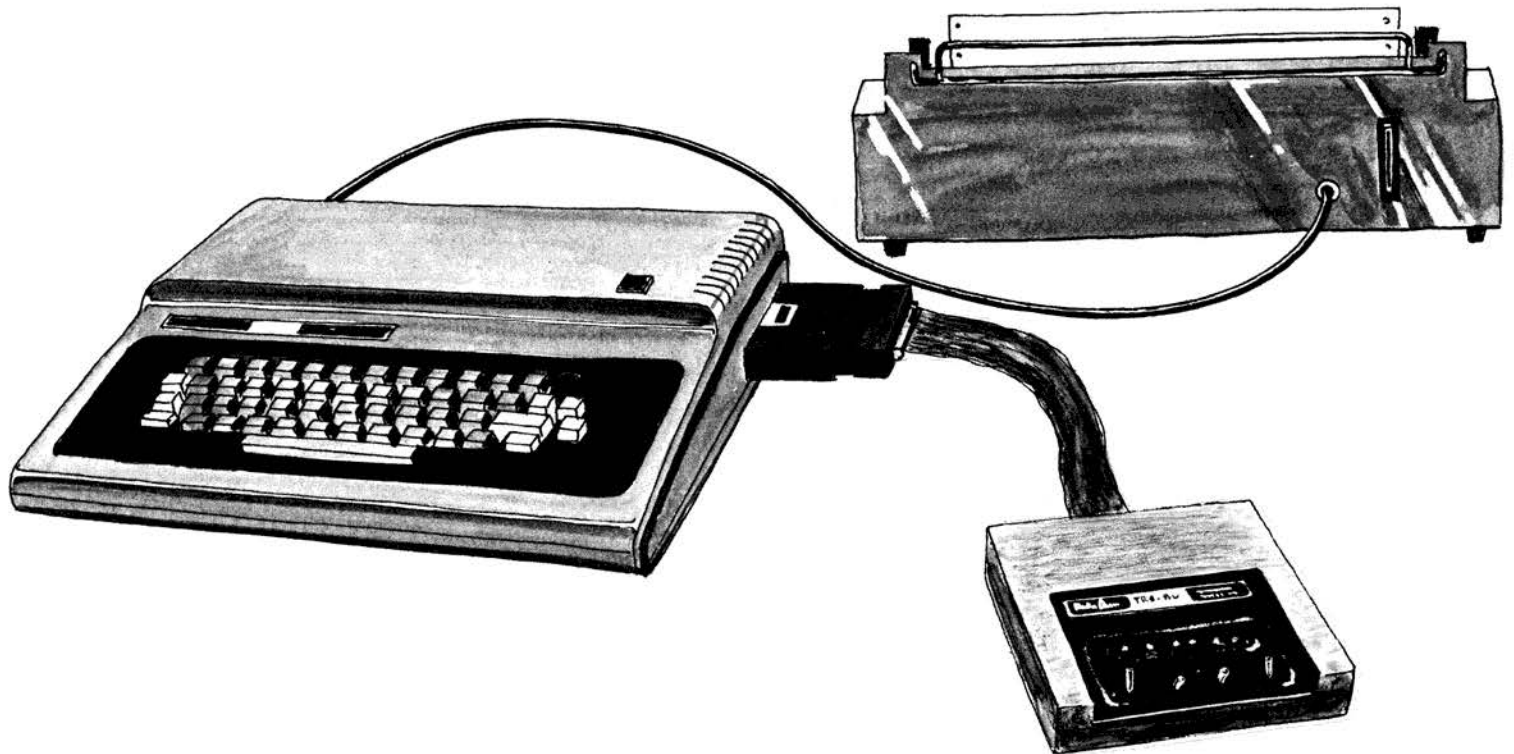


Figure 2. Connecting a Modem to the RS-232 Program Pak

## 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 **TRS-80 Color Computer Operation Manual** and the cassette recorder owner's manual for instructions on 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.

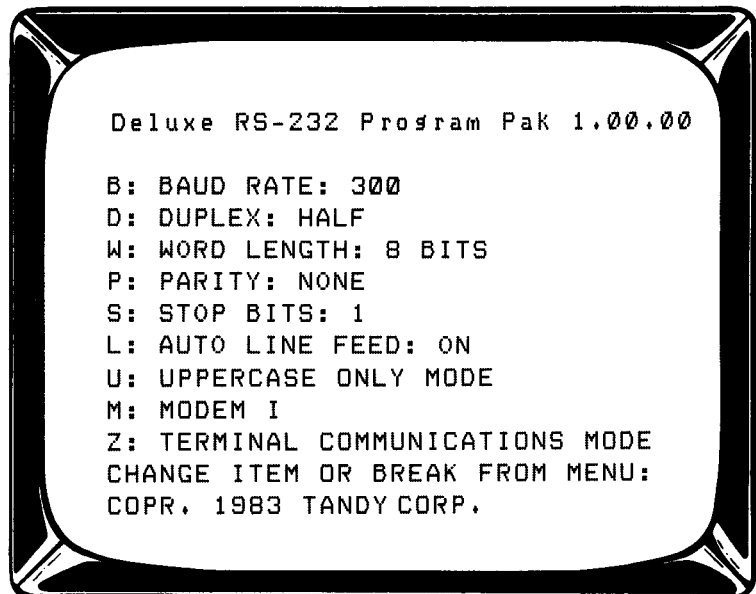
2. Once the OK prompt is displayed, type:

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.

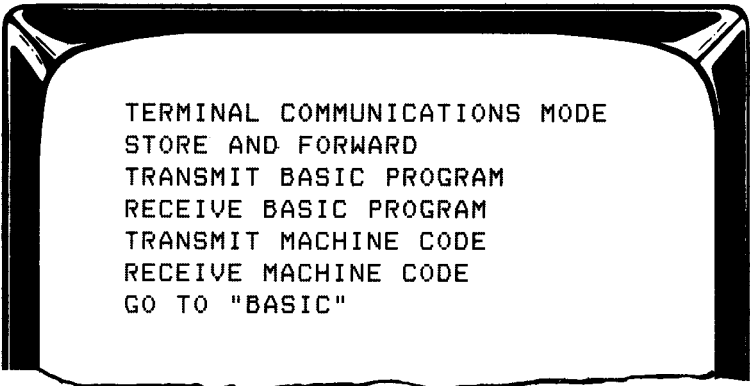
- For **PHONE #**, type the telephone number (up to 19 digits) and press **(ENTER)**.

**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                | Printer toggle |       | NONE              |
| CTL                | 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<br>1 = Error   | Self Clearing**  |
| Framing Error*               | 0 = No Error<br>1 = Error   | Self Clearing**  |
| Overrun*                     | 0 = No Error<br>1 = Error   | Self Clearing**  |
| Receive Data Register Full   | 0 = Not Full<br>1 = Full  | Read Receive Data Register                             |
| Transmit Data Register Empty | 0 = Not Empty<br>1 = Empty  | Write Transmit Data Register                           |
| DCD                          | 0 = $\overline{\text{DCD}}$ Low<br>1 = $\overline{\text{DCD}}$ High | Not Reusable<br>Reflects $\overline{\text{DCD}}$ State |
| DSR                          | 0 = $\overline{\text{DSR}}$ Low<br>1 = $\overline{\text{DSR}}$ Low  | Not Reusable<br>Reflects $\overline{\text{DSR}}$ State |
| IRQ                          | 0 = No Interrupt<br>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<br>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                              |
|-------------------------|--------|--|--------------------------------------|
| <b>Control Register</b> |        |  |                                      |
| 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         |
| <b>Command Register</b> |        |  |                                      |
| 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

|   |      |        |                               |
|---|------|--------|-------------------------------|
| <b>To Check Modem Status (DSR):</b>       |      |        |                               |
| 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)   |
| <b>To Check the Carrier Status (DCD):</b> |      |        |                               |
|   | LDA  | \$FF69 |                               |
|   | ANDA | #\$20  |                               |
|   | BNE  | CAROFF | Carrier is not present        |
|   | BRA  | CARON  | Carrier is present            |
| <b>To Transmit a Data Byte:</b>           |      |        |                               |
| 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  |
|---|--|
| <b>To Program the Control Register:</b> |  |
| 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)   |
| <b>To Program the Command Register:</b> |  |
| 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)   |
| <b>To Check Modem Status:</b>           |  |
| 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

|               |                 |
|---------------|-----------------|
| <b>Length</b> | 6.6" (16.5 cm)  |
| <b>Width</b>  | 4.4" (11 cm)    |
| <b>Height</b> | 1" (2.5 cm)     |
| <b>Weight</b> | 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                        |

## **SERVICE POLICY**

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