

MODEL I/III

**COMMUNICATIONS
PACKAGE**

**CAT. NO.
26-1149**

Radio Shack

TRS-80

SOFTWARE

TM

CUSTOM MANUFACTURED IN USA BY RADIO SHACK, A DIVISION OF TANDY CORP.

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Note:

*If you have a disk system these instructions only apply to versions
2.3 of TRSDOS on the Model I and
1.3 of TRSDOS on the Model III*

1/Introduction

This program package allows communications between a pair of Model I and/or Model III TRS-80's. The TRS-80's may be tape or disk systems. Using this Communications Package (CP), you and a friend will be able to send and receive programs, data, and messages. You can also make your TRS-80 act like a "host" system for use by your friend's "terminal" TRS-80 or vice versa.

Your TRS-80's will "talk" to each other over ordinary telephone lines. Assuming you have a good phone connection, you'll be able to communicate with another TRS-80 friend wherever a telephone is available.

To use the CP, you and your friend will both need:

- A Model I or III with at least 16K RAM.
- An RS-232-C interface. Model I tape and disk systems get Radio Shack Cat. No. 26-1145. Model III tape systems get 26-1148. Model III disk systems come equipped with an RS-232-C interface.
- A telephone interface or "modem." Suggested models: 26-1170, 26-1171, and 26-1172.

Note: If you will be using this package to send 1) a BASIC program or 2) a data file created with BASIC, you will need to send it from one storage medium to the other. This means that both TRS-80s must have the same storage medium—both must have a disk drive or both must have a tape recorder.

What This Package Contains

This package contains:

- **HOST** — Allows a TRS-80 to accept commands and data from a remote TRS-80 and to output to that remote TRS-80. The remote TRS-80 must be running the TERM program.
- **TERM** — Sends keyboard input to a "host" TRS-80, and displays information that is received from the host. The host TRS-80 must be running the HOST program.
- **COMPROG** — Allows a pair of TRS-80's to send and receive BASIC programs, data files, machine-language programs, and blocks of memory; also allows both TRS-80's to act as terminals for keyboard communications.

There are five versions of COMPROG — one for each system (memory size and model). There is one version of both HOST and TERM. The programs are distributed on three cassettes and two disks.

INTRODUCTION

How to Use This Manual

First, read the section titled *Setting Up*. Then, read the instructions for the programs you and your friend will use. If you're going to try the host/term arrangement, read *HOST and TERM*. If you're going to transfer files or do other computer-to-computer operations, read *COMPROG*.

2/Setting Up

RS-232-C Interfaces

The RS-232-C interface is a standardized system for serial communications (one bit at a time). You and your friend must agree on several RS-232-C variables before attempting communications between computers. Most of these may be chosen arbitrarily, but both of you must use the same values for each of them. Required or recommended values are shown in *Table 1*.

RS-232 Switch	Recommended Settings
Baud rate (speed of data transmission)	110 or 300 (the modems cannot operate at rates higher than 300 baud).
Word length (bits per word)	7 or 8 (use 8 if graphics, non-ASCII data, or programs will be sent)
Parity (automatic error checking)	Even, odd or none (arbitrary)
Stop bits	1 or 2 (arbitrary)

Table 1. RS-232-C Settings.

In Model I TRS-80's, you set these variables via mini-switches mounted on the RS-232-C circuit board. See *Appendix A*. HOST and TERM will use the settings specified by these switches. COMPROG will allow you to override the switch settings.

In Model III TRS-80's, you set these variables via software (BASIC statements or TRSDOS commands — see *Appendix B*). HOST and TERM will use the software settings you provided. COMPROG will allow you to override these software settings.

Modems

Your TRS-80's will “talk” over the phone lines via modems. These devices translate RS-232-C signals into tones which may be transmitted over ordinary phone lines. The same devices can receive such tones and re-translate them into RS-232-C signals. See *Figure 1*.

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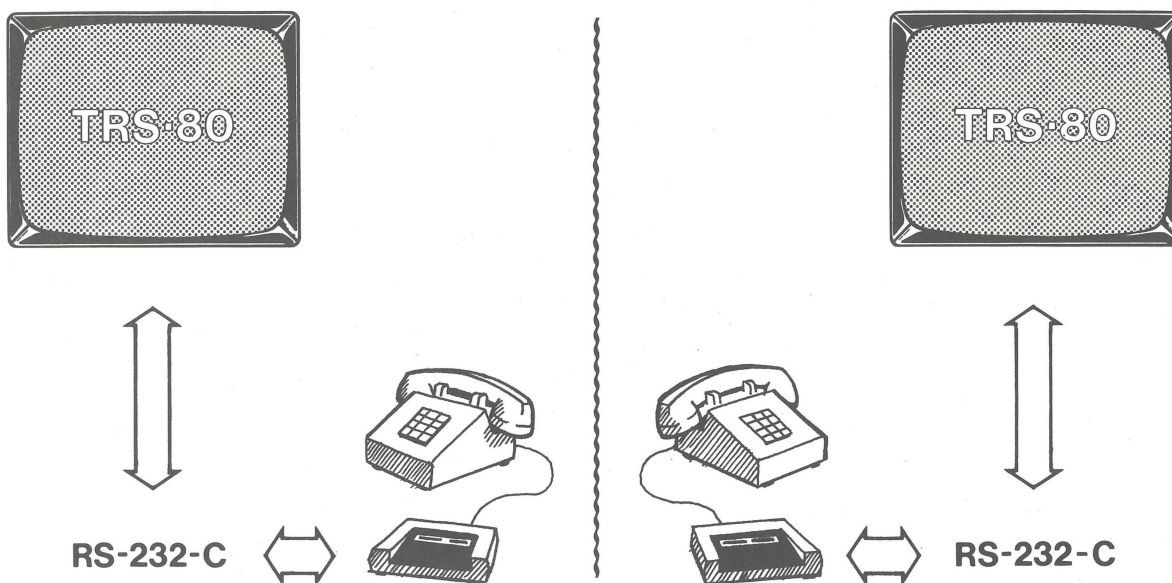


Figure 1. Communications via RS-232-C/Modem connection.

Radio Shack sells several models you may choose from, including: Telephone Interface I (26-1170), Telephone Interface II (26-1171) and Modem I (26-1172). The first two models provide an acoustic connection to your telephone handset. The third one provides a direct connection to the phone circuit, bypassing the telephone handset. All three models allow communications at up to 300 baud.

You and your friend may use any combination of these models with one exception: only one may be a Telephone Interface I.

Connect your TRS-80 to the modem using the cable that was supplied with your RS-232-C interface. See *Figures 2 and 3*. For connection of the modem to the AC power and telephone system, see the modem owner's manual.

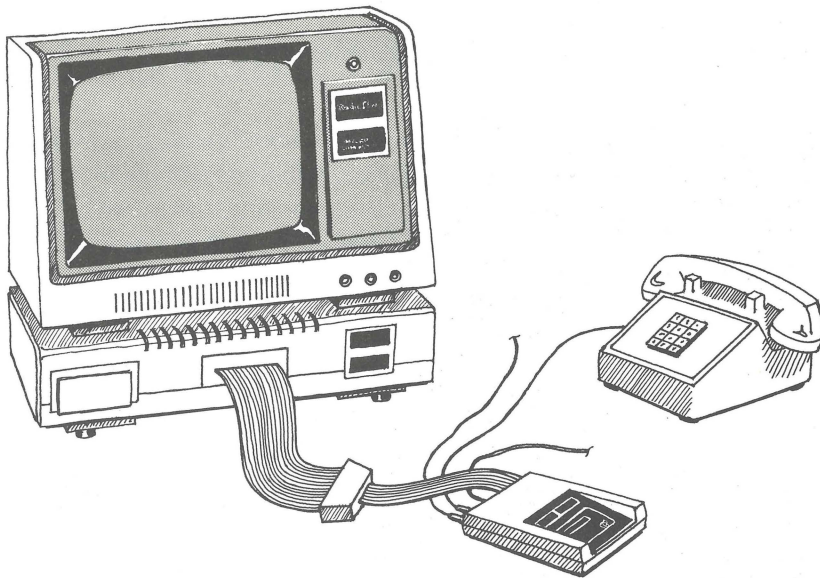


Figure 2. Connection of a modem to the Model I TRS-80.

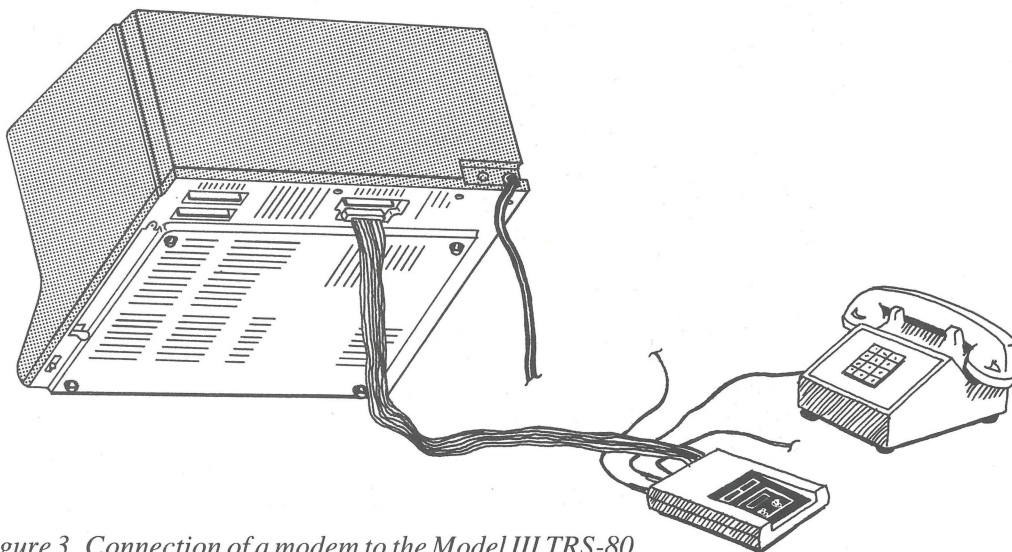


Figure 3. Connection of a modem to the Model III TRS-80.

Modem Control Settings

During communications, one modem must be set to originate mode (O or ORIG); the other must be set to answer mode (A or ANS). The choice is arbitrary, but the modems must be set to opposite modes.

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Note: The Telephone Interface I is an originate-only mode, so the other modem must be set to answer mode.

Both modems must be set to full duplex mode (Modem I is always full duplex).

Hints and Tips

1. Before attempting communications between computers, you and your friend may test the modems to see that they are set up properly. Call up your friend and both of you put your modems on the line ("online"). (Refer to the modem owner's manual for details of modem operation.)
2. If the modems are online and functioning properly, the modem carrier detect light should be lit on both units.
3. Allow 15 seconds for the lights to come on, then pick up the phone so you can talk to your friend (not to other computer!). If either of the modems failed to detect the carrier, then both of you should re-check your modem connections and control settings.

3/HOST and TERM

These two programs allow one computer, called the terminal, to use the resources of another computer, called the host. Commands from the terminal are processed by the host computer and the results or output from these commands and data are sent back to the terminal.

For example, suppose you have a tape system and a friend has a disk system. Your friend's computer can play host to your computer's terminal, allowing you to use all the resources of a disk system.

To make this possible, you run TERM and your friend runs HOST. The CP includes a single version of each program. Each of these will run on 16, 32 or 48K Model I or III systems, tape or disk.

Instructions for Starting TERM

Tape Systems

1. Set the RS-232-C variables according to the values you and your friend have agreed on. (See *Appendix A*.)
2. Start your Computer and answer the MEMORY SIZE question by typing 31993 (ENTER). If you have a Model III, answer the CASS question by typing L.
3. Locate the tape labeled TERM and prepare your recorder to play it.
4. Type SYSTEM (ENTER). The prompt, *?, will appear. Type TERM (ENTER). The Computer will now load the program from tape. Blinking asterisks indicate the computer is loading the tape properly. It should take about one minute.

If the program does not load, the recorder volume may be too high or low. Adjust the setting and try again.

5. After a successful load, another *? will appear. To start the program, type ⌘ (ENTER). A program heading will appear on the screen. Now skip to the section titled *Using HOST and TERM*.

Disk Systems

1. Set the RS-232-C variables according to the values you and your friend have

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agreed on. (See *Appendix A*.)

2. Start your disk system, insert the appropriate diskette, and get in the TRSDOS READY mode.
3. Start TERM by typing TERM **(ENTER)**. The program heading will appear on the screen. Now skip to the section titled *Using HOST and TERM*.

Instructions for Starting HOST

Tape Systems

1. Set the RS-232-C variables according to the values you and your friend have agreed on. (See *Appendix A*.)
2. Start your computer and answer the MEMORY SIZE question by typing the address for your system, as shown in *Table 2*. Press **(ENTER)** after typing in the number. If you have a Model III, answer the CASS question by typing L.
3. Locate the tape labeled HOST and prepare your recorder to play it.
4. Type SYSTEM **(ENTER)**. The prompt, *, will appear. Type HOST **(ENTER)**. The computer will now load the program from tape. Blinking asterisks indicate the computer is loading the tape properly. It should take about two minutes.

If the program does not load, the recorder volume may be too high or low. Adjust the setting and try again.

5. After a successful load, another *? will appear. To start the program, type / **(ENTER)**.
6. A program heading will appear on the screen and the computer will ask you what memory size you have. Type in the appropriate response (1 for 16K, 2 for 32K, 3 for 48K).

For further instructions, skip to the section titled *Using HOST*.

RAM in Your System	Answer to Memory Size
16K	28662
32K	45046
48K	61430

Table 2. Memory Size Response for HOST in Model I Tape Systems.

Disk Systems

1. Set the RS-232-C variables according to the values you and your friend have agreed on. (See *Appendix A*.)
2. Start your disk system, insert the appropriate diskette, and get it in the TRSDOS READY mode.
3. Start HOST by typing HOST **(ENTER)**. The program heading will appear on the screen. Now skip to the section titled *Using HOST*.

Note for Tape System Customers:

If you exit HOST or TERM, you can return to it providing you have not overwritten the program. Type SYSTEM **(ENTER)**. In response to the *? prompt, type / followed by the program's transfer address. The transfer address is the memory size (listed on *Table 2*) plus one.

Using HOST and TERM

A typical session goes like this:

You and your friend first decide who will be the host and who will be the terminal. Set up the modem as explained in the section titled *Setting Up*. Also be sure that you are both using the same RS-232-C variables (*Appendices A and B*).

You don't need to put the computers online with each other yet. You'll probably want to talk over the lines to confirm that you're both following the proper procedure.

HOST Operation

If you are to be the host operator, start the HOST program as explained previously.



If you have a cassette system, the computer will ask you what memory size you have. Answer 1 for 16K, 2 for 32K, or 3 for 48K RAM.

You may put the terminal computer online now or wait until after the start-up questions have been answered.

First, the computer will ask if you want to disable the remote terminal's **(BREAK)** key. If you disable the remote **(BREAK)**, the terminal will be somewhat restricted in its use of your system. If you do not disable it, the terminal will have greater

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freedom in using your system (interrupting BASIC programs, etc.). Answer Y or N in response to this question.

Next, the computer will ask if you want to send nulls to the terminal after each carriage return. If the remote terminal is a hard-copy computer (Teletype  TM  etc.), it might be necessary to send nulls to give the carriage return time to take effect. But for TRS-80 terminals, you won't need to send any nulls. Type in a number from 0 to 255 in response to this question and press **ENTER**. If you press **ENTER** without a number, 0 will be used.

Your Computer will then return you to the TRSDOS READY or READY mode depending on whether you have a disk or tape system. It is now the host Computer.

During host operation, the host operator may use the host computer as usual, except that all video output will be duplicated to the remote terminal and all data received from the remote terminal will be interpreted just as if it came from the host terminal's keyboard.

If the computers aren't online yet, put them on now.

TERM Operation

If you are the terminal operator, start the TERM program as explained previously. A program heading will appear. Press any key and the screen will be erased.

When you go online with the host computer, everything you type will be sent to the host computer. The information you send will be accepted as commands or data, depending on the current mode of the host computer.

For example, if the host computer is a disk system in the TRSDOS READY mode, the terminal may type in TRSDOS commands or specify programs to be run.

Hints and Tips

HOST Operation

Before allowing the terminal to go online, get the computer ready. For example, if you want the terminal to run a specific BASIC program, disable the remote **BREAK** key (if you don't want the remote terminal to interrupt the program) and start the program running. If you want the terminal to execute TRSDOS com-

mands (disk systems only), get the host computer in the TRSDOS READY mode before going online.

Do not allow the terminal program to run any programs that will overwrite the host program. If running BASIC, answer the MEMORY SIZE question with an address below the HOST memory area. See the memory maps in *Appendix C* for details on restricted memory areas.

To disable the HOST function, press the reset button.

For technical information and special applications, see the appendices.

TERM Operation

The terminal operator must not issue commands or perform operations that cause the host computer to overwrite the HOST program. See *Appendix C* for restricted memory areas in the host computer.

To type in control characters, use **(SHIFT) (↓)** plus the desired control letter. *(Note: Control characters are not available using some Model III keyboards. If the control characters on your Model III do not work, contact your local Radio Shack store.)*

To quit terminal operation, type a **(SHIFT) (↓) (G)**.

On Model I computers use **(SHIFT) (↓) (G)**, not **(BREAK)**, to send a break character to the host computer.

For technical information and special applications, see the appendices.

4/COMPROG

This program allows you and a friend to exchange programs and data files using the RS-232-C/modem/telephone connection. It allows you to do any of the following:

You

Set the baud rate, word length, parity, and number of stop bits with keyboard commands.

Load any tape or disk file (BASIC program, Z-80 program, or data file)

Send the contents of a block of memory.

Operate as a terminal.

Your Friend

Set the baud rate, word length, parity, and number of stop bits with keyboard commands.

Receive the file and write it to tape or disk.

Receive the data into memory and write it to tape or disk.

Operate as a terminal.

Of course, you and your friend may reverse these functions as well.

If you have:	Use this tape:
Model I/III Tape, 16K	COM16T
Model I/III Tape, 32K	COM32T
Model I/III Tape, 48K	COM48T

Table 3. Versions of COMPROG for each tape system.

Now you and your friend may both start COMPROG. Read the customized starting procedures below for your tape or disk systems.

Instructions for Starting COMPROG

Tape Systems

1. Set the RS-232-C variables according to the values you and your friend have agreed on. (See *Appendix A*.) Or, you may do this via a COMPROG command described later on.
2. Start your Computer and answer the MEMORY SIZE question by typing the

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correct number from *Table 4*, then press **(ENTER)**.

- Using *Table 3*, locate the correct COMPROG tape for your computer system and prepare your recorder to play it.
- Type **SYSTEM (ENTER)**. The prompt, ***?**, will appear. Type in the name of the tape (e.g., COM16T for 16K systems) and press **(ENTER)**. The Computer will now load the program from tape. Blinking asterisks indicate the computer is loading the tape properly. It should take about one minute.

If the program does not load, the recorder volume may be too high or low. Adjust the setting and try again.

- After a successful load, another ***?** will appear. To start the program, type **(F) (ENTER)**. A program heading and an option list or "menu" will appear on the screen. Now skip to the section titled *Using COMPROG*.

RAM in Your System	Answer to Memory Size
16K	27807
32K	44191
48K	60575

Table 4. Memory Size Response for COMPROG in Tape Systems, Model I and III.

If you exit COMPROG, you can return to it (providing you have not overwritten the program). Type **SYSTEM (ENTER)**. In response to the ***?** prompt, type /46357 on a 32K system or /62741 on a 48K system.

Disk Systems

- Set the RS-232-C variables according to the values you and your friend have agreed on. (See *Appendix A*.) Or, you may do this with a COMPROG command described later on.
- Start your disk system, insert the appropriate Model I or Model III diskette, and get it in the TRSDOS READY mode.
- Now that you have the disk copy, you may start COMPROG by typing **COM32D (ENTER)** if you have a 32K system or **COM48D (ENTER)** if you have a 48K system. The program heading will appear on the screen. Now skip to the section titled *Using COMPROG*.

Using COMPROG

COMPROG allows you and a friend to perform a variety of

computer-to-computer communications. Each of you runs COMPROG and each may send or receive information. In this section, we will go through each of the possible operations.

You call your friend and agree on the modem settings and RS-232-C variables you will use. (See the section titled *Setting Up*.)

You don't need to put the modems online yet. You'll probably want to talk over the lines to confirm that you're both following the proper procedure.

Both of you should start COMPROG and your screens should resemble one of those shown in *Figure 4*. Notice the solitary question mark prompt, `?`, at the bottom of the screen. This prompt is unique to the main menu; other menus in COMPROG have slightly different prompts.

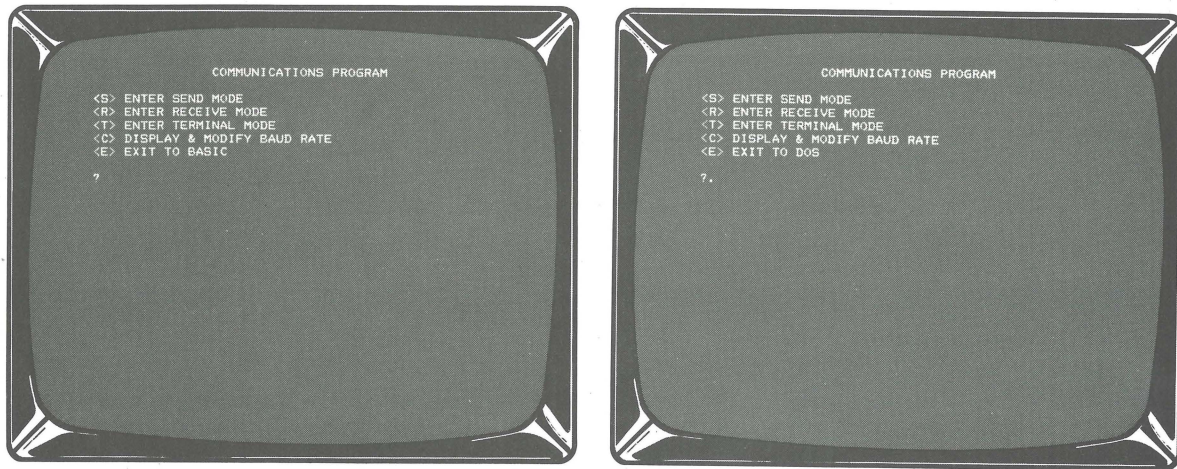


Figure 4. Main menu for COMPROG Tape and Disk Versions.

The first thing you'll probably want to do is try communicating as terminals. In this mode, you'll be able to put the computers online and continue communicating with each other by typing in messages on your keyboard. What you type will be sent to your friend, and vice versa.

Note: You can try setting both modems to *HALF DUPLEX*. This way, what you type will appear on your screen.

Put the computers online and type `T` (**ENTER**). Your computer will display the current baud rate so you may change it if desired. If the rate is correct, press (**ENTER**). If you want to change it, type in the agreed-on rate and press (**ENTER**). (For telephone communications, you should use 300 baud.)

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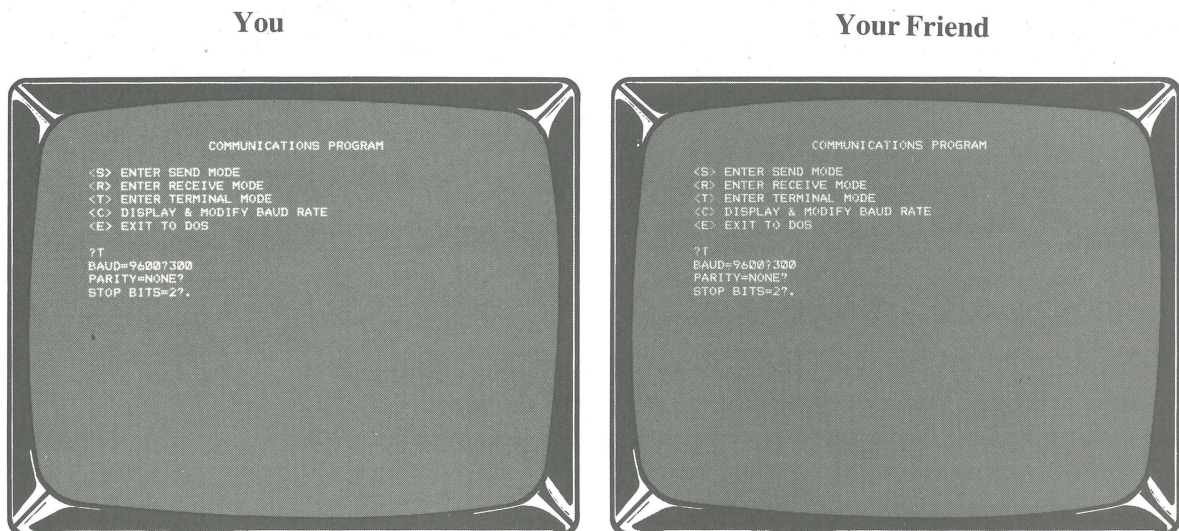
In a similar manner, the computer will display the parity and stop-bit settings and give you a chance to change these. Press **(ENTER)** to leave a value as-is or type in the desired value and press **(ENTER)** to change it.

After you select the stop-bit setting, the computer will clear your screen and go into a terminal mode. If your friend has answered the questions as you have, and the computers are online, the two of you will be able to communicate by typing on the keyboard. If the computers are not online, your computer will automatically return to the main menu.

The purpose of the terminal mode is to let you and your friend plan what you're going to do (send programs, etc.) without having to take the computers offline and talk. Instead, you "talk" via the computer hookup. The terminal mode also lets you set RS-232-C variables and verify that communications can take place.

To exit from the terminal mode at any time, type in a control X (left **(SHIFT) (↓) (X)**). Exception: On early-Model III's without control key capability, type **(SHIFT) (↑)**.

Figure 5 shows a sample session using the terminal function of COMPROG. You can assume that **(ENTER)** was pressed at the end of every short line.



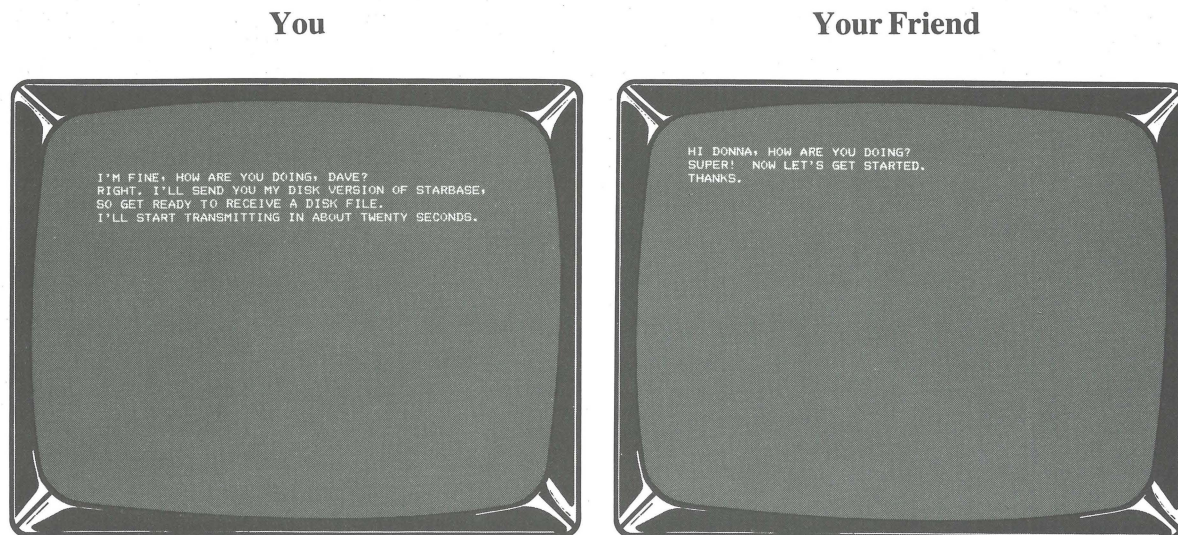


Figure 5. Sample Use of COMPROG's terminal function.

Send and Receive Modes

We are assuming you will be sending in information to your friend. This means you will be in the "send mode" and your friend in the "receive mode". To get into the send and receive modes, follow these procedures.

First, be sure that both of your modems are set to FULL DUPLEX. One of them must be set to ORIGINATE and the other to ANSWER. It makes no difference which modem is set to ORIGINATE, you just need to make sure that both modems are not set to the same setting. Once set up, you can transmit data both ways, not just from the ORIGINATE modem to the ANSWER modem.

Then, make sure that any other equipment you will be using is set up (cassettes, disks, etc.). When you and your friend are ready to start sending information, place both of your telephone handsets into the modems.

Remember that the baud rate must be set to 300 for transmission using the modems. From the main menu, you select the send mode by typing S (ENTER). Your friend selects the receive mode by typing R (ENTER). Each of you will get a new menu on the screen. The send menu always shows S? as a prompt; the receive menu always shows R? as a prompt. See Figure 6 for sample screens.

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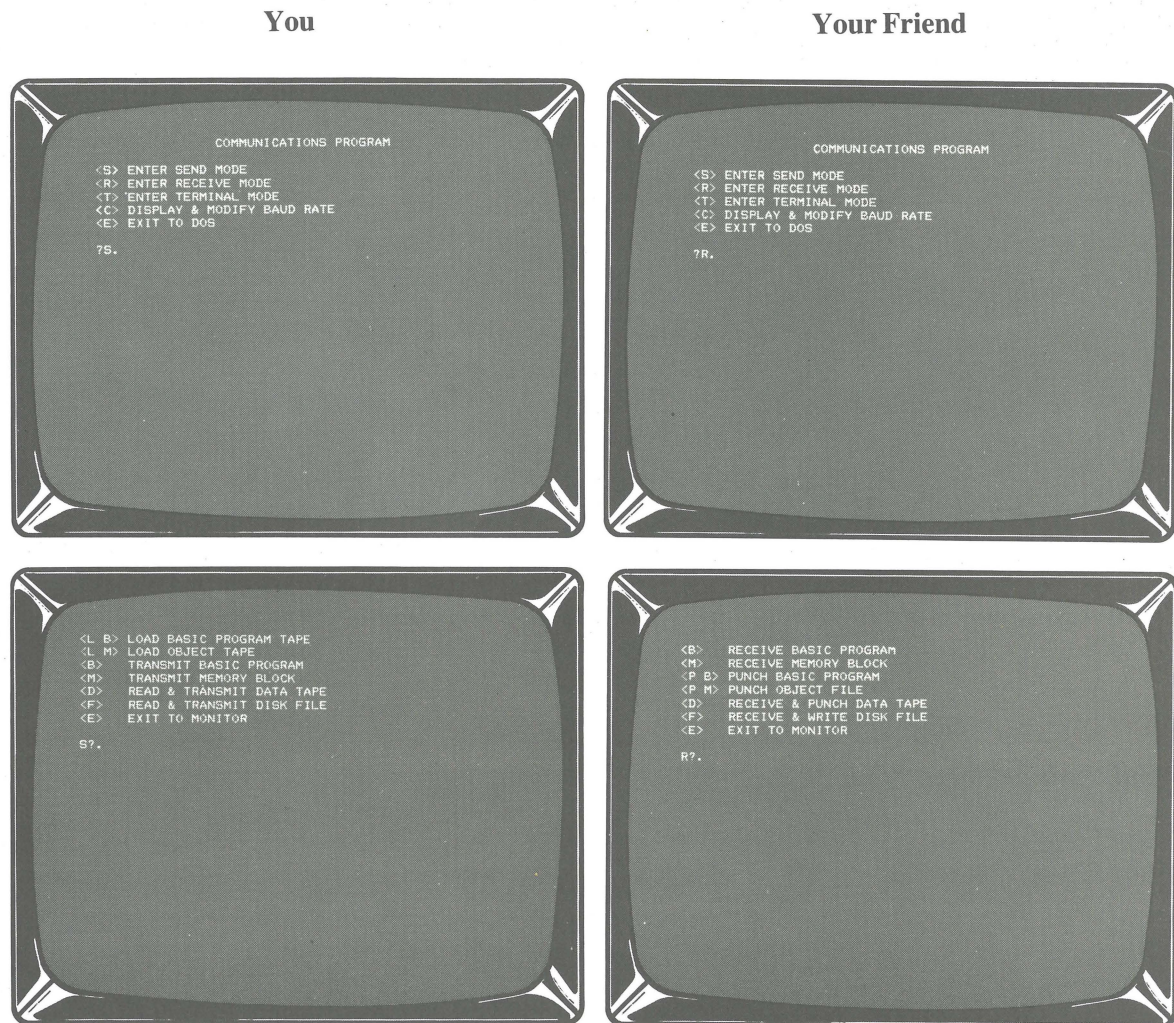


Figure 6. Screen sequence for preparing to send information.

Transmitting Programs or Data

Once you are in the send mode and your friend is in the receive mode, you can transmit data to your friend's computer. The data you can transmit can be in any of these forms:

1. a BASIC program stored on tape.
2. any kind of program or data stored on disk.
3. data stored on tape with the BASIC PRINT # statement.

4. an object file.

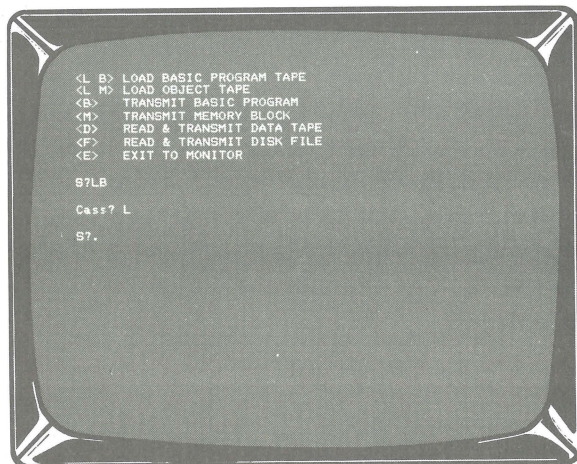
If you are transferring from tape, we suggest that you use only a tape which contains a single data file. Otherwise, you will have to manually stop the tape recorder after the file is transmitted to keep COMPROG from transferring the next file.

The command you should use to transmit your data depends on which of these four forms it is in. We will demonstrate the commands for each of these types of data below. The next section, *During the Transmittal*, shows what will happen while you are transmitting your data and what to do if the transmittal does not work.

1. A BASIC Program Stored on Tape

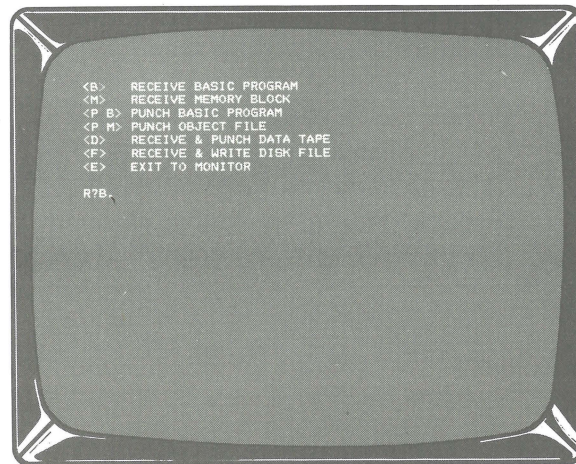
To transmit your tape copy of a BASIC program, you must have used the BASIC command CSAVE to save it. This command puts it on tape in ASCII format. Your friend must also have a tape system for saving the tape image you will be transmitting. Before beginning the transmittal, rewind your tape to the beginning of the BASIC program and press the PLAY button. Then you and your friend should follow these procedures:

You



Type LB **(ENTER)** to load your BASIC program. If you have a Model III, answer the Cass? prompt with L for Low Baud Rate.

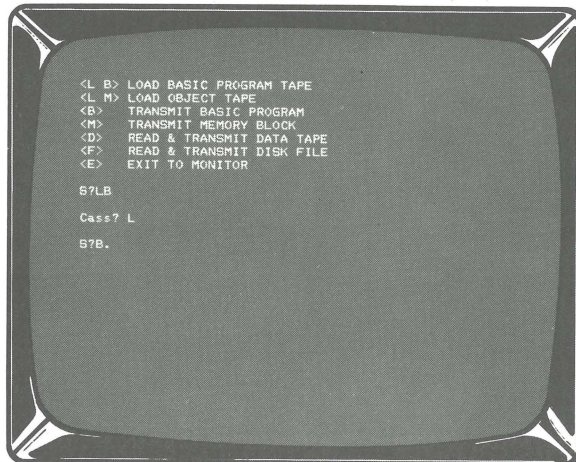
Your Friend



Type B **(ENTER)** to prepare the Computer for receiving the program.

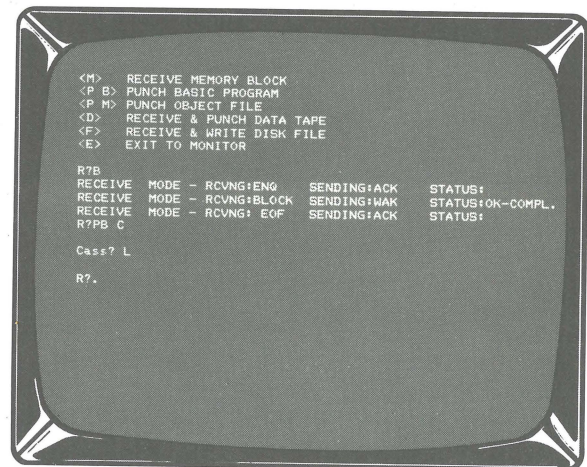
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You



Type B **(ENTER)** to transmit your BASIC program. The program will then be transmitted (See *During the Transmittal.*)

Your Friend



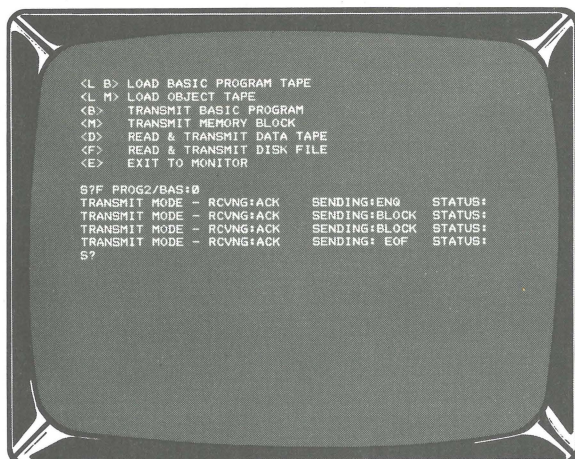
Once the transmission is completed, your friend must store it on tape before running it. Connect the tape recorder, put a tape in it, rewind it, and press the PLAY and RECORD buttons. Then type PB followed by a one letter file name. In this example, your friend is storing the program under the file name C. Model III users should answer the `C a s s ?` prompt with L for Low Baud.

After storing it on tape, your friend can load it into memory using the CLOAD command. If your friend has a disk system, it can then be saved on disk with the SAVE command.

2. Data Stored on Disk

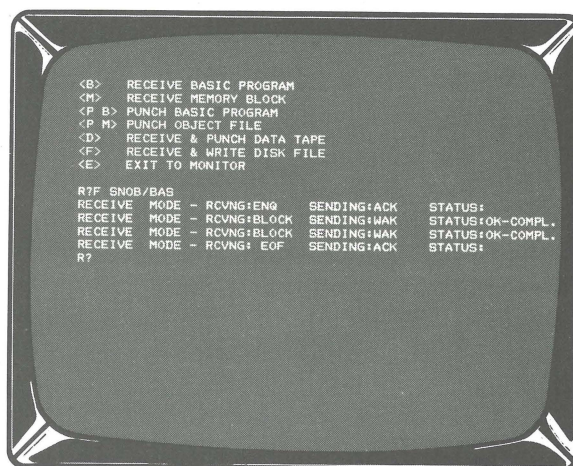
You may transmit anything you have stored on disk (a BASIC program, a data file, an object file, etc.) to your friend's disk. To transmit your disk files, you and your friend must follow these procedures:

You



Type *Ffilename* and press **(ENTER)** to load your program or data file from disk and transmit it. *filename* should be the TRSDOS file specification you would use to load the file from disk. (See the TRSDOS section of your Owner's manual). In this example, you are loading and transmitting a file named PROG2/BAS from the disk in drive 0. After typing this command, the program will be transmitted. (See *During the Transmittal*.)

Your Friend



Type *F filename* and press **(ENTER)** to receive the program or data file and save it on disk. Notice, your friend can use a different filename to store the data. In this example, your friend is storing the data you transmitted as SNOB/BAS. Your friend must type this command before you type your command.

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3. Data stored on tape with BASIC

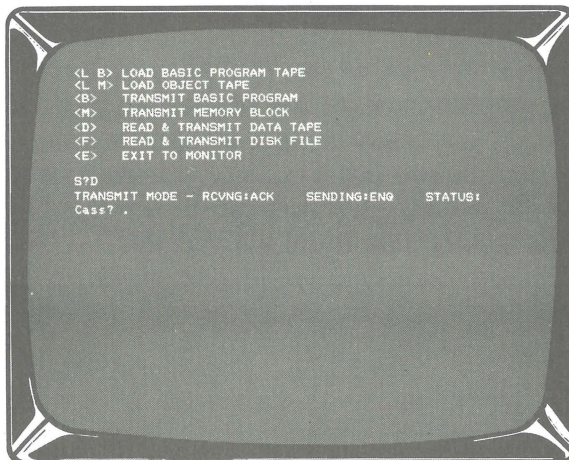
These procedures show how to transmit a data file which you saved on tape using the BASIC word PRINT #. It will be transmitted directly to your friend's tape recorder.

If you are transferring from tape, we suggest that you use only a tape which contains a single data file. Otherwise, you will have to manually stop the tape recorder after the file is transmitted to keep COMPROG from transferring the next file.

To transmit your data, you and your friend need to follow these procedures:

You

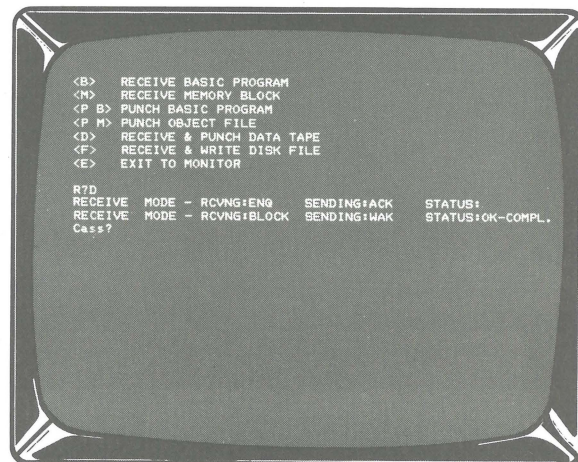
Rewind your tape recorder to the beginning of the data file which you want to transmit and press the PLAY button.



Type D (**ENTER**) to transmit your data file which you have on tape. The transmittal will begin. The data file will be loaded into memory and transmitted, one "block" at a time. See *During the Transmittal*.

Your Friend

Connect a tape recorder to the computer, put a tape in it, rewind it, and press the PLAY and RECORD buttons.



Type D (**ENTER**) to prepare your computer for receiving the data. Your friend must type this command before you type your command.

Once your friend receives the data file, it can be read into memory using the same program you use to read it. Then, if desired, your friend can write another program to store it on disk.

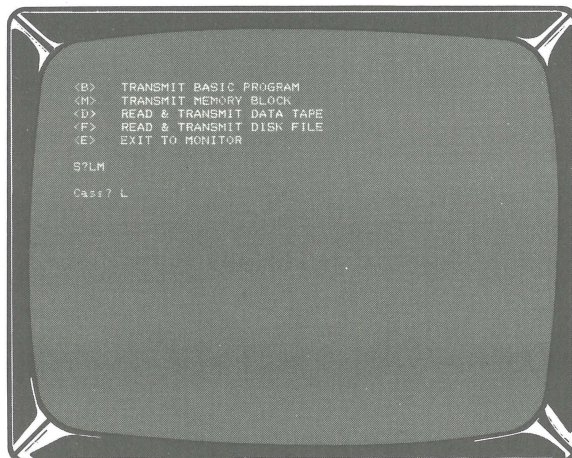
4. An Object File

You can transmit a block of memory from your computer to your friend's or a machine-language program which you have stored on tape. To do this, you must know the starting and ending addresses of the data you are sending.

CAUTION: Be careful not to send any object file which will be written over either BASIC or TRSDOS in low RAM locations or the Communications Program itself in high RAM locations. The hexadecimal loading addresses which you and your friend assign the object file (shown below) must not be below 42E9 (for Level II or Model III BASIC) or 5200 (for TRSDOS). Nor can the assignments be above 6CA0, ACA0, or ECA0 for 16K, 32K, or 48K computers, respectively. If it is too long to fit between these two addresses, you will need to store it in a disk file, and transmit it using method number 2 above.

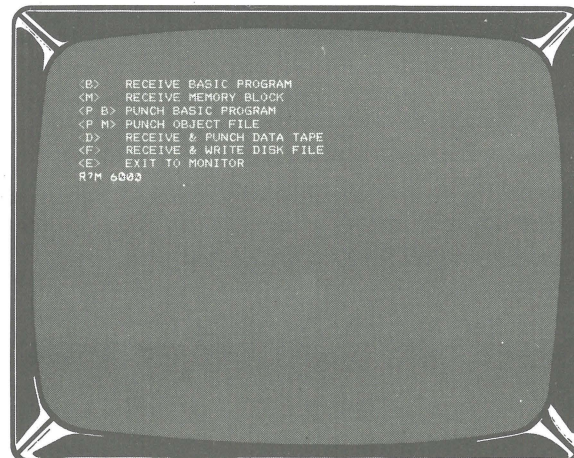
To transmit your object file, you and your friend need to follow these procedures:

You



If your object file is stored on tape, you need to first load it by typing LM and pressing **(ENTER)**. If you have a Model III, answer the Cass? prompt with L for Low Baud Rate.

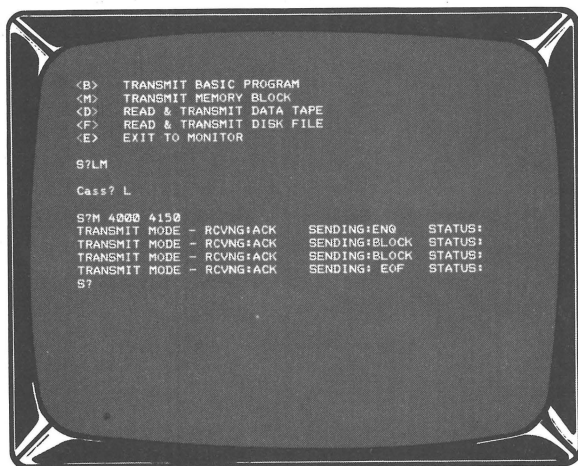
Your Friend



Type the starting address where you want the object file to reside once it is transmitted and press **(ENTER)**. In this example, your object file will be transmitted to your friend's computer beginning at hexadecimal address 6000.

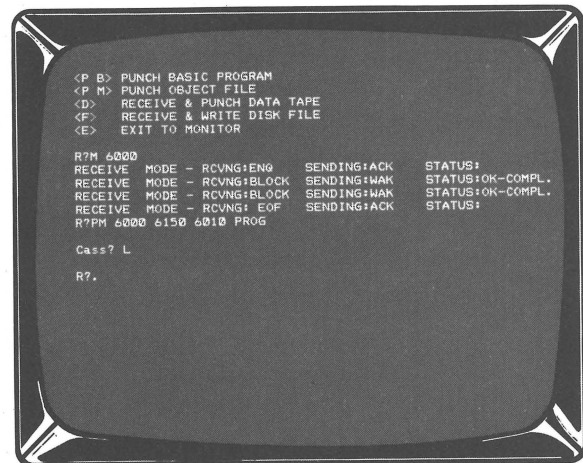
COMMUNICATIONS PACKAGE

You



Type *Maaaa bbbb* and press **(ENTER)**. *aaaa* and *bbbb* are the starting and ending addresses. In this example, you are transmitting the object file residing in memory between the hexadecimal addresses of 4000 to 4150. After you type this command, the transmittal will begin. See *During the Transmittal*.

Your Friend



After the transmittal, your friend can store the object file on tape. Type *PM aaaa bbbb cccc filename* and press **(ENTER)**. *aaaa*, *bbbb*, *cccc* are the hexadecimal starting, ending and entry-point addresses. In this example, your friend is storing the file under the filename *PROG*. The starting address is 6000; the ending, 6150; and the entry-point, 6010. Notice, the addresses may be different from yours, but must have the same relative position.

During the Transmittal

As soon as you type the command to transmit your data, your computer will send an enquiry signal (ENQ) to your friend's computer once every second for one minute. Your friend's computer will send back an acknowledgement signal (ACK).

If your friend's computer does not receive the ENQ signal within one minute, it will cancel the transmittal and print SENDER NOT READY. It will then return to the R? prompt.

By the same token, if your computer does not receive the ACK signal within one minute, it will cancel the transmittal and print RECEIVER NOT READY. It will then return to the S? prompt.

If either of you get this NOT READY message, you should find out why the other one is not ready and try the transmittal again.

During the transmittal, both of your computers will display messages showing the status of the transmission. *Appendix G, COMPROG Communications Protocol* gives an explanation of these status messages (ENQ, ACK, WAK, NAK, etc.) When the transmission is complete, your computer will return to the S? prompt and your friend's will return to the R? prompt.

See *Error Conditions* for an explanation of any error messages you or your friend might get during the transmittal.

Notes on Model III Tape Transfers:

On the Model III, COMPROG will prompt you and your friend with Cass? before each block (portion) of data is transferred. Both of you must specify the baud rate in response to each of these prompts.

BASIC data files may only be transmitted at a low baud rate. Therefore, when transmitting a BASIC data file, you must respond to all the Cass? prompts with L. If you will be writing a program to read the file, you must specify the low baud rate before running the program.

Hints and Tips for Using COMPROG

You and your friend should set up procedures that you will follow if an error in transmission occurs. For example, you might both pick up the telephone and wait for the other station to do the same when an error message occurs.

Some early Model III's do not have the control key function. You will need to press RESET to exit COMPROG.

If you continue to get RECEIVER NOT READY and SENDER NOT READY messages when you think everything is connected correctly, check your baud rate using the C command from the main menu. It's easy to forget that the modems can't handle anything higher than 300.

Remember that both you and your friend can send and receive information regardless of which modem is set to ORIGINATE or ANSWER. You just need to have one person working off the send menu and one working off the receive menu.

When transmitting or receiving information, do not move or disturb the modem since this could result in the transmission being slightly garbled.

After receiving information from your friend, you might want to scan it quickly, if you can, to see if it looks okay. If there are obvious errors you may want to retransmit the information.

If the message NO DATA FOUND is displayed when you are trying to transmit a file, check to see if your cassette is turned on.

If you decide in the middle of a transmission that you want to abort it or find that you are sending the wrong file, you can end the transmission by holding down the C or the X key. Pressing the C key will stop the transmission and send a message to the other station. Pressing the X key stops the transmission but does not notify the other computer. You may have to hold the key down for a few seconds before the system recognizes it.

In the Terminal mode, the data sent is checked by parity bits. If an error is detected, a graphics bar is displayed next to the character in which the error is found. A vertical bar will be displayed if the byte that has an error is not a keyboard character.

Transmission checking is done in the send and receive modes also. See *Appendix G COMPROG Communications Protocol*.

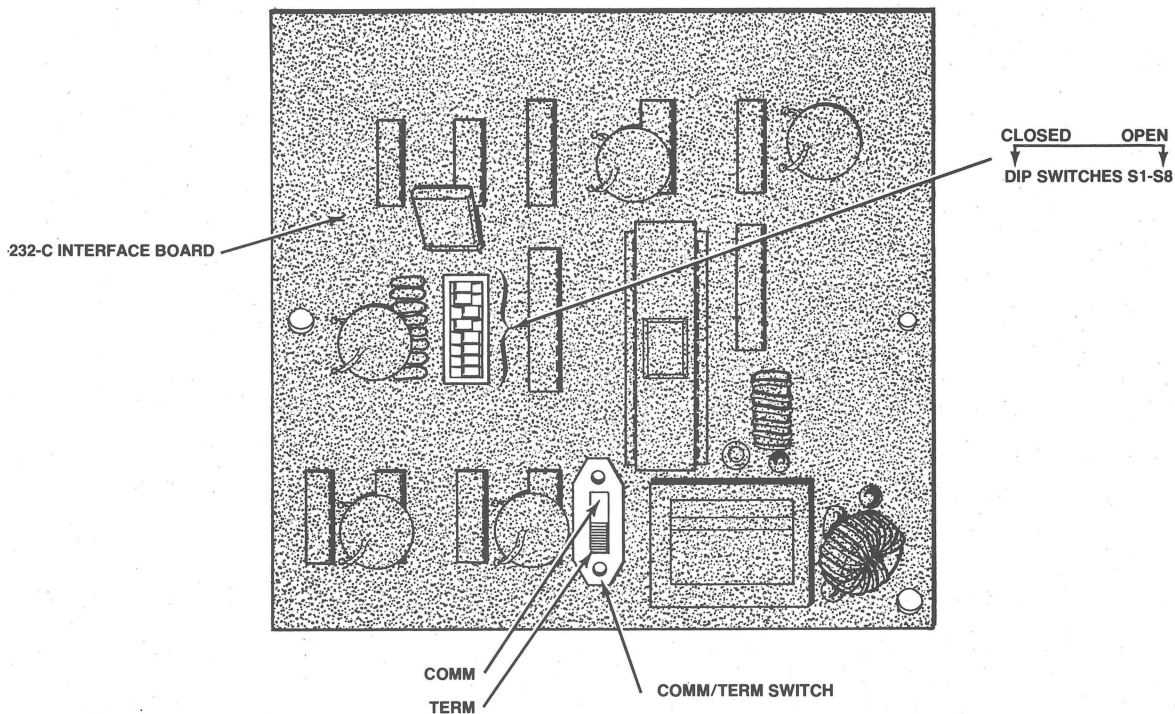
Error Conditions

Message	Meaning
DSK FLT	Disk read or write error. Transmission will end, returning both stations to their prompts.
MODEM FLT	In all the following cases, transmission will end, returning both stations to their prompts. The phone is off the coupler so no carrier is detected. The phones have been disconnected (lift receiver and listen for tone). The phone connection is so bad that no messages can get through. Both modems are set to ORIGINATE or both to ANSWER (check switch settings). Modem is set to HALF-DUPLEX at one or both stations (check switch settings). Modem is powered off or cable is disconnected.
COMM FLT	Unspecified communication fault.
ILL RQST	Meaningless request
CHK SUM FLT	An error in the data. The check sum as computed by the receive station does not agree with the amount calculated by the send station. The same block is retransmitted.
BC FLT	The byte count received does not agree with its one's complement check sum computed by the receive station. Transmission will end, returning both stations to their prompts.
???	Unknown message has been received.

If no error message occurs, but no transmission is taking place and no status message appears, see the *Hints and Tips* section. If you cannot find the problem, try hanging up and calling again or reloading the Communications Program and starting over. If this does not work, you may have problems with the RS-232-C hardware. Refer to your *TRS-80 RS-232-C Interface Manual*.

Appendix A/Model I RS-232-C Settings

The stations must set the switches on the RS-232-C Board identically, following the chart in this section. The drawing below shows the switches on the RS-232-C Board.



When using modems and the TRS-80's, you should set the switches according to the charts below. The baud rate should be 300, one stop bit, parity disabled, and an eight-bit word length.

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Baud Rate	S6	S7	S8
110	Closed	Closed	Closed
150	Closed	Closed	Open
300	Open	Closed	Closed
600	Open	Closed	Open
1200	Closed	Open	Closed
2400	Closed	Open	Open
4800	Open	Open	Closed
9600	Open	Open	Open

Parity Enable	S4	Stop Bits	S5
Parity Enabled	Closed	One Stop Bit	Closed
Parity Disabled	Open	Two Stop Bits	Open

Word Length (Excluding parity bit)	S2	S3
5 Bit Word	Closed	Open
6 Bit Word	Closed	Open
7 Bit Word	Open	Closed
8 Bit Word	Open	Open

Parity Select	S1
Odd Parity	Closed
Even Parity	Open

Table A-1. Operation of Mini-switches.

The setting of switch one does not matter; the parity is disabled anyway. It can be either open or closed.

Your switches should look like the following, assuming a 1 means the switch is open and a 0 means that it is closed.

Switches -	1	2	3	4	5	6	7	8
Settings -	0/1	1	1	1	0	1	0	0

The COMM/TERM switch must be set to TERM.

Refer to the *RS-232-C Interface Manual, Catalog Number 26-1145*, for more information on setting up this board.

The programs read the hardware switches only once when they are first executed, so if you change the board after the program has been executed, you'll have to rerun the program to pick up the new switch settings.

Appendix B/Model III RS-232-C Settings

You can change the RS-232-C settings from either MODEL III BASIC or TRSDOS. Most likely this will not be necessary as the RS-232-C is automatically initialized to the proper values for the Communications Program when you press the reset button.

You should always check the setting values before entering the Communications Program to make sure they have not been inadvertently changed. To do this, type in the following instructions.

From BASIC;

At the ready prompt, type in `PRINT PEEK (16888)`. When you press **(ENTER)**, the value returned should be 85. If it is 85, then there is no need to change this value. If this value is not 85, you will need to change it using the POKE command. This is accomplished by typing `POKE 16888,85`. After you press **(ENTER)**, the value will be changed to 85. You can check this by using the PEEK command again. Similarly, type `PRINT PEEK (16889)` to make sure that value is set to 104. If it is not, change it using the command `POKE 16889,104`. Finally, using the PEEK and POKE commands as demonstrated above, you need to make sure that 255 is in memory location 16890.

Memory Location	---	Setting
16888	-----	85
16889	-----	108
16890	-----	255

From TRSDOS:

Type `SETCOM (ENTER)` to check the current values. The values returned should be

```
BAUD = 300, WORD = 8, STOP = 1, PARITY = NONE, WAIT MODE
```

If any of these are different, you need to change them using the SETCOM command. Simply type

```
SETCOM (WORD=8,BAUD=300,STOP=1,PARITY=3,WAIT)
```

When you press **(ENTER)**, the values will be reset. Type `SETCOM (ENTER)` to make sure you typed the command correctly.

Appendix C/HOST Memory Maps

These maps show where HOST will reside in memory. You must remember not to overwrite this area. The HOST program will, of course, reside in different areas according to the size of RAM in your machine. Refer to the charts below for the starting and ending addresses of HOST for disk systems. The transfer address is also given. Tape systems need only make the correct answer to the Memory Size prompt to protect the program. Four different charts are given: Model I Tape System, Model I Disk System, Model III Tape System, Model III Disk System.

RAM in Your System	Answer to Memory Size
16K	28662
32K	45046
48K	61430

Table C-1. Memory Size Response for HOST in Model I Tape Systems.

Amount of RAM in Your System	Start Address (aaaa)	End Address (bbbb)	Transfer Address (cccc)
32K	B000	B1E4	B000
48K	F000	F1E4	F000

Table C-2. Addresses for HOST in Model I Disk Systems.

RAM in Your System	Answer to Memory Size
16K	28662
32K	45046
48K	61430

Table C-3. Memory Size Response for HOST in Model III Tape Systems.

Amount of RAM in Your System	Start Address (aaaa)	End Address (bbbb)	Transfer Address (cccc)
32K	B000	B1E4	B000
48K	F000	F1E4	F000

Table C-4. Addresses for HOST in Model III Disk Systems.

Appendix D/COMPROG Memory Maps

These maps show where COMPROG will reside in memory. You must remember not to overwrite this area. The COMPROG program will, of course, reside in different areas according to the size of RAM in your machine. Refer to the charts below for the starting and ending addresses of COMPROG for disk systems. The transfer address is also given. Tape systems need only make the correct answer to the Memory Size prompt to protect the program. Two different charts are given, one for tape systems and one for disk systems, since for Model I and Model III the addresses and numbers are the same.

RAM in Your System	Answer to Memory Size
16K	27807
32K	44191
48K	60575

Table D-1. Memory Size Response for COMPROG in Tape System, Model I and III.

Amount of RAM in Your System	Start Address (aaaa)	End Address (bbbb)	Transfer Address (cccc)
32K	ACA0	BFA8	B515
48K	ECA0	FFA8	F515

Table D-2. Addresses for COMPROG in Disk Systems, Model I and III.

Appendix E/Custom Applications for HOST and TERM

This section will explain the use of certain control keys and how they can be used. It will also give some special applications you can do.

Wherever there is the word "Control" in the chart below, it means to press **(SHIFT) (↓)**. For example, to enter a Control C, you would press **(SHIFT) (↓)** and **(C)** simultaneously. (Please note that this control function does not work on some of the early Model III's. You will have to press RESET to exit the TERM program.)

CODE	MEANING
Control C	Same as the (BREAK) key
Control E	Not used by the TRS-80
Control F	Not used by the TRS-80
Control G	Return from TERM program to LEVEL II or TRSDOS
Control Q	Identifies Term Station as a TRS-80

At the term station, you should enter Control Q (**(SHIFT) (↓) (Q)** all pressed at the same time) in order to identify yourself to the host station. This will allow you to receive PRINT AT output on your video correctly. You can enter this control key at any time before you expect any PRINT AT output from the host station.

If the host station is running under TRSDOS, you can enter any valid TRSDOS command from the term station to execute at the host station. This includes executing BASIC and then running a BASIC program. (Be sure to protect memory by answering the MEMORY SIZE? prompt according to *Table 2* or *Table 4* in the HOST and TERM section, *Table 2* for Model I and *Table 4* for Model III.) If a program requires input, either the host or term station can supply it.

If the host station is running under LEVEL II BASIC, you can run any BASIC program from the term station. Again, you can supply input at either station. It will be just as if you were running LEVEL II with two keyboards and two videos hooked up to the host TRS-80.

You can also run machine language programs in both of the above cases if they do not use memory space which is required by HOST. See *Appendix C* for HOST memory requirements.

Appendix F/Custom Applications for COMPROG

Although Radio Shack cannot guarantee other manufacturer's equipment and cannot supply any special programming that may be necessary to support it, the following items are provided, without obligations to Radio Shack, to facilitate such work.

1. There is much valuable reference information in the *TRS-80 RS-232-C Interface Manual* which should be used.
2. It is possible to make direct RS-232-C connections in case telephones and modems are not used. In this case, it is necessary to solder pins 20, 6, 5, and 8 (DTR, DSR, CTS, and CD, respectively) together on the DB25 connector at both Interface Boxes.

This makes the RS-232-C think there is a modem connected and turned on (DSR) receiving a carrier tone (CD) and clear to send (CTS). Refer to the *TRS-80 RS-232-C Interface Manual* for illustrations.

3. The send and receive modes are made up of two major routines (RCV and XMIT) which are called by the Data Access routines at both stations. You can access these from an outside machine (not a TRS-80 running COMPROG). To do this, you will need to know the block sending protocol which you can find in *Appendix G COMPROG Communications Protocol*.

If you are using the RS-232-C hardware, you must remember that three types of program access are required. These are automatically taken care of when you have a TRS-80 with COMPROG.

- a. Initialize
 - 1) UART is reset.
 - 2) Baud Rate Generator is set to the desired Baud rate.
 - 3) UART and Modem Control Register are set to the proper number of bits/word, Parity or not, Modem control, etc.
- b. Receive incoming bytes
 - 1) UART status is checked to see if a character has been received (if bit seven of the I/O address, EA (hex) or 234 (decimal), is set (equals one), then a character has been received).
 - 2) Character must be read from the UART data register at I/O address EB (hex) or 235 (decimal).

c. Transmit a byte

- 1) UART status is checked to see if previous output character has been transmitted before the next is loaded (if bit seven of the I/O address EA (hex) or 234 (decimal) is set (equals one), then the new byte may be loaded).
- 2) Character is output to the UART data register at I/O address EB (hex) or 235 (decimal).

Appendix G/COMPROG

Communications Protocol

The following is the Block Protocol which the TRS-80 Communications Package uses in sending blocks of data. Using this information, other communications systems can be programmed to accept data transmitted through the RS-232-C Interface. The receiver must still have the RS-232-C unit.

BLOCK PROTOCOL						
	SYNC Char	Message Type Code	Data Block Size	Data Size Check Number	Data Block	Data Block Size Check
Contents	7E (hex)	00-0E (hex)	# of bytes in data block	1's complement of data block size	Any Data	# of bytes of data sent
Length	1	1	2	2	# of bytes specified in the data block size number	2
Example	7E	00	0005	FFFB	32 0C CA 64 19	0005

CONTROL CODES				
00 = DATA BLOCK	03 = WAK	06 = CANCEL	09 = ILLEGAL RQST	0C = CHKSUM ERROR
01 = ENQ	04 = EOF	07 = MODEM FAULT	0A = ???(unknown error)	0D = BLOCK LNTH CHKER
02 = ACK	05 = NAK	08 = COM. FLT.	0B = DISK ERROR	0E = OK-COMPLETED

The following chart explains the meaning of each of the status messages.

Message	Meaning
ENQ	Enquiry. Are you there?
ACK	Unconditional acknowledge. The receive station can send this to let the send station know another block can be transmitted.
BLOCK	A block is being sent or received.
WAK	Wait acknowledge. The receive station can send this to let the send station know that it got the block but wait before sending another.
EOF	End-of-file. The send station transmits this at the end of the data to indicate a successful transmission.
NAK	Negative acknowledge. The receive end can transmit this if it detects certain errors in the data (such as a check-sum error) so the send station can try retransmitting the block.
CANC	Cancel. The transmission has been terminated for some reason.
OK COMPL	This is displayed in the status message at the send station when the block has been transmitted without error (when the send station receives the ACK message).

The sync character (7E hex) is sent to allow synchronization of transmission between the sender and the receiver. When the sending station is ready to send the data, it will first send control code 01 which is the ENQ signal. This ENQ signal is sent once every second of one minute. If no ACKnowledgement signal (control code 02) is sent back within the one minute period, the sender will terminate transmission and the procedure will have to be started again.

If the receiving station sends the ACK signal back within one minute, the transmission of the data can start. The sending station sends a control code 00 signifying that a data block is to follow. It then sends a two-byte number specifying the number of bytes in the data block to be sent. This second number is used as a check to be

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sure the data size number was not garbled in transmission.

The data itself is the next block of transmission. This will consist of any type of information you wish to send. Following the data transmission, the data size number is sent again as another check. If this last number is not the same as the first data size number, then there were some errors in transmission and the procedure should be done again. This final transmission is the sender's count of the number of data bytes actually sent. Before each block transmission, it is automatically initialized to zero.

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