ESC is SHIFT (UP-ARROW) followed by the character   eg: 1B (n).
CONTROL is SHIFT (DOWN-ARROW) and the character along with it.

MODEM 80 COMMUNICATIONS PACKAGE

The MODEM80 Communications package is a disk oriented system designed to allow data transfer with a wide variety of other computers or terminals. All programs will run in either a model I or III TRS80 with at least 32K and disk.

Programs are included to permit:

(1) Remote operation of a TRS-80 model I or III from a terminal or a second TRS-80 through a telephone link - files may be transferred with the unattended computer.

(2) Error free file transfers with another TRS80 or a computer that can use the protocol of the CP/M program "Modem" which is widely used on computer bulletin boards (and available on CP/M user group disk #25).

(3) File transfers with many other types of computers with the TRS-80 acting as a terminal. The program is set up for use with MicroNET, the Source, Forum 80's and similar systems, but the communication parameters, character set and control characters may be re-defined to operate with many other computers.

Advantages of a disk oriented system:

(1) Files of unlimited length may be handled, even in a 32K computer. With the "XMODEM/CMD" file transfer utility, files may be transfered with a 16K computer.

(2) Files may be prepared off-line, taking advantage of the features of your word processor program, or the included program "SAVE/CMD" may be used if a word processor is not available. If the transmission cannot be made on the first attempt, the file is still safely on your disk and available for a second try.

(3) Transmit and receive files may be opened before communication begins, and may be turned on and off independently. In a specialized application, one file may be transmitted while a different file is simultaneously being received. Control codes may be used to allow the remote computer to control the file operations.

(4) A single line may be sent from the file, allowing sending from the file to be intermixed with typing from the keyboard. This allows a more flexible response to prompts from the remote computer and permits transmitting data to a computer that cannot accept full speed transmission and does not use control codes to stop and start the file transmission.

(5) DOS commands and programs which execute in the lower 16K of memory may be executed while maintaining positions in the transmit and receive files. The previous screen contents are restored when the DOS command is completed.

The Programs:

MODEM80/CMD - The main terminal and file transfer program.

HOST1/CMD - Allows remote control of the computer

XMODEM/CMD - file transfer utility that may be used alone or run under HOST1

SAVE/CMD - Key to disk for off line text file preparation or run under HOST1 to receive a text file from a remote computer. This program (only) is limited to the available memory of the computer.

TYPE/CMD - Lists a text file to video or printer - when run under HOST1, it will also send to the remote, and will send the <save to file ON> and <OFF> codes to control MODEM80 at the other end.

TEXTFIX/CMD - Clean up text files so they will load into a word processor. Removes control characters, extra linefeeds, deletes characters where a backspace or rubout was received. Can add a terminating 00 byte to a file as required by Visicalc and Electric pencil.

HEX/CMD - Converts binary files to ASCII hex characters and the reverse, for transmission to computers that cannot handle the full character set. Checksums a file to verify accuracy of transmission.

MODEM80 ver. 3.0

Using MODEM80:

The program initializes the RS232 to 300 baud, 8 bit words and no parity, regardless of the switch (model I) settings on the RS232 board. This configuration will work with MicroNet, The Source, Forum-80's, and may be altered if necesary for other uses. For TRS-80 to TRS-80 communications, one must have its modem set to "originate" mode and the other to "answer" (doesn't matter which), and one should use the <E> (echo) option from the main menu while the other uses <T> (the default condition when the program is loaded). Both modems should be set to full duplex. When possible, the file transfer mode, <S> and <R> from the main menu, should be used to take advantage of the error-free protocol and to transfer machine code or compressed Basic program files. The terminal and echo modes are restricted to ASCII files - text or Basic programs saved in ASCII, or direct operation from the keyboard.

Terminal or Echo mode:
local control codes:

<BREAK> or <CLEAR> + - goes to main menu

Clear + - should be used if debug is active. Any characters received after going to the menu will be missed, so it should be done before the connection is made or while the remote is waiting for a response, or a CTL-S may be sent from the keyboard to stop the remote temporarily. (If it responds to CTL-S, then a CTL-Q would be used to restart the remote after returning to the terminal mode. The current screen contents are saved and restored when returning from the menu.

<CLEAR> + 2 open/transmit file

The first time this control is used, a prompt will be given for the file to transmit, and the file is opened. Another <clear> + 2 is required to start the transmission (a prompt is given) and subsequent <clear> + 2 's will toggle the file transmission off/on as desired until the end of the file. When the last character has been transmitted, an ">> End of file" message will be displayed (not transmitted). When running in full duplex, the characters are seen only after they are echoed back from the remote, and it is normal for the end of file message to occur before the last characters from the file are displayed.

<CLEAR> + 1 transmit single line

After a file has been opened for transmission using the <clear> + 2 control or from the disk menu, <clear> + 1 will send a single line from the file, that is, until a carriage return is encountered and transmitted. <clear> + 1 may also be used to stop after starting a file transmission with <clear> + 2, and will cause transmission to stop at the end of the current line.

<CLEAR> + 5 display status

Shows the current ON/OFF status of the printer and files (if open), the remaining free space in the receiving buffer before a disk write will be necessary, and the remaining characters in the transmit file buffer. The SEND status will include "/EOF" if the entire file to be transmitted is in the memory buffer or "/MORE", if the transmission will require additional disk accesses.

<CLEAR> + 4 toggle printer on/off

A 256 byte print buffer is provided to allow the printer to allow it to perform carraige returns without losing characters, but it must otherwise keep up with the communication rate. If the print buffer is overrun, an error message will be displayed and the printer output automatically disabled. If the printer cannot keep up, it will be necessary to save to a disk file and print off-line.

<CLEAR> + 3 save to disk file

The first <clear> + 3 will prompt for a filename, and open the file. Text will not be written into the file until <clear> + 3 is pressed again, or a control code (default = X'12') is received from the remote. Repeating the <clear> + 3 will stop/start the save to file as desired, with a status message displayed each time. Receiving an X'14' control code from the the remote will turn the file save OFF. When the memory buffer space is full, a control-S (XOFF) is transmitted to stop the remote computer while the current buffer is written to the file. Then a control-Q (XON) is sent to re-start the remote, allowing files of any length to be transferred with any system that responds to the XOFF code. Passwords should not be used with the output filespec - the file is closed and re-opened during a DOS command or the <write buffer to disk> option from the disk menu and will not re-open properly if a password is used. The output file may be replaced, closed, or canceled from the disk menu. The remaining buffer contents will automatically be written out and and the file closed when the <X> option is used to return to DOS from the main menu.

<CLEAR> + 7 generates backslash character X'5C'
(displayed as down-arrow on the model I)

<CLEAR> + 9 right square-bracket X'5B'
(displayed as up-arrow on the model I)

<CLEAR> + 8 left square-bracket X'5D'
(displayed as left-arrow on the model I)

The bracket characters are necessary to surround user numbers other than your own when accessing MicroNet files.

<CLEAR> + 0 send communications BREAK

This is a 150 ms spacing condition on the communication line. This signal is used for different purposes by different host computers. Pressing repeatedly will cause some systems to disconnect.

<CLEAR> + * clear screen

Local action only.

The Main Menu choices:

Pressing <break> or <clear> + - while in the terminal mode will enter the main menu and display the following:

```
              >>  Modem-80   version 3.0  <<

    <T> = Terminal mode
    <E> = Echo (to remote in terminal mode)
    <D> = Disk access in terminal or echo mode
    <L> = Change local communication parameters
    <C> = Accept DOS command - DIR, FREE, LIST  etc.
    <R> = Receive a file
    <S> = Send a file
    <X> = End program and return to DOS
  Options <R> and <S> require compatible programs
   (This program or derivatives of CP/M "MODEM")

    Enter Option: _
```

<T> Terminal mode - This is the default mode entered when the program is loaded. Unless changed using the <L> option, terminal mode selects full duplex operation (characters are only displayed after the remote computer echos them back) and no echo. This mode should be used with Forum-80's, MicroNet and other host computers.

<E> Echo mode - Selects half duplex operation (characters are displayed locally as they are transmitted) and echos received characters back to the remote, which may be a terminal or another TRS80 using the terminal mode. Only one computer may echo, and one must have its modem set for originate mode and the other must use the answer mode.

<L> Display menu of local parameters which may be changed as necessary.

<D> Disk menu - send/receive files in terminal or echo mode

<C> Accept a DOS command The buffer contents are written to the disk and the file is temporarily closed before the DOS command is started (this takes a few seconds). This makes it possible to list the file you are currently receiving or determine the remaining free space on the disk after the current buffer contents are saved. After the DOS command is completed, the file is re-opened and extended, and the previous terminal screen contents are restored, allowing operation to continue exactly as before the DOS command. Any program which executes in memory below X'8600', respects the high memory pointer set by the operating system, and does not alter the high memory pointer, may be run as a DOS command from MODEM80.

<R> and <S> Transmit a file using handshaking protocol to insure correct recption. This mode requires a compatible program at the remote end (this program or a derivative of the CP/M program "Modem"). Any type or length file may be transmitted, using checksums and automatic re-tries to make sure it is correct at the receiving end. Object code or compressed basic programs may be transmitted without conversion to ASCII. The end of the file may be padded with nulls to match up with the CP/M convention of 128 byte sectors but that will not normally affect program or text files (or most data files). It will wait about 2 minutes after the filename has been entered for the remote computer to establish contact, then will re-try up to 10 times per block if errors are encountered. When finished, the file is automatically closed and it will return to the previous terminal or echo mode with a "transmission completed" or "transmission aborted" message. At 600 baud or slower, the file is displayed as it is transmitted or received, with any non-printable characters converted to periods on the video. At higher speeds, only block numbers (in hex) are displayed to show the progress of the transmission. The translation tables are not used in this mode, and the only terminal mode parameter that affects this type of transmission is the baud rate setting. Text files and Microsoft Basic programs saved in ASCII may be interchanged with CP/M based computers running a version of "Modem" (The original version was written by Ward Christensen and is available on CP/M User Group disk 25). Any type of file may be transferred and stored on the CP/M computers disk, even though the format might not be usable under CP/M. For example, a machine language program file could be transferred to a CP/M computer and retrieved by another TRS80.

<X> End program and return to DOS. If a file has been open to receive text, any buffer contents will be written out and the file closed before exiting to DOS.

The Local Parameter Menu:

Entering "L" at the main menu will transfer control to the "Local" menu:

```
        Local option:      Setting:
        <1> = Baud Rate         300
        <2> = Duplex Setting    FULL
        <3> = Word Length       8 BITS
        <4> = Parity Setting    NONE
        <5> = Stop bits         1
        <6> = Echo Setting      OFF
        <7> = Add Line Feeds    OFF
        <8> = Nulls after CR    0
        <9> = Screen Scroll     ON
        <G> = Receive Graphics  OFF
        <P> = Print Line Feeds  OFF
        <W> = Wait for line prompt  OFF
        <Enter> to return to main menu

                           Setting to change? _
```

Where a parameter has only two possible settings, selecting that option will toggle to the opposite condition. If more than two choices are possible, further prompts are given. The changes may be made permanent by exiting to DOS from the main menu to DUMP a new copy of the program which will default to the new conditions. Use : DUMP MODEMXX/CMD (START=X'8D00',END=X'B7E7',TRA=X'B50A') (With Model III TRSDOS, the X' notation is not used.) Do not DUMP a copy after using the file transfer functions - MODEM80 should be re-loaded first. Use a different filename to identify the altered version.

Baud rate - may be set from 110 to 9600

Duplex - may be full or half - this affects only the terminal mode - the <E> echo mode choice from the main menu always forces half duplex operation. Half-duplex operation simply displays the characters as they are transmitted rather than expecting the remote to echo the transmission.

Word length - may be set from 5 to 8 bits. The normal program default is 8 bit words with no parity bit. Other common conventions are 7 bit words with an even or odd parity bit.

Parity - may be set to even, odd, or none. Even or odd parity is typically used with 7 bit words for a total word lenght of 8 bits. This program ignores parity on received characters but can be configured to match the conventions of the remote computer.

Stop bits - may be set to 1 or 2. One stop bit is required to signal the end of a character transmission. Additional stop bits provide a delay between characters. Two stop bits are required to communicate with a teletype at 110 baud; with faster equipment, one is generally sufficient.

Echo - may be ON or OFF. This setting only affects the terminal mode operation to allow the echo and duplex conditions to be set seperately if desired. Selecting <E> from the main menu always sets both echo <ON> and half duplex conditions, while the terminal mode <T> uses the conditions set up with the Local menu.

Add Line Feeds - may be ON or OFF. If turned ON, a line feed will be sent after each carriage return character, as required by some hardcopy terminal types. This would not normally be used when communicating with another computer. If MODEM80 is echoing, and add-line-feeds is ON, a line feed will also be added after each carriage return is echoed.

Nulls after carriage returns - may be any number up to 99. Nulls are used to provide a delay to allow a hardcopy terminal to perform its carriage return without missing the next character transmitted. Use the number recommended by the terminal manufacturer or experiment until a value is found which does not result in characters being lost - typically in the 0 - 9 range. At baud rates of 1200 and up, nulls will be necessary to allow the screen of a remote TRS-80 to scroll normally. For this to work without losing characters, each line transmitted must be shorter than the video width. Another approach is to turn the screen scoll off while receiving high speeds.

Screen Scroll - may be ON or OFF. At speeds up to 600 baud, the time required to scroll the screen should not result in lost characters even when transmitting files at full speed. Turning scrolling off will allow dependable operation at 1200-2400 baud (if no keys are pressed while receiving at full speed). The progress of the transmission may still be observed in this mode.

Receive Graphics characters - may be ON or OFF. This choice should only be set ON if the remote computer is using NO parity. The Forum-80's have a graphics - experimental mode that may be accessed with this feature. Generally, it should be left OFF since it may not be used when the remote is using parity.

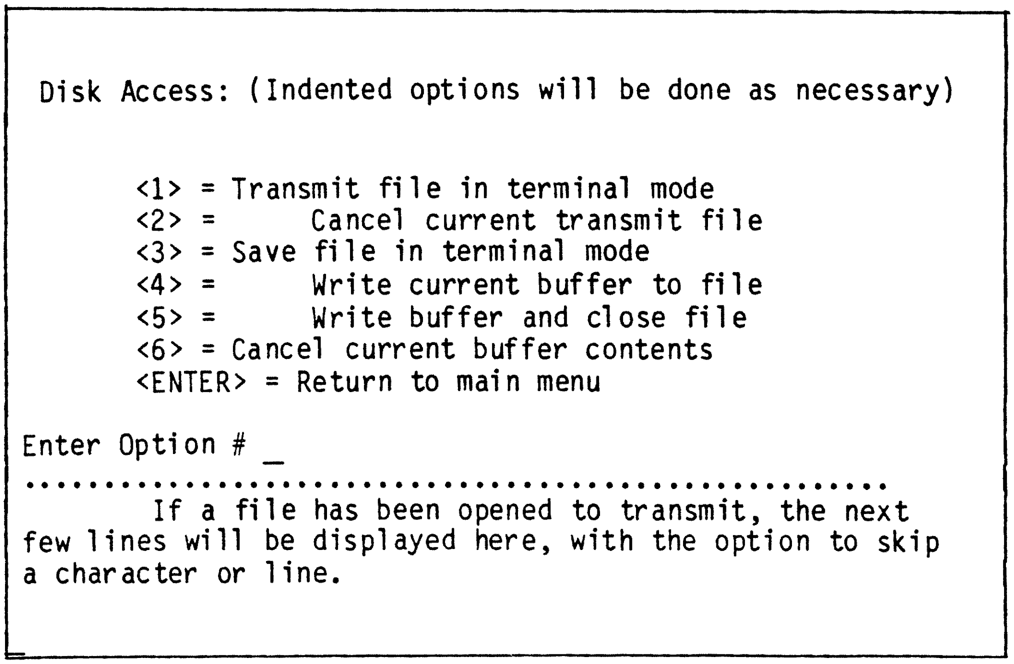
Print Line Feeds - may be ON or OFF. This is a local function for the printer output. If turned ON, a linefeed will be sent to the printer after each carriage return as required by some types of printers.

Wait for Line Prompts - may be ON or OFF. If this function is ON, each time a carriage return (ENTER) character is transmitted, transmission will stop until the prompt character is received. When used with a computer that is echoing the transmission, waiting for the default prompt character X'0D' will simply cause a pause in transmission until the remote has echoed back the carriage return, possibly helping to avoid overrunning the remote's buffering. This mode may also be used for true half-duplex operation, where only one end may transmit at a time, using the prompt character to indicate the line turn-around. The prompt character (and the character transmitted as a carriage return) may be changed if necessary. For use with some systems, it would be desirable to change the prompt character to X'11'. This would allow one line to be transmitted each time a CTL-Q is received from the remote.

Parity errors on received characters are ignored, but overrun errors are flagged by displaying a large graphic block on the video. Since the standard keyboard and video drivers are used, it is possible that a software keyboard debounce routine could cause an excessive delay and cause characters to be missed. This situation can be detected by the graphic blocks on the screen and would be corrected by not using the debounce routine or going to a lower baud rate. The printer output is done directly, to allow buffering while the printer executes a carriage return. If a non-standard printer is used, it may be necessary to save the text in a disk file and print off-line, when the necessary software may be used.

The Disk Menu:

Entering "D" at the main menu prompt will display the "Disk" menu:



```
 Disk Access: (Indented options will be done as necessary)


       <1> = Transmit file in terminal mode
       <2> =      Cancel current transmit file
       <3> = Save file in terminal mode
       <4> =      Write current buffer to file
       <5> =      Write buffer and close file
       <6> = Cancel current buffer contents
       <ENTER> = Return to main menu

Enter Option # _
.....................................................
        If a file has been opened to transmit, the next
few lines will be displayed here, with the option to skip
a character or line.
```

Transmit file - this is the same function selected by <clear> + 2 in the terminal mode - after the file is opened, control is returned to the previous terminal mode. Sending must then be initiated by pressing <clear> + 2 for non-stop transmission, pressing <clear> + 1 to send a single line, or MODEM80 may be modified to allow a control code from the remote to start the transmission. More than one transmit file may be loaded into memory before transmission begins by selecting the function from the disk menu. (only one may be loaded with the <CLEAR> + 2 function). Additional files may be loaded up to the point that one will not fit into memory. Selecting this function with a file currently open will cause the STATUS message to be displayed.

Cancel transmit file - skips remaining contents of a file opened for transmission and allows a new file to be opened. Control is returned to the previous terminal mode.

Save file in terminal mode - the same function as <clear> + 3 in the terminal mode. Control is returned to the terminal mode with the file save <OFF>. Saving may be turned on and off as often as desired by pressing <clear> + 3. A status message is displayed after each change. Selecting this function from the disk menu with a file currently open will cause the current buffer contents to be written and the file closed before opening a new file.

Write current buffer to disk - writes any text in the memory buffer to the disk file, closes the file, then reopens and extends the same file. Closing the file writes the current postion as the end-of-file in the disk directory and will allow the file contents up to that point to be read back even if the system crashes or is re-booted later. Using this function will not affect the ON or OFF status of saving to the file.

Write buffer and close file - writes any text in memory to the disk file and closes the file, turning the save to file function <OFF>. A new file may then be opened with the <clear> + 3 function. If the text is to be editted with PENCIL or SCRIPSIT, new files should be started often enough to insure that the text will fit in memory.

Cancel current buffer contents - deletes from memory any text that has been stored but not written into the file. This does not alter the current status of saving to the file and may be used to save disk space by eliminating unwanted text.

Transmit and receive files may both be opened before communications are started to save time. Each file is handled independently and both may be active at the same time.

If a transmit file has been opened before going to the disk menu, the next few lines to be transmitted will be displayed, with the option to skip a character or a line of the text. This feature allows re-starting transmission in the middle of a file after an interruption.

Remote control characters (Default values)

character received:	action:
X'0C' form-feed	home cursor and clear screen
X'11' ctl-Q XON	Will re-enable transmission after a ctl-S (X'13') has stopped output.
X'12' ctl-R	initiate receiving into a file which has been opened but is currently turned <off> locally. If a file has not been opened, the data will be saved into the memory and a prompt will be given to allow opening a file when disk access is necessary.
X'13' ctl-S XOFF	halt all transmission until a ctl-Q is received. An "XOFF received "message will be displayed at the top of the screen. Going to the main menu and back to the terminal mode will re-enable transmission if the XON character is not received.

character received:	action:
X'14' ctl-T	turn <off> receive to file function - file remains open and the save-to-file may be restarted locally with <clear> + 3 or by an X'12' character from the remote.
X'1B' escape followed by X'12'	turn printer <on>
X'1B' escape followed by X'14'	turn printer <off>

Character translation tables:

Four character translation tables are located as follows:

communication output -	X'8D00 - 8DFF
video	X'8E00 - 8EFF
disk file	X'8F00 - 8FFF
printer	X'9000 - 90FF

Each table consists of 256 characters where the untranslated character is indicated by the low byte of the table address and the translated value is the character stored at that location. The full screen memory display of DEBUG makes alterations easy. Type in :

```
DEBUG     <enter>      (with model III TRSDOS, debug must be
MODEM80   <enter>       called as a DOS command from MODEM80)
D8E00     <enter>   (to see the video table)
S                   (for the full screen display)
A                   (to see the ASCII characters)
H                   (to see the hex values)
```

Any received character may be displayed as any other character by changing the appropriate table entry using the DEBUG M (modify memory) command.

For example, to display every "A" character as a "B", type:

```
M8E41  <space> (note that <enter> terminates the M command)
                DEBUG will display the original entry (41)
42   <enter>   (the hex value for a "B" - use <space> rather
             than <enter> if multiple changes are being made)
When finished with the changes, return to DOS with:
G402D      (and type DEBUG (off)  or just re-boot)

(With model III TRSDOS, use G <enter> to return to MODEM80
 and exit to DOS with the <X> option.)
```

Save the altered version with the DOS command:

```
    DUMP MODEMXX/CMD (START=X'8D00',END=X'B7E7',TRA=X'B50A')
(Model III TRSDOS does not use the X' notation.)
```

If more than one version is required, be sure to give each program a distinctive name.

Having seperate translations for each device allows sending different control codes to the video and printer while filtering out control characters going to the disk file. To prevent any character from being output to a device, replace it with a NULL (X'00') in the translation table. The null character will not be written to any device.

The remote control codes may also be altered with DEBUG.

memory location:	normal value:	function:
X'9100'	X'12'	file save <ON>
X'9101'	X'14'	file save <OFF>
X'9102'	X'00'	transmit file <ON>
X'9103'	X'00'	transmit file <OFF>
X'9104'	X'00'	start printer
X'9105'	X'00'	stop printer
X'9106'	X'00'	write file
X'9107'	X'1B'	check next character
X'910B'	X'11'	send to start remote
X'910C'	X'13'	send to stop remote

If MODEM-80 is echoing, the control characters in the above locations and up to X'910D' will not be echoed. Additional characters which are control codes to the remote computer may be placed in locations X'9108'-X'910A'.

X'910D'	X'11'	re-enable transmission
X'910E'	X'0D'	line prompt character (if using)
X'910F'	X'13'	disable transmission

The following codes are checked only after receiving the character stored at X'9107', normally X'1B' or <escape>

X'9110'	X'12'	printer output <on>
X'9111'	X'14'	printer output <off>

The transmit file <OFF> and disable transmission are handled as separate functions. The default condition does not allow the remote computer to initiate sending a file. If this function is desired, simply place the control characters to start and stop the transmission in the corresponding memory locations. An XON (X'11') may be used to start, and XOFF (X'13') to stop if it is not likely that the remote would send the XOFF/XON sequence before file transmission would be desired. Setting the transmit file <OFF> character to a different value than that used for disable transmission would allow the remote computer to stop transmission from the file without also disabling the keyboard. Likewise, file transmit <ON> could be set to a different character than that used for re-enabling transmission.

Going to the main menu and back to the terminal mode will re-enable transmission to allow continuing if an XOFF is received accidentally from telephone line noise (or is echoed back by a computer that doesn't know any better), but the file transmission must be restarted manually if it is controlled by the same character.

Placing a non-zero value at X'9106' will allow the remote computer to force MODEM80 to write its receive buffer to the disk and close the file. It will then reopen and extend the same file, and can continue receiving, but the file close will allow the contents of the file to be read back up to that point even if the system is rebooted later. This would allow more dependable transfers with MODEM80 left unattended. The suggested character for this function would be X'04', a ctl-D or EOT.

The extra functions should be be enabled only as necessary, since accidently picking up these characters from phone line noise or computers using some other protocol could cause some confusion.

It is possible to simultaneously transmit different files in each direction, but for this to work, both ends must be in terminal mode, full duplex, and echo <off>. The display will show only what is being received, not what is transmitted. It would be a good idea to type a few messages back and forth to be certain that the connection is working -be sure to wait for an answer, since you won't see what you type. The transmit and receive files should be be opened before the connection is made, then when ready, turn the receive to file <on>, then the transmit file <on>.

MODEM80 tests incoming characters for the re-enable character before the disable character. Putting the same value in both locations will prevent the disable transmission function from occurring, which might be desirable if operating in the line-prompted mode. Either the re-enable character or the line-prompt character will serve as a prompt for the next line. (IBM uses an XOFF for both functions for some terminal types.)

All characters transmitted from the keyboard or disk file are converted to the corresponding values in the output translation table, including linefeeds and nulls, if they are being added. The control characters used to stop and restart the remote are transmitted as the actual values stored in the respective positions (X'910B', X'910C') without further translation. These characters are transmitted as necessary for disk accesses, regardless of whether a disable transmission code has been received.

Incoming characters are compared against the actual values in the control code positions, then converted to the character stored in the corresponding position in the translation tables for the display, disk file, and printer. Echoed characters are not translated.

Additional translations:

Keyboard - The keyboard driver defined by the operating system is used, allowing the use of programmable key utilities and the LDOS type-ahead feature. The normal control character set generated by pressing <shift><down-arrow><character> is available with the exception of Ctl-B, which is translated in the default output table to the more commonly used Ctl-A. The real Ctl-A character is recognized internally by the TRS-80 as a <break> and will cause MODEM80 to display the main menu (under some operating systems).

In addition, <clear> + 8 is converted to right-square bracket and <clear> + 9 is the left square bracket as required by MicroNet to surround user ID numbers when accessing files other than your own.

<clear> + 7 is converted to the backslash character used in some systems to separate program statements. To send the <clear> character, the <shift> key must also be pressed.

If additional characters are needed which cannot be generated from the TRS-80 keyboard, the output translation table may be altered to convert some uneeded control characters to the desired values. For use with host computers other than MicroNet or TRS-80's it may be desirable to convert the "backspace" character (X'08') to a "rubout" or X'7F'.

Video - The X'OC' (form feed) character (after translation) is converted to a cursor-home, clear-screen sequence. If you prefer not to allow the remote computer to clear your screen, do not include the OC character in the video translation table.

Printer - Some printers cannot handle multiple carriage returns with no intervening characters, so subsequent carriage returns are converted to line feeds before output.

The handshaking file transfer mode may also be established by placing the command character R or S followed by a filename on the command line when loading Modem-80. example: MODEM80 S file or MODEM80 R file

When this method is used, only the block numbers are displayed (using the ROM video driver) and the program exits to DOS level when finished or if the transfer is aborted. This feature allows MODEM80 to be used for file transfers with an unattended computer running a HOST program. (With MODEM80 also available on its disk). Contact should be established with the HOST using the terminal mode of MODEM80 At the HOST's command level, enter: MODEM80 S filespec (to have the host send a file) Wait for the "Ready to send" message from the HOST, then go the the main menu, enter R and give a filespec to receive. When the transfer is completed, the unattended computer will return to the HOST command level, the attended computer will return to the terminal mode.

The "standard" output translation table:
Ctl-B is changed to the more commonly used Ctl-A, since the real Ctl-A character is used internally as "break". Otherwise, no translations are made.

```
8D00 =>  00 01 01 03 04 05 06 07  08 09 0A 0B 0C 0D 0E 0F
8D10 =>  10 11 12 13 14 15 16 17  18 19 1A 1B 1C 1D 1E 1F
8D20 =>  20 21 22 23 24 25 26 27  28 29 2A 2B 2C 2D 2E 2F
8D30 =>  30 31 32 33 34 35 36 37  38 39 3A 3B 3C 3D 3E 3F
8D40 =>  40 41 42 43 44 45 46 47  48 49 4A 4B 4C 4D 4E 4F
8D50 =>  50 51 52 53 54 55 56 57  58 59 5A 5B 5C 5D 5E 5F
8D60 =>  60 61 62 63 64 65 66 67  68 69 6A 6B 6C 6D 6E 6F
8D70 =>  70 71 72 73 74 75 76 77  78 79 7A 7B 7C 7D 7E 7F
8D80 =>  80 81 82 83 84 85 86 87  88 89 8A 8B 8C 8D 8E 8F
8D90 =>  90 91 92 93 94 95 96 97  98 99 9A 9B 9C 9D 9E 9F
8DA0 =>  A0 A1 A2 A3 A4 A5 A6 A7  A8 A9 AA AB AC AD AE AF
8DB0 =>  B0 B1 B2 B3 B4 B5 B6 B7  B8 B9 BA BB BC BD BE BF
8DC0 =>  C0 C1 C2 C3 C4 C5 C6 C7  C8 C9 CA CB CC CD CE CF
8DD0 =>  D0 D1 D2 D3 D4 D5 D6 D7  D8 D9 DA DB DC DD DE DF
8DE0 =>  E0 E1 E2 E3 E4 E5 E6 E7  E8 E9 EA EB EC ED EE EF
8DF0 =>  F0 F1 F2 F3 F4 F5 F6 F7  F8 F9 FA FB FC FD FE FF
```

Video translation table:
Note that this setup will remove linefeeds (0A) from the display to prevent double spacing on the screen, and (17) is removed to prevent the remote or phone line noise from putting the video in the 32 character mode.

```
8E00 =>  00 00 00 00 00 00 00 00  08 00 00 0B 0C 0D 0E 0F
8E10 =>  00 00 00 00 00 00 00 00  18 19 1A 1B 1C 1D 1E 1F
8E20 =>  20 21 22 23 24 25 26 27  28 29 2A 2B 2C 2D 2E 2F
8E30 =>  30 31 32 33 34 35 36 37  38 39 3A 3B 3C 3D 3E 3F
8E40 =>  40 41 42 43 44 45 46 47  48 49 4A 4B 4C 4D 4E 4F
8E50 =>  50 51 52 53 54 55 56 57  58 59 5A 5B 5C 5D 5E 5F
8E60 =>  60 61 62 63 64 65 66 67  68 69 6A 6B 6C 6D 6E 6F
8E70 =>  70 71 72 73 74 75 76 77  78 79 7A 7B 7C 7D 7E 7F
8E80 =>  80 81 82 83 84 85 86 87  88 89 8A 8B 8C 8D 8E 8F
8E90 =>  90 91 92 93 94 95 96 97  98 99 9A 9B 9C 9D 9E 9F
8EA0 =>  A0 A1 A2 A3 A4 A5 A6 A7  A8 A9 AA AB AC AD AE AF
8EB0 =>  B0 B1 B2 B3 B4 B5 B6 B7  B8 B9 BA BB BC BD BE BF
8EC0 =>  C0 C1 C2 C3 C4 C5 C6 C7  C8 C9 CA CB CC CD CE CF
8ED0 =>  D0 D1 D2 D3 D4 D5 D6 D7  D8 D9 DA DB DC DD DE DF
8EE0 =>  E0 E1 E2 E3 E4 E5 E6 E7  E8 E9 EA EB EC ED EE EF
8EF0 =>  F0 F1 F2 F3 F4 F5 F6 F7  F8 F9 FA FB FC FD FE FF
```

Disk translation table:
Most control characters are removed to keep cursor control characters out of files for better compatibility with word processors. Backspace (08) and tab (09) are left in because processing a file with TEXTFIX/CMD will allow these characters to produce their intended function. 1A is left in because it is used as an End Of File marker for Edtasm files.

```
8F00 =>  00 00 00 00 00 00 00 00  08 09 00 0B 0C 0D 00 00
8F10 =>  00 00 00 00 00 00 00 00  00 00 1A 00 00 00 00 00
8F20 =>  20 21 22 23 24 25 26 27  28 29 2A 2B 2C 2D 2E 2F
8F30 =>  30 31 32 33 34 35 36 37  38 39 3A 3B 3C 3D 3E 3F
8F40 =>  40 41 42 43 44 45 46 47  48 49 4A 4B 4C 4D 4E 4F
8F50 =>  50 51 52 53 54 55 56 57  58 59 5A 5B 5C 5D 5E 5F
8F60 =>  60 61 62 63 64 65 66 67  68 69 6A 6B 6C 6D 6E 6F
8F70 =>  70 71 72 73 74 75 76 77  78 79 7A 7B 7C 7D 7E 7F
8F80 =>  80 81 82 83 84 85 86 87  88 89 8A 8B 8C 8D 8E 8F
8F90 =>  90 91 92 93 94 95 96 97  98 99 9A 9B 9C 9D 9E 9F
8FA0 =>  A0 A1 A2 A3 A4 A5 A6 A7  A8 A9 AA AB AC AD AE AF
8FB0 =>  B0 B1 B2 B3 B4 B5 B6 B7  B8 B9 BA BB BC BD BE BF
8FC0 =>  C0 C1 C2 C3 C4 C5 C6 C7  C8 C9 CA CB CC CD CE CF
8FD0 =>  D0 D1 D2 D3 D4 D5 D6 D7  D8 D9 DA DB DC DD DE DF
8FE0 =>  E0 E1 E2 E3 E4 E5 E6 E7  E8 E9 EA EB EC ED EE EF
8FF0 =>  F0 F1 F2 F3 F4 F5 F6 F7  F8 F9 FA FB FC FD FE FF
```

Printer translation table:
Only linefeeds are removed here, this may require customization for each printer type.

```
9000 =>  00 01 02 03 04 05 06 07  08 09 00 0B 0C 0D 0E 0F
9010 =>  10 11 12 13 14 15 16 17  18 19 1A 1B 1C 1D 1E 1F
9020 =>  20 21 22 23 24 25 26 27  28 29 2A 2B 2C 2D 2E 2F
9030 =>  30 31 32 33 34 35 36 37  38 39 3A 3B 3C 3D 3E 3F
9040 =>  40 41 42 43 44 45 46 47  48 49 4A 4B 4C 4D 4E 4F
9050 =>  50 51 52 53 54 55 56 57  58 59 5A 5B 5C 5D 5E 5F
9060 =>  60 61 62 63 64 65 66 67  68 69 6A 6B 6C 6D 6E 6F
9070 =>  70 71 72 73 74 75 76 77  78 79 7A 7B 7C 7D 7E 7F
9080 =>  80 81 82 83 84 85 86 87  88 89 8A 8B 8C 8D 8E 8F
9090 =>  90 91 92 93 94 95 96 97  98 99 9A 9B 9C 9D 9E 9F
90A0 =>  A0 A1 A2 A3 A4 A5 A6 A7  A8 A9 AA AB AC AD AE AF
90B0 =>  B0 B1 B2 B3 B4 B5 B6 B7  B8 B9 BA BB BC BD BE BF
90C0 =>  C0 C1 C2 C3 C4 C5 C6 C7  C8 C9 CA CB CC CD CE CF
90D0 =>  D0 D1 D2 D3 D4 D5 D6 D7  D8 D9 DA DB DC DD DE DF
90E0 =>  E0 E1 E2 E3 E4 E5 E6 E7  E8 E9 EA EB EC ED EE EF
90F0 =>  F0 F1 F2 F3 F4 F5 F6 F7  F8 F9 FA FB FC FD FE FF
```

Program control character table:

```
9100 =>  12 14 00 00 00 00 00 1B  00 00 00 11 13 11 0D 13
9110 =>  12 14 00 00 00 00 00 00  00 00 00 00 00 00 00 00
9120 =>  55 6D
```

The character at 9120 is the baud rate code sent to the UART during initialization, and should be changed by using the baud rate setting at the Local Parameter menu. The value at 9121 is output to the UART control register, and will normally be set according to the options selected at the Local menu. It may be necessary to alter bits 0 and 1 of this value to set the DTR and RTS lines on the RS232 to match the requirements of different modems.

HOST1/CMD - HOST PROGRAM FOR MOD I OR III ANY DOS

Incoming ctl-C characters are converted to <BREAK> X'01' for use with terminal programs that do not generate the X'01' or ctl-A that is used by the TRS-80 for the BREAK character - This is not the same as a communication break signal which may be sent by the key marked <break> on some terminals. That is a spacing condition on the communication line that the TRS-80 will ignore.

Displayed line feeds or carriage returns may be converted to carriage return, line feed combinations, as required by hard copy terminals. Most TRS-80 terminal programs will ignore the additional line feed. To obtain this additional translation, specify L (with or without parentheses) on the command line when loading HOST1/CMD examples:

```
HOST1 (L)
HOST1 L
HOST1 LINEFEEDS (doesn't matter what is after the L)
```

Remember that sending the linefeed character takes addition time, so it will be necessary to take some precautions when sending to HOST1 at full speed using the terminal mode file transfer of MODEM80 to send text to SAVE/CMD. MODEM80 should add 2 nulls after each carriage return to allow sufficient time for HOST1 to echo the carriage return, send the line feed, and scroll the screen. At typing speeds, the linefeed will generally not cause any problems, and it will not affect the use of the XMODEM file transfer. When another TRS-80 will be used as the terminal to HOST1, the linefeed parameter is not needed. Since many TRS-80 programs use the linefeed character to seperate lines on the display, and most terminal programs ignore the linefeed character, the default condition of HOST1/CMD is to translate linefeeds displayed on the video to carriage return characters (which are handled identically on the TRS video) before sending out the RS232. If this translation is undesirable, specify N on the command line when loading HOST1.

```
Examples: HOST1 (N)
          HOST1 N
```

HOST1 will respond to a CTL-S character by pausing output until some other character is received. However, it will not recognize the CTL-S unless the program that is running is checking the keyboard for input. The TYPE/CMD program checks after each character, and may be preferable to the DOS command "LIST" to list a text file to a remote terminal.

Many TRS-80 programs access the keyboard directly, rather than through the operating system. Loading one of these programs will cause the remote terminal to lose control, so some expermentation may be necessary before leaving the computer unattended.

The RS232 link will be active only when a carrier signal is detected by the modem. Otherwise the computer will operate at full speed.

If a lowercase driver (Model I) is being used it must be loaded before HOST.

Programs which access the keyboard or video memory directly (word processors, Basic PEEKS or POKES) may mot be run from a remote terminal.

The following applies only to LDOS:
LDOS SYSTEM(TYPE) may be loaded before HOST to give type-ahead at the keyboard only or after host to give type-ahead at the remote also !! (5.0.2 or later only) The XMODEM file transfer utility will not work if TYPE is active for the remote.

SPOOL *DO may be used after loading HOST1. The display output will procede at the same speed as the RS232 link but the computer will operate at full speed. This may be useful to speed up program applications being run from a remote location, but could be confusing for general operation. For example, when listing a file, there will be several minutes of output in the SPOOL buffer. Trying to abort with <break> may stop the computer, but the remaining contents of the buffer will continue to be sent out.

HOST may not be SYSGENed or loaded from a DO file.

XMODEM/CMD

XMODEM performs file transfers with MODEM80, CP/M MODEM or another computer running XMODEM. Use the command character R or S followed by a filename on the command line when loading XMODEM.

example: XMODEM S file or XMODEM R file

If only S or R is on the command line, a prompt will be given for the filename.

Only the block numbers are displayed (using the ROM video driver) and the program exits to DOS level when finished or if the transfer is aborted. This feature allows XMODEM to be used for file transfers with an unattended computer running a HOST program. (With XMODEM available on its disk). Contact should be establised with the HOST using the terminal mode of MODEM80. At the HOST's command level, enter: XMODEM S filespec (to have the host send a file) Wait for the "Ready to send" message from the HOST, then go the the main menu, enter R and give a filespec to receive. When the transfer is completed, the unattended computer will return to the HOST command level, the attended computer will return to the terminal mode of MODEM80.

TYPE/CMD

TYPE lists a file on the display or printer and may be used under HOST1 to send a file to a remote computer or terminal.

The Save to File <ON> code for MODEM80 is first sent to the display (and the remote if using HOST1), then the contents of the file, followed by the Save to File <OFF> code.

Pressing any key (or sending any character from the remote) will cause TYPE to pause until another key is pressed or character received. <Break> will cause TYPE to abort. A Ctl-S from the keyboard or remote will cause TYPE to wait and ignore any other input until Ctl-Q is received to continue.

The file to be listed is entered on the command line, or a prompt will be given after TYPE is loaded.

Specifing the parameter P after the filename will cause the file contents to be printed also.

Examples:

```
    TYPE PROG/TXT         ; lists file to display
                          ; and remote (if using HOST1)
    TYPE PROG/TXT (P)     ; list to display and printer
    TYPE PROG/TXT PRINT   ; also prints - the P may be in
                          ; parentheses or not
```

The file control characters are not sent to the printer.

SAVE/CMD

SAVE will allow text to be typed to a disk file. Only normal text characters may be entered.

The filespec may be given on the command line or a prompt will be displayed after the program is loaded. The backspace character will backspace and delete the previous character. Shift-backspace will delete the current line. There is no limit to line length, and shift-backspace (or ctl-X) will delete everything back to the last carriage return or linefeed character entered. Only the current line may be editted. Text may be entered from the keyboard or a HOST program may be used to allow entry from a remote terminal. The file size is limited to the available computer memory. When <break> or <ctl-C> is typed, the buffer will be written to the disk file and the program terminated. (Some operating systems will not recognize "break", so ctl-C must be used.)

HEX/CMD

The HEX/CMD utility has three functions:

1 Convert a binary file to ASCII hex
2 Convert ASCII hex to binary
3 Checksum a file

The <S> and <R> file transfer mode of MODEM80 will transfer any type of file with no conversions, and is the recommended method when a compatible program is available for the remote computer.

Data and programs are stored in the TRS-80 as 8-bit binary values. Machine language programs, binary data files and basic programs saved without the ,A extension will contain all possible combinations of 8-bit values. Many computers use the high order bit of the character as a parity bit for error checking, ingore nulls (00 characters) and use certain characters to control transmission functions.

Transferring data with these computers (and the <T> or <E> modes of MODEM80) requires the character set to be limited to certain combinations of 7-bit values, generally called the ASCII characters. Files saved with basic's SAVE "PROGRAM",A , or SCRIPSIT'S® SAVE,A FILENAME will meet these requirements.

Machine language programs and binary data files require conversion into the ASCII character set before transmission in the terminal mode - The HEX/CMD program will perform this conversion by changing each binary character in the file into two ASCII characters representing the hex value of each actual byte. Carriage returns are placed in the file every 60 characters. This file may then be transmitted in the terminal mode. For example, a machine language program could be converted to hex, uploaded to a MicroNET file, downloaded by another TRS80 and re-converted to binary.

The checksum feature allows a quick method of checking that the file has been transferred successfully. If the checksum of the received file is the same as the file that was transmitted, it is very likely that no errors occurred during the transfer.

TEXTFIX/CMD

This program is designed to convert CP/M type text files to TRS-80 type, expanding the tabs to column positions with spaces and removing line feeds before or after carriage returns. It may also be used to convert lowercase text to uppercase and remove control characters to make files compatible with PENCIL® or SCRIPSIT.

The input file may be any TRSDOS type file (transferred via MODEM etc.) The output file may be larger due to the tab expansion. Normally, the prompts given should be answered "Y" (upper/lower case as desired).

It can also delete backspace characters (and the previous characte) if desired -these might be in text files saved when typing on-line using a terminal program that saves each character in its receiving file, and may cause trouble when loaded into a text editor.

The output file will be terminated by an X'00 character as required by unmodified versions of PENCIL, and VISICALC®.

RS232 DESCRIPTION

The Recommended Standard 232-C (the C means the third revision) describes the cable standards for connecting Data Terminal Equipment (the TRS-80) to Data Communicatons Equipment (a modem). It does not specifically cover connecting two pieces of Data Terminal equipment together (TRS-80 to TRS-80 or TRS-80 to a terminal or printer. This connection can be accomplished, however, by switching the appropriate lines in the connecting cable.

The Electrical Signal Characteristics:

Signal Voltage	Condition
+25v to + 3v	"spacing" state
+ 3v to - 3v	transition levels
- 3v to -25v	"marking" state

The Radio Shack RS232 interface provides the following signals:

Pin #	Abbrev.	EIA designation	Description
1	PGND	AA	Frame ground
2	TD	BA	Transmit Data
3	RD	BB	Receive Data
4	RTS	CA	Request-to-Send
5	CTS	CB	Clear-to-Send
6	DSR	CC	Data Set Ready
7	SGND	AB	Signal Ground
8	CD	CF	Carrier Detect
20	DTR	CD	Data Terminal Ready
22	RI	CE	Ring Indicator

Notes: In the Model I, the large switch on the interface board may be used to interchange the signals on pins 2 and 3. At least some of the Radio Shack RS232 manuals have the bit positions controlling DTR and RTS reversed in the chart on page 17. RTS is controlled by bit 0, DTR by bit 1 output to port 0EAH.

Signal descriptions

Group A - Grounds

Protective Ground: Pin 1 should be connected to the equipment frame. If the connected equipment may be plugged into different circuts where the ground potential might be at a different level, this wire should be connected at one end only.

Signal Ground: Pin 7 - Reference ground for all the other signals and must be connected at both ends of the cable.

Group B - Data Signals

For the data circuts, the following apply:

Signal condition		Binary state
Marking	=	1
Spacing	=	0

Transmit Data - Pin 2: Direction: computer to modem
Signals on this circut are generated by the data terminal (TRS-80) for transmission to the remote equipment.

Receive Data - Pin 3: Direction: modem to computer
Signals on this line are received from the remote equipment.

Group C - the control signals

For the control signals, the following apply:

Signal condition		Function
Mark	=	OFF, false
Space	=	ON, true

Note that this is the reverse of the conditions for the data signals. In the TRS-80, the ON condition of a line from the modem is sensed by reading a 0 in the corresponding bit of the port, a control line from the TRS-80 is set ON by writing a 0 to the bit position indicated in the manual.

Request to Send - Pin 4: Direction: computer to modem
This signal indicates that the computer wishes to send some data. With half duplex equipment, it will initiate the switch to the transmit mode.

Clear to Send - Pin 5 Direction: modem to computer
Indicates that the modem is ready to transmit data.

RTS and DTR are primarily used to control the direction of data transfer with half duplex equipment. Full duplex modems normally tie RTS to the CTS line since they are always ready to transmit.

Data Set Ready - Pin 6 Direction: modem to computer
This signal indicates that the modem is powered on and functional. For an auto-answer modem, it indicates that the phone line is connected.

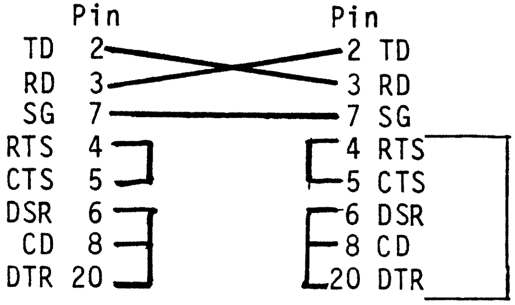
Data Terminal Ready - Pin 20 Direction: computer to modem
This signal indicates that the data terminal (TRS-80) is powered on and ready to communicate. A modem equiped for auto answer will pick up the phone only when DTR is on.

Ring indicator - Pin 22 Direction: modem to computer
"ON" indicates the phone is ringing and it will be off between ringing cycles.

Carrier Detect - Pin 8 Direction: modem to computer
When "ON", this signal indicates that the modem is receiving a carrier tone from the remote equipment.

Circuts to connect TRS-80 to other data terminal equipment (terminal, printer or another TRS-80)

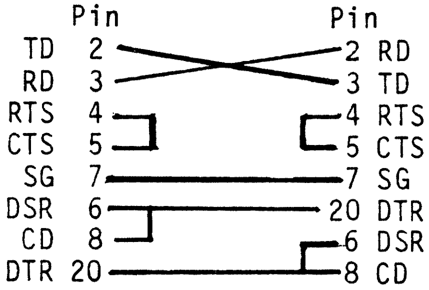
Simple 3-wire connection:



May not be necessary

Note: Pins 2 and 3 may be switched in the above manner by changing the position of the large switch on the interface board to the COMM position. (Mod I only)

5 wire connection - recommended where it is important to detect a loss of connection (by software)



Each terminal's DTR line provides DSR and CD to the other.

To connect the TRS-80 to a modem, none of the lines need to be changed, and the switch on the Model I's interface board should be set to TERM.

GLOSSARY OF DATA COMMUNICATIONS TERMS

ASCII American Standard Code for Information Interchange. This is the code established as an American standard by the American Standards Association, and defines the character set used by most manufacturers other than IBM.

Asynchronous Serial Transmission A method of data transfer that uses framing characters to surround each character. The transmitter and receiver are syncronized only for one character at a time and the time between characters is not critical.

Baud A unit of transmission speed. One baud corresponds to a rate of one signal element per second. 300 baud is thus 300 bits per second. If transmitting one character requires a total of 10 bits, a rate of 300 baud will correspond to a maximum of 30 characters per second.

Bit A single unit of information. A contraction of "binary digit", and the smallest unit of information in a binary system. It is the choice between two possible states, usually designated one and zero.

Bit Rate The speed at which bits are transmitted, expressed as bits per second.

Buffer Data storage used to compensate for a difference in transmission rates or timing of events when transferring data from one device to another.

Carriage Return In a character-by-character printing mechanism, the operation that causes the next character to be printed at the left margin. In the TRS-80 and some printers, a carriage return character (X'OD') will also cause the next character to be printed on the next line.

Character The actual or coded representation of a digit, letter, or symbol.

Code A system of symbols and rules for representing information.

Code Conversion The conversion of data from one code to another.

Data Any representations such as characters, binary signals or analog quantities to which meaning might be assigned.

Data Communication The movement of encoded information through electrical transmission systems.

Data Set A device that converts the signals of a computer or terminal to signals that are suitable for transmission over communication lines and the reverse. Typically, a modem.

Demodulation The process of seperating an original signal from a modulated carrier frequency.

Duplex A communication channel allowing simultaneous and independent transmission in both directions. Often refered to as Full Duplex.

Half-Duplex An alternate one-way-at-a-time transmission.

Hard Copy Printed output.

Modem Contraction for modulator-demodulator. A device that modulates signals into a carrier frequency suitable for transmission over communication facilities, and retrieves the signals by demodulation.

Modulation A process of altering some characteristic of a high frequency carrier signal in accordance with the content of a lower frequency information signal.

Parallel Transmission A method of data transfer where all the bits of a character are transmitted simultaneously.

Parity Using the most-significant bit of a character to dermine the accurracy of transmission. For even parity, this bit is set to make the total of the one bits of a character add up to an even number. By convention, asyncronous communication uses even parity, synchronous uses odd parity, but this is not always observed. Over phone lines, parity bits are not a dependable method to verify accurracy, since a noise burst is typically longer than one bit interval.

RS232C A standard cable definition to connect data terminal equipment to data set equipment, typically terminal to modem.

Serial Transmission A method of data transfer in which the bits of a character are sent sequentially.

Simplex Channel A communication channel that permits transmission in one direction only.

Start Bit A framing bit used in asynchronous transmission to indicate the beginning of a character.

Stop Bit A framing bit used in asynchronous transmission to indicate the end of a character transmission and allow the receiver to find the next start bit. Mechanical equipment may require two stop bits to allow time to handle the character; electronic equipment usually only requires one stop bit.

Synchronous Serial Transmission A method of transmission that sends a serial bit-stream with no start-stop bits. A block of data is transmitted along with a clock signal to syncronize the transmitter and receiver. This method requires more expensive equipment than asynchronous transmission and is generally not used with microcomputers.

Terminal An input/output device that can send or receive data.

Word Length The number of bits used to transmit one character. A parity bit may be added to this length if parity is being used, but framing bits (stop and start bits) are not counted.

Saving to disk file

MODEM80 attempts to be very careful with received data and responds to disk errors by asking if you want to save the buffer contents to a new file. If the current disk is full, you must have another formatted disk ready to start the new file. While it is possible to run FORMAT as a DOS command from MODEM80, the buffer contents must be written out first, which can only be done on a disk which has been previously formatted. If the Receive to File <ON> code is received, MODEM80 will begin saving the incoming data even if a file has not been opened. Then when a disk write is necesary, you will be prompted for a filename.

Multiple operations

In the terminal mode, MODEM80 may have files open for both receiving and transmission, and a DOS command may be executed while maintaining positions in both files. However, the <S> and <R> file transfers share buffer space with the terminal mode transmit file. If <S> or <R> is selected from the main menu while a file is open or loaded for transmission in the terminal mode, the terminal mode transmission will be canceled. A receive file may remain active, but it will not receive any data until control is returned to the terminal mode.

Input buffer overflow

In the terminal or echo modes, MODEM80 maintains a 256 character input buffer to allow for differences in input and output speeds and to give the remote time to stop when MODEM80 sends an XOFF before disk access. Under certain conditions, this buffer may overflow and lose data. The message "Input buffer overflow!" will be displayed. Normally, this will only occur when (1) the remote computer does not respond to the XOFF and keeps transmitting, or (2) when MODEM80 is echoing, the remote computer sends an XOFF (stopping the echos) and then sends more than 256 characters before sending an XON. In the second case, it may be possible to make the transmission by running the remote in half-duplex instead of setting MODEM80 to echo.

Not enough memory

MODEM80 will run in a 32K computer but requires memory to be free (not used for drivers etc.) up to X'BFOA. If MODEM80 aborts with the message "Not enough memory available!", too much high memory has been claimed by drivers or utility programs. In a 48K system, there is plenty of room for programmable key utilities, the LDOS type-ahead, and other programs which consume high memory. They must, however, protect themselves by setting the DOS high memory pointer (X'4049' in the model I, X'4411' in the III).

Originate vs Answer

Full duplex modems manage to simultaneously send and receive over the same telephone line by using a different frequency at each end. Auto-answer modems will always use the "answer" frequency when they respond to a call, thus the person originating the call must have his modem set to "originate". With acoustic modems, the choice of who uses each setting is arbitrary, but they must be set oppositely. Two "originate only" modems cannot communicate with each other. A modem set to "answer" will generate its carrier tone as soon as it is on-line; when set to "originate", it may produce the carrier frequency only after receiving the "answer" tone.

"MODEM" protocol transfers

The file transfers initiated by the <R> and <S> selections from MODEM80 or via XMODEM may have some limitations when used with data files. TRSDOS and compatible DOSes have the ability to write files which do not end exactly on a sector boundary, and maintain the end-of-file information in the disk directory. For compatibility with the CP/M versions of "Modem", this type of file transfer must send blocks of 128 characters, and if the end-of-file is encountered, it will add NULL (X'00') characters to fill out the 128 byte block. This technique allows TRS80 files to be stored on a CP/M computers disks, to be retreived by another TRS80, and some types of files (text or Microsoft Basic, saved in ASCII) may be useable with both systems. The terminating NULLs will not cause any problems with program files (object code or Basic), and will normally not affect data files which are read sequentially. However, such files should not be APPENDed after transmission, since NULLs in the middle of a text or data file may be interpreted as a terminating character or incorrect data. Random access files will also be unaffected if they use the normal 256 byte logical record length (which will be an exact multiple of the 128 byte blocks), or if the program accessing the file maintains the number of records in a descriptor file. There may be problem with data files where the logical record length is less than 256 and the program relies on the DOS directory information to determine the number of records in the file. This programming technique is not widely used, because there are some incompatibilities among the popular DOSes; however, this may not always be true. If this type of file must be transmitted, it will be necessary to use the HEX/CMD utility to convert the file to ASCII hex characters before transmission. Then, the conversion back to binary will eliminate the NULLs and establish the correct file length in the disk directory. Processing a file with TEXTFIX/CMD will remove NULL characters, but in a binary data file, X'00' characters may be valid data.

If it doesn't work:

While communications via the RS232c is the most standardized means of data transfer between computers, there are many different standards. It is therefore necessary to be certain that both ends are using the same baud rate, word length and parity conventions. Also, the modems must be compatible types, with one set to "originate", and one to "answer". If these conditions are met and the high pitched carrier tone from the remote can be heard clearly on the phone, then suspect local hardware problems. If your modem has a "half-duplex" or "test" switch setting which will echo characters back to the computer, use it with MODEM80 in its terminal mode. If characters appear on the screen as they are typed, the signals are getting as far as the modem, and the problem is most likely incorrect communication parameter settings or incompatible modems. If the characters do not appear, then the problem lies in the modem, RS232 interface or cable. On the model I, the large switch must be set to the "term" position for connection to a modem. The connector between the RS232 board and the expansion interface is notorious for causing problems, and may require removal of the board in order to clean the contacts.

Auto answer modems

Acoustic coupled or manually switched direct-connect modems usually "don't care" about the control signals on the RS232 lines. Auto answer modems, on the other hand, normally require the DTR line to be "on" when they are expected to answer the phone. The RS232 Microconnection auto-answer modem (and possibly others) requires the RTS line to be "on" also to answer, but requires RTS "off" to originate a call. For use with this type of modem, MODEM80 will have to be modified according to the service desired. The byte output to the UART control register determines the setting of the control lines. This value is stored at X'9121 and is set to X'6D initially. Bit 0 of this value controls the RTS line; bit 1 controls DTR, where a 0 bit in each position turns the corresponding line "on". The 6D value (binary 0110 1101) sets DTR on, RTS off. Changing this to 6C (binary 0110 1100) would set both DTR and RTS on. A similar value is stored at X'B03E and is used to reset the UART parameters to 8 bit words and no parity while the <R> and <S> type file transfer is invoked. This may also need to be changed to match the modem requirements.

Program modifications

Since MODEM80/CMD resides in memory high enough to be saved with the DOS DUMP command, modifications can be made with the program in memory. Any monitor program which does not overlay the program area would work, but for this purpose, DEBUG is easy to use. DO NOT alter your original copy - it should be maintained for backup purposes. The areas which might be modified for special purposes are:

The translation tables - X'8D00 - X'90FF
The control codes X'9100 - X'9111
The UART initialization values - X'9121 and X'B03E

MODEM80 also can be modified to ignore any input unless it is receiving a carrier signal from the remote by changing the byte at X'926E from C9 to C0 and X'9278 from C9 to C8. This might be desirable if it will be left connected to an auto-answer modem with the receive file <ON>, to avoid picking up garbage while the connection is established. If this change is not made, the control signals are not tested, allowing a direct connection between a model I and model III by simply changing the large switch on the model I RS232 interface board to the "comm" position.

The utility programs

HOST1/CMD and XMODEM/CMD also may be modified for different baud rates and RS232 configurations, although these programs load into lower memory locations, so making the changes may require a disk ZAP type utility and a knowledge of the DOS loader codes. The values used for the UART initialization are:

HOST1/CMD

Address	contents	purpose
X'5529	X'55	set to 300 baud
X'522D	X'6C	8 bit words, no parity, 1 stop bit, DTR and RTS on

XMODEM/CMD

Address	contents	purpose
(These values are used during the XMODEM file transfer)		
X'6100	X'55	baud rate for XMODEM
X'6101	X'6C	UART configuration for XMODEM
(These values are used to reset the UART after XMODEM is finished)		
X'6102	X'55	
X'6103	X'6C	

The settings could be changed to allow XMODEM to run with different parameters than the HOST uses. XMODEM MUST use 8 bit words and no parity for it's file transfers.

Possible values for the baud rate code may be determined from this table:

Baud rate	code	Baud rate	code
110	22	1200	77
150	44	2400	AA
300	55	4800	CC
600	66	9600	EE

The value for the UART configuration byte must be calculated according to the function of each bit position.

Bit 7	1=even parity, 0=odd parity (if bit 3 = 0)
Bit 6	word length select 1
Bit 5	word length select 2
Bit 4	1=2 stop bits, 0=1 stop bit
Bit 3	1=disable parity, 0=enable parity
Bit 2	0=disable transmit data (must be 1)
Bit 1	0=DTR on, 1=DTR off
Bit 0	0=RTS on, 1=RTS off

The interaction of bits 5 & 6 are as follows:

Bit 6	Bit 5	word length
0	0	5 bits
0	1	7 bits
1	0	6 bits
1	1	8 bits

Note that if parity is enabled, another bit will be added to the total word length, thus the normally used settings will be 7-bit words with parity, or 8-bit words with no parity.

Decimal	Binary	Hex	ASCII	EBCDIC
0	0000 0000	00	NULL	NULL
1	0000 0001	01	SOH	SOH
2	0000 0010	02	STX	STX
3	0000 0011	03	ETX	ETX
4	0000 0100	04	EOT	
5	0000 0101	05	ENQ	HT
6	0000 0110	06	ACK	
7	0000 0111	07	BEL	DEL
8	0000 1000	08	BS	
9	0000 1001	09	HT	
10	0000 1010	0A	LF	
11	0000 1011	0B	VT	VT
12	0000 1100	0C	FF	FF
13	0000 1101	0D	CR	CR
14	0000 1110	0E	SO	SO
15	0000 1111	0F	SI	SI
16	0001 0000	10	DLE	DLE
17	0001 0001	11	DC1	DC2
18	0001 0010	12	DC2	DC2
19	0001 0011	13	DC3	DC3
20	0001 0100	14	DC4	
21	0001 0101	15	NAK	
22	0001 0110	16	SYN	BS
23	0001 0111	17	ETB	
24	0001 1000	18	CAN	CAN
25	0001 1001	19	EM	EM
26	0001 1010	1A	SUB	
27	0001 1011	1B	ESC	
28	0001 1100	1C	FS	IFS
29	0001 1101	1D	GS	IGS
30	0001 1110	1E	RS	IRS
31	0001 1111	1F	US	IUS
32	0010 0000	20	Sp	
33	0010 0001	21	!	
34	0010 0010	22	"	
35	0010 0011	23	#	
36	0010 0100	24	$	
37	0010 0101	25	%	LF
38	0010 0110	26	&	ETB
39	0010 0111	27	'	ESC
40	0010 1000	28	(	
41	0010 1001	29	)	
42	0010 1010	2A	*	
43	0010 1011	2B	+	
44	0010 1100	2C	,	
45	0010 1101	2D	-	ENQ
46	0010 1110	2E	.	ACK
47	0010 1111	2F	/	BEL
48	0011 0000	30	0	
49	0011 0001	31	1	
50	0011 0010	32	2	SYN
51	0011 0011	33	3	
52	0011 0100	34	4	
53	0011 0101	35	5	
54	0011 0110	36	6	
55	0011 0111	37	7	EOT
56	0011 1000	38	8	
57	0011 1001	39	9	
58	0011 1010	3A	:	
59	0011 1011	3B	;	
60	0011 1100	3C	<	DC4
61	0011 1101	3D	=	NAK
62	0011 1110	3E	>	
63	0011 1111	3F	?	SUB
64	0100 0000	40	@	Sp
65	0100 0001	41	A	
66	0100 0010	42	B	
67	0100 0011	43	C	
68	0100 0100	44	D	
69	0100 0101	45	E	
70	0100 0110	46	F	
71	0100 0111	47	G	
72	0100 1000	48	H	
73	0100 1001	49	I	
74	0100 1010	4A	J	
75	0100 1011	4B	K	
76	0100 1100	4C	L	<
77	0100 1101	4D	M	(
78	0100 1110	4E	N	+
79	0100 1111	4F	O	|
80	0101 0000	50	P	&
81	0101 0001	51	Q	
82	0101 0010	52	R	
83	0101 0011	53	S	
84	0101 0100	54	T	
85	0101 0101	55	U	
86	0101 0110	56	V	
87	0101 0111	57	W	
88	0101 1000	58	X	
89	0101 1001	59	Y	
90	0101 1010	5A	Z	!
91	0101 1011	5B		$
92	0101 1100	5C		*
93	0101 1101	5D		)
94	0101 1110	5E		;
95	0101 1111	5F	_	
96	0110 0000	60		&
97	0110 0001	61	a	-
98	0110 0010	62	b	/
99	0110 0011	63	c	
100	0110 0100	64	d	
101	0110 0101	65	e	
102	0110 0110	66	f	
103	0110 0111	67	g	
104	0110 1000	68	h	
105	0110 1001	69	i	
106	0110 1010	6A	j	
107	0110 1011	6B	k	,
108	0110 1100	6C	l	%
109	0110 1101	6D	m	_

Appendix 6

Decimal	Binary	Hex	ASCII	EBCDIC	Decimal	Binary	Hex	ASCII	EBCDIC
110	0110 1110	6E	n	>	165	1010 0101	A5		v
111	0110 1111	6F	o	?	166	1010 0110	A6		w
112	0111 0000	70	p		167	1010 0111	A7		x
113	0111 0001	71	q		168	1010 1000	A8		y
114	0111 0010	72	r		169	1010 1001	A9		z
115	0111 0011	73	s		170	1010 1010	AA		
116	0111 0100	74	t		171	1010 1011	AB		
117	0111 0101	75	u		172	1010 1100	AC		
118	0111 0110	76	v		173	1010 1101	AD		
119	0111 0111	77	w		174	1010 1110	AE		
120	0111 1000	78	x		175	1010 1111	AF		
121	0111 1001	79	y		176	1011 1111	B0		
122	0111 1010	7A	z	:	177	1011 0001	B1		
123	0111 1011	7B		#	178	1011 0010	B2		
124	0111 1100	7C		@	179	1011 0011	B3		
125	0111 1101	7D		'	180	1011 0100	B4		
126	0111 1110	7E		=	181	1011 0101	B5		
127	0111 1111	7F	DEL	"	182	1011 0110	B6		
128	1000 0000	80			183	1011 0111	B7		
129	1000 0001	81		a	184	1011 1000	B8		
130	1000 0010	82		b	185	1011 1001	B9		
131	1000 0011	83		c	186	1011 1010	BA		
132	1000 0100	84		d	187	1011 1011	BB		
133	1000 0101	85		e	188	1011 1100	BC		
134	1000 0110	86		f	189	1011 1101	BD		
135	1000 0111	87		g	190	1011 1110	BE		
136	1000 1000	88		h	191	1011 1111	BF		
137	1000 1001	89		i	192	1100 0000	C0		
138	1000 1010	8A			193	1100 0001	C1		A
139	1000 1011	8B			194	1100 0010	C2		B
140	1000 1100	8C			195	1100 0011	C3		C
141	1000 1101	8D			196	1100 0100	C4		D
142	1000 1110	8E			197	1100 0101	C5		E
143	1000 1111	8F			198	1100 0110	C6		F
144	1001 0000	90			199	1100 0111	C7		G
145	1001 0001	91		j	200	1100 1000	C8		H
146	1001 0010	92		k	201	1100 1001	C9		I
147	1001 0011	93		l	202	1100 1010	CA		
148	1001 0100	94		m	203	1100 1011	CB		
149	1001 0101	95		n	204	1100 1100	CC		
150	1001 0110	96		o	205	1100 1101	CD		
151	1001 0111	97		p	206	1100 1110	CE		
152	1001 1000	98		q	207	1100 1111	CF		
153	1001 1001	99		r	208	1101 0000	D0		
154	1001 1010	9A			209	1101 0001	D1		J
155	1001 1011	9B			210	1101 0010	D2		K
156	1001 1100	9C			211	1101 0011	D3		L
157	1001 1101	9D			212	1101 0100	D4		M
158	1001 1110	9E			213	1101 0101	D5		N
159	1001 1111	9F			214	1101 0110	D6		O
160	1010 0000	A0			215	1101 0111	D7		P
161	1010 0001	A1			216	1101 1000	D8		Q
162	1010 0010	A2		s	217	1101 1001	D9		R
163	1010 0011	A3		t	218	1101 1010	DA		
164	1010 0100	A4		u	219	1101 1011	DB		

Decimal	Binary	Hex	ASCII	EBCDIC
220	1101 1100	DC		
221	1101 1101	DD		
222	1101 1110	DE		
223	1101 1111	DF		
224	1110 0000	E0		
225	1110 0001	E1		
226	1110 0010	E2		S
227	1110 0011	E3		T
228	1110 0100	E4		U
229	1110 0101	E5		V
230	1110 0110	E6		W
231	1110 0111	E7		X
232	1110 1000	E8		Y
233	1110 1001	E9		Z
234	1110 1010	EA		
235	1110 1011	EB		
236	1110 1100	EC		
237	1110 1101	ED		
238	1110 1110	EE		
239	1110 1111	EF		
240	1111 0000	F0		0
241	1111 0001	F1		1
242	1111 0010	F2		2
243	1111 0011	F3		3
244	1111 0100	F4		4
245	1111 0101	F5		5
246	1111 0110	F6		6
247	1111 0111	F7		7
248	1111 1000	F8		8
249	1111 1001	F9		9
250	1111 1010	FA		
251	1111 1011	FB		
252	1111 1100	FC		
253	1111 1101	FD		
254	1111 1110	FE		
255	1111 1111	FF		

Notes: values in the range 7-31 decimal are TRS-80 cursor and screen control codes. Values 129 to 191 are graphics codes, and 192 to 255 are space compression codes. See the Level II reference manual.

Binary to Hex conversion:

Binary values may easily be converted to hex by finding the corresponding value for each four bit group in the following table.

Binary	Hex
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

Please do not alter the original copies of the programs. Instructions are given in the manual for making changes for special purposes. This should only be attempted after copying the programs so the original can be maintained for backup purposes. Model III LDOS users will have to remove the write-protect on the disk while using the REPAIR (ALIEN) command to make the disk readable by that system. Otherwise, leave the write-protect on.

Be sure to read the directions before using the <S> and <R> file transfer modes from the main program menu. They are easy to use, but require a compatible program at the remote end. The "terminal mode" file transfers would be used instead with MicroNet and similar systems.

If you get double characters on the screen, check the modem setting. It should be "full duplex". Also, the "local parameter" menu should show "full duplex" and you should go to the terminal mode with T (not E) from the main menu.

Model III LDOS users must not have the RS232T/DVR loaded when using MODEM80, XMODEM or HOST1. It will read the input during interrupt processing and prevent these programs from functioning properly. If problems are encountered, re-boot with the clear key pressed in case RS232T had been SYSGENed.

Model III TRSDOS users should be aware that version 1.3 handles directory entries differently than earlier versions. Therefore, when running 1.3, the file being transmitted must have been created under 1.3 and vice-versa. Model I TRSDOS 2.3B will have a similar incompatibility with other model I systems.

When preparing files for transmission, be careful to use carriage returns <enter> where necessary. With word processors which automatically wrap the text on the screen, this is easy to forget. Files that are downloaded from MicroNet and other systems may contain extra carriage returns that were not in the original text. If this occurs in a BASIC program, it will cause a "direct statement in file" error when the program is loaded. If Scripsit or a similar text editor is available, use it to delete the extra carriage returns, making sure that each program line begins with a line number.

MODEM80 should never lose characters when running at 300 baud. The drivers set up by the operating system are used for the keyboard and video display, and these limit the maximum useable speed. The screen can scroll normally at 600 baud, although a character may be lost if a key is pressed while data is coming in at full speed. 1200 baud operation can be managed if the screen scrolling is turned off, 2400 if echoing is not required. The block mode file transfers will operate at any speed, since the file is not displayed at the high rates. For example, a model I cable may be plugged directly into a model III and files transferred at 9600 baud.

The patch file LDOSIII/FIX will make MODEM80 operate at up to 2400 baud in the terminal mode with the screen scrolling normally and prevent losing incoming characters when a key is pressed. It will work ONLY in the model III under the LDOS operating system. Do not apply it unless operation at speeds above 300 baud will be required. Use the command: PATCH MODEM80/CMD using LDOSIII/FIX to install the patch. Do not patch your original copy, as it will no longer be useable under other operating systems, or possibly even future versions of LDOS.