

WT / WT2

Advanced Wang 2200 Terminal Emulation

with Document and File Transfer

for IBM, Compatibles and Wang Computers

WT Release 3.1

WT2 Release 4.0

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WT/WT2

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1 Introduction

1A Overview

WT, Advanced Wang 2200 Terminal Emulation, was written for users of the Wang 2200 series mini-computers who would like to take advantage of the wealth of software available for personal computers, but also want to continue to use the capabilities of the Wang 2200. WT allows you to use an IBM or compatible personal computer, or a Wang personal computer, as a terminal into a Wang 2200. WT also can capture and send data from the PC disk to the 2200, and convert 2200 data into popular PC software formats, such as Lotus 1-2-3 or Wordstar.

This manual is also for the WT2 and WT-DOC programs. WT2 combines all the features of the WT Advanced Terminal Emulation program with the WTCOPY File Transfer program. All references to the WT program also hold for the WT2 program. WT-DOC combines all the features of WT2 and *MacSoft Archive Disk Utility software*.

Any baud rates up to and including 9600 baud are supported for all PCs. 19,200 baud may be set for any kind of PC, however some IBM PCs may have timing problems when running this fast.

All data, stop, and parity bits can be redefined. An optional display choice lets the user see the decimal value of every byte that is transmitted or received from the Wang 2200.

When operating as a terminal, the PC's screen, printer and keyboard are completely user defined by separate definition tables. The user may have as many different definitions for each device as desired.

Almost any PC keystroke can be redefined to send up to 75 different keystrokes of any value to the 2200. For example, the special function keys of the 2200 can be mapped any way you desire on the PC keyboard.

Multiple keyboard definitions are supported. As many different keyboard layouts are possible, limited only by available disk space for storing the definitions. For example, one keyboard layout might be used for programming, another keyboard for running DATA 3500, or another for running application software.

Similarly, almost any character sent by the Wang 2200 to the terminal screen can be redefined to become any PC display character. (The exceptions to this are the 16 characters from HEX(00) to HEX(0F), which are reserved by Wang to mean special screen control codes.)

Box graphics or character graphics are simulated on the PC by using either special characters or by simultaneous graphics display, depending on the type of PC. Box graphics display can be turned on or off by the user.

When using a color monitor on IBM PCs, the foreground, background, and underline display colors are also completely user defined. One popular color combination is light grey foreground and blue background, with underlines displayed in red and reverse underline in green. The colors can be set either by the user, or under 2200 program control by using a special PRINT HEX sequence. A color demonstration program is included.

All parallel printers are fully supported by the WT program as terminal printers. Most serial printers will also work. The WT program sends data to the MS DOS printer device, so that any installed device drivers will work. The PC printer may be passed a setup string to select compressed or enhanced printing. The printer definition table may be altered by the user, and multiple printer definition tables are allowed. Each single 2200 character can be translated to become up to nine characters to the PC printer. This is useful for mapping such special characters as HEX(0E). Also, extra line feeds can be added to the data stream as it is sent to the printer, so that a normal PC printer does not have to be re-configured to run properly when used as a terminal printer.

When the WT program is ended by the user, the current configuration is stored on the PC disk for the next time the program is used.

Several utility programs are also included with WT. The first is WTTRAN, which converts captured 2200 print files to DIF format for use with Lotus 1-2-3, Dbase II and III, R:base 4000 and 5000, SuperCalc, or Visicalc.

The second utility program is called NIAKWA, and is used to move Niakwa compiler source code programs on the PC back onto the 2200.

The last utility is KEYPRINT, which displays the current keyboard programming. This is useful if you plan to do extensive changes to the default keyboard mapping.

1B System Requirements

WT/WT2/WT-DOC requires the following minimum features:

256K of RAM

2 floppy drives or

1 floppy and hard disk

DOS 2.0 or above

Supports monochrome or color monitors

1C IBM PC and Wang PC differences

The WT program runs on either IBM PCs or Wang PCs virtually identically. However, there are some differences that are caused by the different keyboards, serial ports, and video displays. These differences are summarized below. The rest of the manual will point out the differences only when necessary.

1C1 Keyboard Differences

The default keyboard layout for each type of PC is shown in Table 1.

The WT menus and utility programs use the following keys:

<u>Function</u>	<u>IBM PC</u>	<u>Wang PC</u>
Help	F1	Help
Exec	F10	Exec
Cancel	Esc	Cancel

-- SPECIAL NOTE - PLEASE READ --

If you want to access the WT program functions using the 2nd Function keys 2nd F1 to 2nd F10, instead of using the menu display using Ctrl A, you need to install a special copy of the Wang PC Bios. The Wang PC Bios version 1.65 or 2.66 is included on the diskette for the Wang PC. The BIOS.SYS file must be copied to your start up disk, and the system rebooted before the 2nd function keys will work properly. This will not affect any other application software. A more detailed description of the BIOS modification is in Table 4.

The Wang PC uses the 2nd key instead of the Alt key. All references to Alt in this manual mean the Wang PC 2nd key.

1C2 Screen Differences

The WT program does not support the Wang color monitor. The IBM color monitor is fully supported. Box graphics on the Wang PC requires the Wang graphics controller board. Box graphics are positioned exactly as they are on the 2200, not shifted down 1/2 line as they are on the IBM PCs.

2 Installation and Setup

2A Backup Procedures

WT is not "copy protected" like some programs, so you are free to make as many copies as you like for your personal use on one PC. If you have more than one PC that you would like to use there is a multi-copy license/discount available. Please don't make copies for other people to use on their machines.

The first thing we recommend you do, when you receive your software, is to make a "Backup Copy". Then use the "Backup Copy" copy for your working copy.

To Copy your diskette, if you have only one floppy disk Drive, Drive A, at the DOS prompt type in:

```
C> DISKCOPY A: A: <RETURN>  
where <RETURN> is the return key.
```

Prompts on the screen tell you when to insert the source and target diskettes.

To Copy your diskette, if you have two disk drives, Drive A and B, at the DOS prompt type in:

```
C> DISKCOPY A: B: <RETURN>
```

Prompts on the screen tell you when to insert the source and target diskettes.

You should store the original diskette in a safe place. If you should need them again, you can make a copy of the diskette again.

2B Floppy

If you have a floppy disk based system, just insert the WT program disk into drive A, and type

```
A > WT <RETURN>  
or if you have the WT2 program type:  
A > WT2 <RETURN>
```

2C Installation on Hard Disk

If you have a hard disk system, the best thing to do is create a sub-directory called WT, and copy all the WT programs and data into that directory. This can be done with the following commands:

```
C: < RETURN >
MKDIR\WT < RETURN >
CD\WT < RETURN >
insert WT Program disk in Drive A
COPY A:*. * < RETURN >
```

Then to run the WT program, type the commands:

```
CD \WT < RETURN >
WT < RETURN >
```

or for WT2:

```
C: < RETURN >
MKDIR\WT2 < RETURN >
CD\WT2 < RETURN >
insert WT2 Program disk in Drive A
COPY A:*. * < RETURN >
insert WT2 Utility disk in Drive A
COPY A:*. * < RETURN >
```

Then to run the WT2 program, type the commands:

```
CD \WT2 < RETURN >
WT2 < RETURN >
```

On a Wang PC, you might want to add the WT program to a system menu, using the Modify System Menu utility. A Wang menu file called "WTMENU.DAT" is included on the WT diskette.

On an IBM PC, you might want to add the WT program to the *MacSoft Menu* utility. A MacSoft menu file is included on the WT diskette called 'WTMENU.DAT'. (The *MacSoft Menu* is a utility program that adds the same menu structure, system utilities, and a text editor that the Wang PC has to any IBM PC, XT, or AT).

For the WT2 program use WT2MENU.DAT on the WT2 diskette.

2D Cables

To connect the PC locally to a Wang 2200, you need a standard 2200 terminal cable. The pins used by the PC are identical to a normal 2200 terminal.

The Wang 2200 communication interface is a standard EIA RS-232-C serial connector. Nine pins are used for generating signals:

<u>Pin</u>	<u>Definition</u>
1	Protective Ground
2	Transmitted Data
3	Received Data
4	Request to Send
5	Clear to Send
6	Data Set Ready
7	Signal Ground
8	Unused
20	Data Terminal Ready

IBM and Wang PC Cable

The IBM PC and Wang PC use the same style of cabling. This is essentially the same cabling used for DEC terminals and is known as a null modem cable. The only difference is that the serial port connector on the back of an IBM PC is a male 25 pin plug, and is a female 25 pin plug on the Wang PC.

<u>PC End (25 Pin)</u>	<u>Description</u>	<u>2200 end (25 Pin)</u>
1	Frame Ground	1
2	Receive Data	3
3	Transmit Data	2
5, 6	Clear to Send	20
7	Signal Ground	7
20	DTR, etc	5,6

IBM AT Cable

IBM decided for some reason to change the connector used for the serial port for the IBM AT to a 9 pin male connector. Many IBM AT compatible companies, such as Compaq, followed IBM's lead. To make the cable you need a female 9 pin connector and a male 25 pin connector. This cable would connect the 9 pin connector on the IBM AT all the way to the 25 pin connector on the 2200. If you just want an adapter to connect from your IBM AT to some existing 2200 cabling please contact MacSoft.. The pins are tied together as follows:

IBM AT End	Description	2200 End
1, 6, 8	DCD, DSR, CTS	20
2	Receive Data	2
3	Transmit Data	3
4	DTR	5, 6
5	Signal Ground	7
9	Ring Indicator	Unused

2E Serial Ports

The serial port on the Wang PC or APC is a female 25 pin plug on the system board. To connect the Wang PC locally to a Wang 2200 you need a standard 2200 terminal cable. The pins used by the Wang PC are identical to the standard 2200 terminal, with one exception. Pin 1 on the terminal side of the cable should be cut. (Pin 1 is the frame ground). Also, sometimes 2200 terminal cables have pins 8 and 9 connected. These should be disconnected as well.

The serial port on an IBM PC is a male 25 pin plug. The required cable adapter is a female-female gender changer.

The serial port on an IBM AT is a male 9 pin plug. The cable adapter for an IBM AT is a 9 pin to 25 pin cable.

Some IBM PCs may not be able to support 19,200 baud. This timing problem of the IBM PC is a due to the combination of a INS8250 UART chip, a 4.77 MHz clock speed, and the IBM BIOS and is not from any limitations of the WT program itself. Quoting from the IBM PC Technical Reference manual, page 1-230, "In no case should the data rate be greater than 9600 baud". When the WT program sets the baud rate at 19,200 it does so by going around both MS DOS and the system BIOS to directly program the INS8250 chip. The IBM PCs that we tested can run 19,200 baud. Therefore, we suggest that if you have an IBM PC, try 19,200 baud first, and if there are problems drop the speed down to 9600 baud. Other PCs with faster clock rates or different UART chips fully support 19,200 baud, such as the IBM AT, AT&T PC 6300, Wang PC, and other personal computers.

2F 2200 MUX Boards

The Mux board on the Wang 2200 must be set for the desired baud rate. The directions to do this are found in the appendix section of the Wang 2236 terminal user manual, or in the end of the VP/MVP Introductory Manual. It usually requires you to pull out the Mux board and change a couple of DIP switches.

3 Startup

Once the WT or WT2 program is started (see section 2B or 2C), the screen is cleared and a message is displayed identifying the appropriate program WT or WT2, author, copyright message and the end users name and serial number.

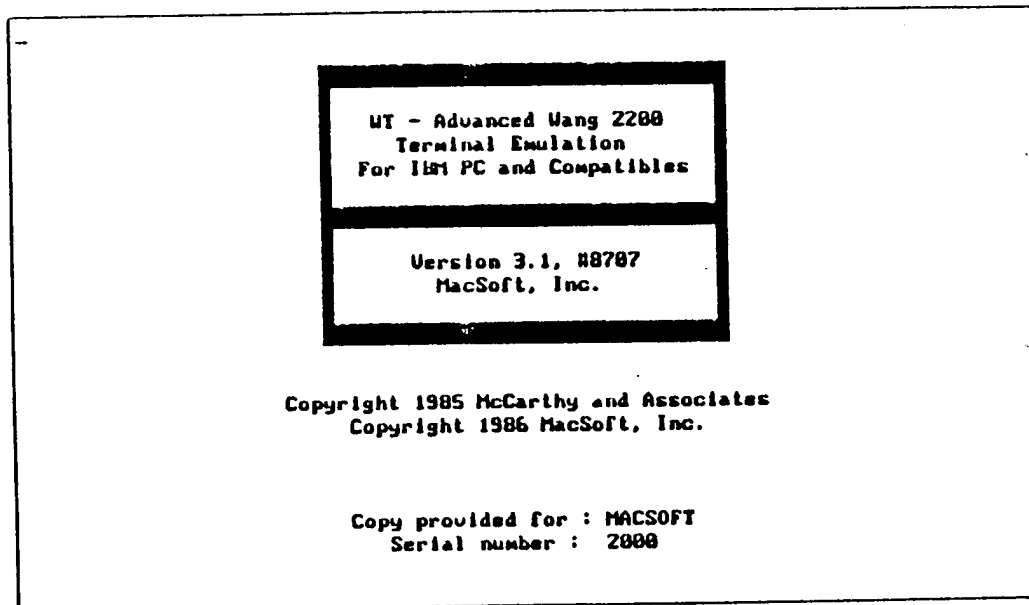


Figure 3-1 The WT Startup Screen

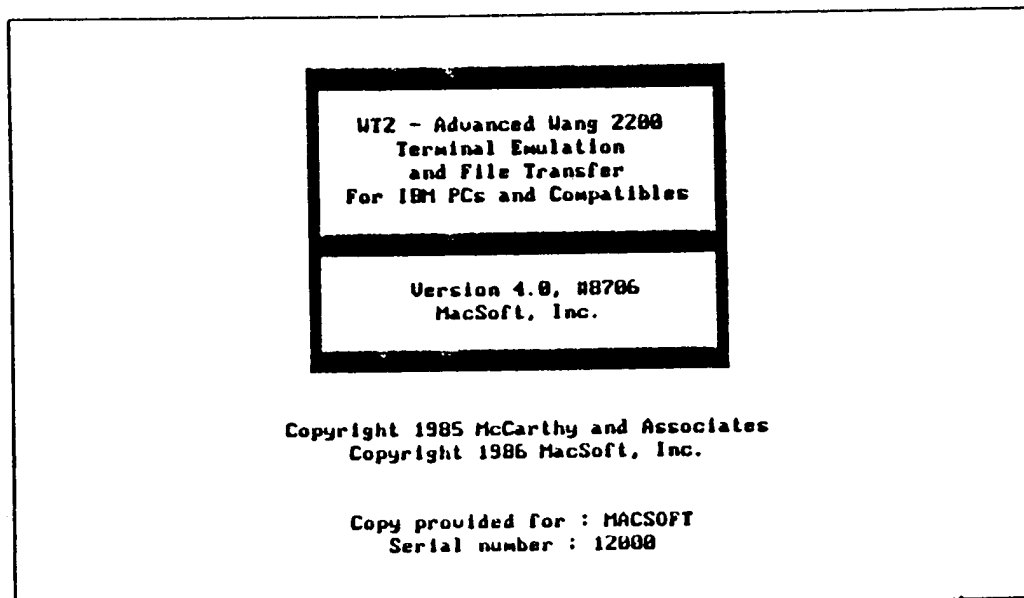


Figure 3-2 The WT2 Startup Screen

Press any key to continue. The screen will clear, and communication between the PC and the Wang 2200 will begin.

Press Alt R (or Help on the Wang PC) for the reset key, and see if you get the message 'READY BASIC-2 Partition 1' or whatever your standard message is. If you don't get that message, here is a list of things to do:

- 1. Change the PC baud rate by pressing Ctrl A and selecting Serial Port Control. One sign of the wrong baud rate is when you get some characters on the screen, but they are meaningless. Also check the other configuration settings. The usual 2200 configuration is 8 data bits, 1 stop bit, odd parity, normal display.
- 2. Check the baud rate that the 2200 Mux board is set to. This is the problem most of the time.
- 3. Check the physical cable connection. Remember, a serial port on a IBM PC is a male 25 pin plug. The female 25 pin plug on an IBM PC is a parallel port. On the IBM AT the serial port is a 9 pin male plug. On the Wang PC the serial port is a female RS 232 plug.
- 4. Make sure that the MUX port that you are plugged into on the 2200 has a partition generated for it. When the 2200 is first turned on, you go through a series of screens which define how much memory is assigned to each terminal, etc. You have to assign some memory to the Mux board port that the PC is plugged into. From experience, we can tell you that this is the kind of mistake that Wang repairmen love to make fun of.

If you don't receive anything at all on your screen you probably either have a bad physical connection or no partition generated. After you have changed the configuration, return to the terminal screen and press Alt R (or Help on the Wang PC). You should get the standard message now.



Figure 3-3. The Terminal Screen

4 WT Main Menu

The next sections go into detail about the ways that you can customize your copy of the WT program to your needs.

When the WT program is running a status line across the bottom will show the baud rate, parity, stop bits, and the message 'Press Ctrl A for WT Main Menu'. On the IBM PC the Shift and Numlock status will also be displayed in the lower right corner of the screen. If you press Ctrl A at any time during terminal emulation, the current terminal screen will be saved and the WT Main Menu will be displayed. The choices are:

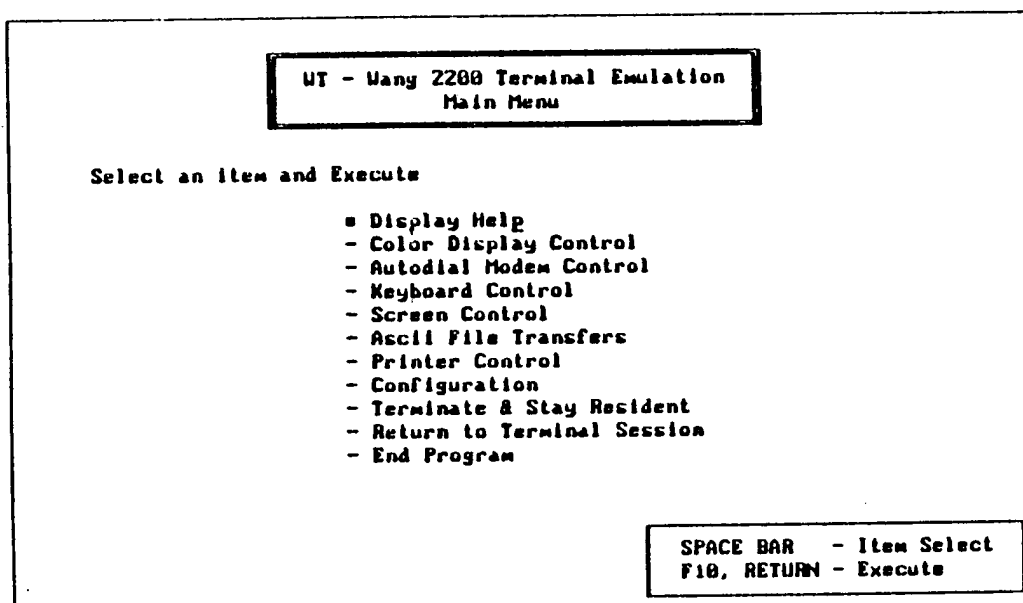


Figure 4-1. The Main Menu Screen

These functions can also be reached by using the Alternate Function Keys. For example, to display help you can either press Ctrl A, and the select Display Help, or press Alt F2. Both ways accomplish the same thing.

The WT menus work the same way as the standard Wang PC menus do. Menu choices on any WT menu can be selected in two ways. One is by pressing the space bar or arrow keys to highlight your choice. The other is by pressing the first letter of your choice (i.e. to select Printer Control on the main menu, you would press "P"). To then execute the function, you must then press the return key or the Exec key. On the IBM PC the Exec key is defined as F10, the Help key is F1, and the Cancel key is Esc. (See section 1C1 for further details.)

4A Display Help or Alt F2

Online help is available at any time when using the WT terminal emulation program. This can be reached by pressing Ctrl A from the terminal session and selecting Display Help, or by pressing Alt F2, either way it will save the current terminal screen, display the help text, and when you are finished, restore the terminal screen back again.

McCarthy & Associates, Bakersfield, California, (805) 324-4291

WT - Wang 2200 Terminal Emulation for the IBM PC

Default Wang - IBM Key Equivalents

Wang Key	IBM Key	Wang Key	IBM Key
Reset	Alt R	SF '0	Home
Run	Alt G	SF '1	F1
Load, Run, Return	Alt S	
Halt	Alt H	SF '10	F10
Continue	Alt C	SF '11	Ctrl F1
Clear	Alt Z	
Load	Alt L	SF '20	Ctrl F10
Insert	Ins	SF '21	Shift F1
Delete	Del	
Edit	Esc	SF '30	Shift F10
Erase	End	SF '31	Alt F1
Edit, Recall	Alt Q	SF '30, SF '31	Alt U

WT - General Help

ALTERNATE FUNCTION KEYS

F1 SF '31	F2 HELP
F3 COLOR	F4 MODEM
F5 KEY	F6 SCREEN
F7 FILE	F8 PRINT
F9 CONFIG	F10 END

HELP - Displays the online help text.

COLOR - Changes the foreground, background, underline, and reverse underline colors on a color monitor.

MODEM - Set up any autodial modem strings.

KEY - Change the keyboard definition in some way.

SCREEN - Change the screen translation tables.

FILE - Send or Receive data to the PC disk.

PRINT - Change the printer device or the translation table.

CONFIG - Change the baud rate, stop bits, parity bits, display type, buffer size.

END - End the WT program.

More specific help may be display by choosing one of the alternate function keys and pressing Alt F2 for more help.

Press any key to continue ...

Figures 4-2. Sample Help Screens

The main help text is stored in a text file called 'WT.HLP' in pages of 25 lines by 80 columns. To further personalize your WT program, you can change the help text anyway you like. To do this use an editor or word processing program that produces straight text files. *MacSoft MED*, *EDLIN* or *PCEDIT* may be used.

There is also help text available for each of the other special functions, such as autodial control, or setting the configuration. Each of these help text files are on the disk, in the same format.

4B Color Display Control or Alt F3

If you have a color monitor, it might be fun to change around the colors that are used to display the text on the screen. There are three ways to do this; by pressing Ctrl A and selecting Color Control, by pressing Alt F3, or from within a 2200 program by printing a special hex code sequence, which is explained in the section on programming. *Color Display is not supported on the Wang PC, or on monochrome IBM PCs.*

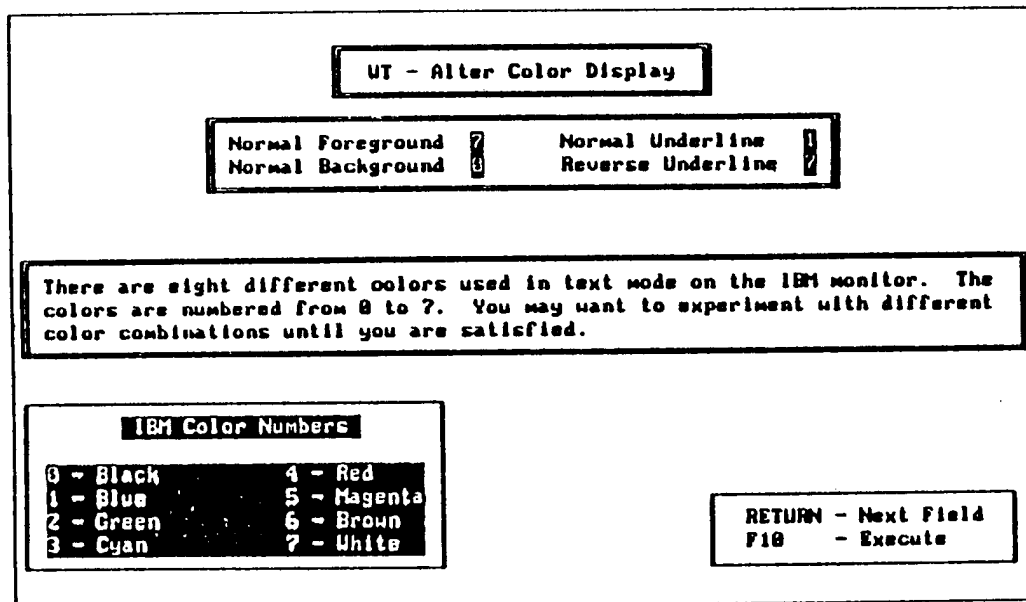


Figure 4-3. The Color Display Screen

When you select Color Control from the main menu, or press Alt F3, the current terminal screen is saved and you are prompted for four values; the foreground color, the background color, the underline color and the reverse underline color.

There are eight foreground and underline colors to choose from: 0-black, 1-blue, 2-green, 3-cyan, 4-red, 5-magenta, 6-brown, and 7-light gray. There are also eight background colors to choose from: 0-black, 1-blue, 2-green, 3-cyan, 4-red, 5-magenta, 6-yellow, and 7-white.

The default colors used are 7-light grey foreground, 0-black background, 1-blue for underline, and 0-light grey for reverse underline. If you are using a color graphics board that displays the colors in shades of green on a monochrome monitor (such as a COMPAQ portable), you should immediately change the default colors. This is because the blue shade of the COMPAQ for underline against a black background is almost impossible to see. A better choice would be color 5-magenta for foreground, color 7-light gray for underline, color 6-brown for reverse underline, and color 0-black for background.

4C Autodial Modem Control or Alt F4

Some modems, such as the Hayes Smartmodem, Racal Vadic, or U.S. Robotics Password modems, have the ability to configure themselves and dial the telephone for you if they are given the appropriate commands. Usually the commands involve some sort of pause control as well.

Note: Some autodial modems can function with 11 bits, but cannot respond to commands given in 11 bits. Therefore, unless you change the 2200 to 10 bit operation, you will not be able to use some of the advanced features of your modem. See section 5E.

When you select Autodial Modem Control from the WT Main Menu, or press Alt F4, the terminal screen is saved and you are prompted for several parameters.

WT - Autodial Modem Control		
Autodial Type Modem		Y or N
Autodial on Startup		Y or N
Autodial Now		Y or N
Autodial String #		1 <=string N<= 4

Autodial Strings	
1	
2	
3	
4	

ESC	- Cancel
RETURN	- Next Field
F10	- Execute

Figure 4-4. The Autodial Modem Control Screen

The first thing you are asked is if your modem is capable of autodialing. If you answer 'Y' then the WT program will assume that it can send an autodial string. If "N" is answered the user must input the autodial command, i.e. ADTtelephone#.

Next, you are asked if you want to autodial the modem every time you start the WT program. This is handy if you connect up to the same system every time.

Answering "Y" to the "Autodial Now" question means that the WT program will transmit the autodial command after you press F10 (or EXEC on the Wang PC).

The autodial string # is the number (from 1 to 4) of the autodial strings that you want to use now.

Finally, you have a list of 4 possible autodial strings of 40 characters each that you can modify.

The exact autodial string depends on the type of modem you use. Most modems now handle the Hayes "AT" commands. For example, the Hayes "AT" commands to dial 1-805-324-0731 are:

ATDT 1-805-324-0731 \013

If your modem does not use the Hayes "AT" commands you can still use WT to dial. If the dial command requires a control character of some sort (i.e. Racal-Vadic modems use Ctrl E) you can enter the Ascii value of the character preceded by a slash ("\") character. For example, Ctrl E would be \005. A carriage return would be \013.

The modem control parameters are saved along with other parameters in the 'CONFIG.DEF' file on the PC.

4D Keyboard Control or Alt F5

To change the meaning of any keystroke combination on the PC keyboard you choose keyboard control from the WT Main Menu, or press Alt F5. The terminal screen will then be saved, and you will be prompted for the key combination and the new meaning for it.

WT - Alter Keyboard Definition

Keystroke █
New Definition
Previous Definition

Enter any special key definitions in the format (-key name-). For example, special function key 8 would be entered as (-sf-8-), SF '31 as (-sf-31-), the return key or enter as (-enter-). Press F1 for a list of all the possible function key values.

RETURN - Next Field
F2 - Repeat Define
F10 - Execute

Figure 4-5. The Keyboard Control Screen

First, you are asked for the keystroke you want to define. This can be almost any key combination on the PC keyboard. The exceptions for the IBM PC are:

Alt F2 to Alt F10, Alt D, and Ctrl Alt Del.

The exceptions on the Wang PC are:

2nd F2 to 2nd F10, 2nd Command Cancel, Ctl C, Ctl D, Ctl P, and Ctl S.

Some important keystrokes are mapped twice on the PC keyboard, i.e. Ctl M is the same as Return, Ctl H is the same as Backspace, and Ctl I is the same as Tab.

After pressing the keystroke you want to redefine, the key number is then displayed. (The key number is the Ascii value of a normal key, or 255 + Ascii value of an PC extended key.) The previous definition of the key is displayed, and you are prompted to edit the new definition of the key. To produce a character not found on the PC keyboard, enter the decimal value of the key using the format /nnn , where nnn is the decimal value. For example, an escape character (decimal 27) would be entered as /027.

The Wang 2200 has two kinds of keys, normal and extended. Examples of the extended keys are the special function keys SF'0 through SF'31, and the LOAD, RUN keys. The extended keys actually send two keystrokes to the 2200, first a decimal 253, and then the key value. For example, SF'1 actually sends decimal 253 and then decimal 1 characters. Table 1 shows all of the extended keys used by the 2200.

To make it easier to enter special function keys, you can enter them in the format (-key name-). For example, to enter SF'1 you would type in (-sf-1-). You can also enter this as /253/001.

The default PC key definitions are stored on the PC disk in the file 'KEYBOARD.KEY'. You may define as many different keyboard setups as you have available disk space. To create a new keyboard definition, or change to a different existing keyboard definition, you have to select Configuration from the WT Main Menu, or press Alt F9, and fill in the 8 letter name of the new keyboard to use.

- **Example 1 - Define IBM PC 'Esc' key to be 2200 'Edit' key.**
While connected as a terminal, press Ctrl A and choose Keyboard Control from the Main Menu (or press Alt F5) to define a keystroke. Press 'Esc' for the key to define. Enter (-edit-) as the key value. Press F10 (or EXEC on the Wang PC) when done. From now on when you press 'Esc', the 2200 value for 'Edit' will be sent instead.
- **Example 2 - Define IBM PC 'F1' key to be 2200 'SF 1'.**
Choose Keyboard Control from the Main Menu (or press Alt F5) to define a keystroke. Press 'F1' for the key to be defined. Enter (-sf-1-) as the key value. Press F10 (or EXEC on the Wang PC) when done. The terminal screen will be restored. The IBM PC 'F1' key will now send to the Wang 2200 the values for 2200 special function key 1.
- **Example 3 - Define IBM PC 'Alt I' key to be 2200 macro keystrokes:**
MacSoft, Inc
2920 "F" Street, Suite E14
Bakersfield, CA 93301
(805) 324-4291
Choose Keyboard Control from the Main Menu (or press Alt F5) to define a keystroke. Press 'Alt I' for the key to be defined. Type in the name, address, and phone number. When finished typing, press Alt F10 to end. Now when you press 'Alt I', the PC will send the entire address to the 2200.

- **Example 4 - Define Ctrl Z to be print screen function.**
 The newer 2200 terminals support a "print screen" function. The print screen function dumps anything displayed on the screen to the terminal printer. If you don't have a terminal printer, it hangs up the terminal until you press return. To program a PC key to be the print screen key, choose Keyboard Control from the Main Menu (or press Alt F5). The change keyboard screen should appear. Press the key you want to define as the print screen key (in this case Ctrl Z). The key number of the key will be displayed, and you will be prompted for the new keystroke definition. Define the key to be (-print-). Finally, press F10 (or EXEC on the Wang PC) to end. With the WT program, the print screen key will dump the terminal screen to the printer device. This may be the PC printer, or a disk file, depending on what you have selected with Printer Control (or Alt F8).
- **Example 5 - Define Wang PC 'Cancel' key to be 2200 'Edit' key.**
 While connected as a terminal, choose Keyboard Control from the Main Menu (or press 2nd F5) to define a keystroke. Press 'Cancel' for the key to define. Enter (-edit-) as the key value. Press EXEC to finish. From now on when you press 'Cancel', the 2200 value for 'Edit' will be sent instead.
- **Example 6 - Define Wang PC 'F1' key to be 2200 'SF 0'.**
 While connected as a terminal, choose Keyboard Control from the Main Menu (or press 2nd F5) to define keystroke. Press 'F1' for the key to be defined. Enter (-sf-0-) as the key value. Press EXEC when done. The terminal screen will be restored. The PC 'F1' key will now send to the Wang 2200 the values for 2200 special function key 0.

4E Screen Control or Alt F6

Both IBM and Wang adopted for the most part the Ascii character set. However, some special characters are numbered differently in the 2200 character sets than in the PC set. For example, the up arrow character is decimal 94 in the 2200's normal character set, and decimal 24 in IBM PC's character set. The WT program uses a translation table to convert the 2200's display characters to the PC's. This translation table can be changed by choosing Screen Control from the WT Main Menu, or by pressing Alt F6 from the terminal screen.

The 2200 terminal actually has two character sets. The normal set is used for underlines, and the alternate set is used for graphics. In both sets the first 144 characters are the same. Characters 0 to 15 are used for controlling the screen in various ways. (Character 251 also does some screen control). In the normal character set the last 112 characters are the same as the characters from 16 to 127 except that they are underlined. The last 112 characters in the alternate set are graphics characters. Not all of the 2200 character graphics are duplicated in the PC character set. If you are not satisfied with the current translation table you may alter it. Again, to change a displayed character definition, choose Screen Control from the WT Main Menu, or press Alt F6.

WT - Alter Screen Display Characters																		
Normal or Alt Set		2200 Decimal Value		PC Decimal Value														
		Low	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
High	0	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6
1	16	>	<	!	@"	#	\$	%	&	'	()	*	+	,	-	.	/
2	32	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?	@	A
3	48	0	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
4	64	0	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
5	80	.	0	R	S	T	U	V	W	X	Y	Z	[\]	^	_	o
6	96	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q
7	112	p	q	r	s	t	u	v	w	x	y	z	{		}	~	Δ	◊
8	128	C	E	U	6	A	X	Δ	8	9	Δ	U	6	E	C	X	A	
9	144	C	E	U	6	A	X	Δ	8	9	Δ	U	6	E	C	X	A	
A	160	6	1	6	6	N	R	Δ	2	7	~	Y	6	1	6	6	N	
B	176	6	1	6	6	N	R	Δ	2	7	~	Y	6	1	6	6	N	
C	192	6	1	6	6	N	R	Δ	2	7	~	Y	6	1	6	6	N	
D	208	a	T	h	A	L	f	H	T	0	0	0	0	0	0	0	0	
E	224	a	P	f	n	Σ	f	H	T	0	0	0	0	0	0	0	0	
F	240	a	z	z	s	f	J	+	z	o	.	.	f	o	o	o	o	

RETURN - Next Field
F10 - Execute
ESC - Cancel

Figure 4-6. The Screen Control Screen

The terminal screen will be saved, and the Alter Screen Display input screen will be shown with the entire PC character set displayed on the bottom. First you will be asked "Normal or Alt Set". A 'N' answer will change the value of the normal 2200 character set, an 'A' answer will change the value of the alternate 2200 character set. Next, you are asked for the decimal value of the 2200 character. And finally, you are asked for the decimal value of the PC character to display instead.

Upon program initialization, the first 144 characters of the alternate set are made the same as the normal set. Therefore, if you want to change the value of a character below 144, you only have to change the normal character set. The special characters that are different in the normal 2200 set are listed in Tables 2A & 2B. The characters that are different in the alternate set are listed in Tables 3A & 3B.

It is also possible to have multiple screen definitions. The current screen definition file name is kept in the configuration file, which you can change by selecting Configuration from the Main Menu or pressing Alt F9.

- **Example 1 - The Up arrow character - IBM PC.**

Choose Screen Control from the Main Menu (or press Alt F6) to tell the WT program you want to change a character definition. Enter 'N' to alter the normal character set. Enter '94' for the decimal value of the 2200 character to change. Enter '24' for the decimal value of the IBM PC character to display instead (24 is the value of the Up Arrow character in the IBM character set). Press F2 to change another key or F10 to end. From now on, whenever the WT program reads a decimal 94 character from the Wang 2200, it will display the IBM PC Up Arrow character.

- **Example 2 - The filled box character - IBM PC.**

Choose Screen Control from the Main Menu (or press Alt F6) to tell the WT program you want to change a character definition. Enter 'A' to alter the alternate character set. Enter '255' for the decimal value of the 2200 character to change. Enter '219' for the decimal value of the PC character to display instead. Press F2 to change another key or F10 to end. From now on, whenever the WT program reads a decimal 255 character from the Wang 2200, it will display the filled box character.

- **Example 3 - The tick mark (') character - Wang PC.**

Choose Screen Control from the Main Menu (or press Alt F6) to tell the WT program you want to change a character definition. Enter 'N' to alter the normal character set. Enter '136' for the decimal value of the 2200 character to change. Enter '247' for the decimal value of the PC character to display instead (247 is the value of the Up Arrow character in the PC character set). Press F10 to end. From now on, whenever the WT program reads a decimal 136 character from the Wang 2200, it will display the Wang PC tick mark.

● **Example 4 - The down arrow character - Wang PC.**

Choose Screen Control from the Main Menu (or press Alt F6) to tell the WT program you want to change a character definition. The enter 'N' to alter the alternate character set. Enter '148' for the decimal value of the 2200 character to change. Enter '151' for the decimal value of the PC character to display instead. Press F2 to change another key or F10 to end. From now on, whenever the WT program reads a decimal 148 character from the Wang 2200, it will display the down arrow character

4F Ascii File Transfers or Alt F7

Ascii file transfers between the PC and the Wang 2200 are very simple in concept. From the standpoint of the 2200 computer, all it sees connected to it is a normal 2200 terminal. However, the PC can both send and receive characters to and from the disk instead of the keyboard, screen, and printer. Therefore, anything the 2200 can print on a screen the PC can capture to disk, and anything that can be entered from a terminal can be sent from the PC disk. If you want to do "Disk Image" or "Exact" file transfers, see section 7 for the WTCOPY utility program.

Often it is better to use the Printer Control utility (section 4G) to capture information from the 2200 to the PC. This is done by routing printer data to an MS DOS file name, rather than to the PC printer itself. The reason is that the 2200 sends a lot of data compressed to the screen device, but not to the printer. So if you just capture the screen information to disk it can look messed up.

WT - Ascii File Transfers	
Send or Receive	S or R - Send from PC or Receive to PC
MS DOS Filename	
Timing Pause	0 (= timing (<=99 in 1/100) of sec units
Timing Block	Number of characters between timing pause
Translate	Y or N - use screen translation table for data
<p>The timing pause and the timing block are only used when sending an MS DOS file to the 2200. After sending timing block number of characters from the file, the PC will pause for the timing pause/100 seconds.</p>	
<p>RETURN - Next Field F10 - Execute</p>	

Figure 4-7. The Ascii File Transfer Screen

To initiate an Ascii file transfer, choose Ascii File Transfer from the Main Menu, or press Alt F7. The terminal screen will be saved, and you will be prompted to either send a file or receive a file. Then you will be asked the file name. (This must be a legal MS DOS file name, with path designation if necessary i.e. C:\wt\text.dat). Press F10 (or Exec on a Wang PC) when ready. The defaults used in this screen are from the last time the program was used.

When sending a file from the PC to the 2200, there is an option to set a timing pause and timing block. This pause is expressed in hundreths of a second, and may be necessary to insert if the Wang 2200 is unable to keep up with the PC as it sends the characters. For example, if the 2200 waits for 256 characters and then writes them to disk, the disk IO time may be so long that the MUX board buffer is overrun, and you could lose some of the characters. This may also happen if you are running at slow baud rates.

The timing pause and block work like this: after sending the timing block number of characters from the PC, the WT program will wait for the timing pause hundreths of a second, and then send the next block of characters. You will have to experiment with these parameters until you get satisfactory results for your application.

Another problem that can occur when sending data from the PC to the 2200 is that the 2200 can only accept certain keystroke values, corresponding to the 2336 keyboard. Most notably, regular text files on the PC contain the linefeed character, which is not represented on a 2200 keyboard. To set the WT program to ignore these characters, set the translate option to "Y".

● **Example 1 - Sending a text file from the PC to Wang DATA 3500.**

In this example we will assume that we have a text file on the PC called 'TEXT.DAT' in the current directory. Next the terminal emulation program WT, start up DATA 3500 and create a new document called 'TEST'. Go in to edit the document. Now choose Ascii File Transfer from the Main Menu, (or press Alt F7) to start file transfer. Enter 'S' for send file. Enter 'TEXT.DAT' for the MS DOS file name. Press F10 (or Exec) to continue. The PC will begin sending the characters from the 'TEXT.FIL' file as if it was being typed in at the keyboard. The file transfer will stop when it reaches the end of the text file, or when you press Alt F7 again.

- **Example 2 - Receiving General Ledger data from the 2200 to the PC disk.**

In this example we will assume that you have some General Ledger package on the Wang 2200, such as TOM or Niakwa. First select Printer Control from the Main Menu or press Alt F8 and answer "Y" to the question "Print To Disk", and fill in the MS DOS Filename as "PRINTER.TXT" (routes file to default drive & directory. User can reroute to another location, i.e. C:\another directory\PRINTER.TXT). Then, as a terminal, start up the 2200 General Ledger and set the program so that the financial statement you want will print on the terminal printer. Instead of printing, the data will be saved in the PC file "PRINTER.TXT". After the data is captured, end the WT program by selecting End Program from the Main Menu, or by pressing Alt F10. The result is that you have on the PC disk a text file filled with your general ledger financial statement. To use this information in a spreadsheet, such as Lotus 1-2-3, it must be converted into DIF format by another program, WTTRAN. (WTTRAN is explained in detail in section 6A.)

- **Example 3 - Capturing a Basic-2 program onto the PC.**

This is a very straightforward example of the power of the file transfer. We will assume that you have a program called 'SAMPLE' that you have written on the 2200, and you would like to try it on the PC. Select Printer Control from the Main Menu (or press Alt F8) and set the terminal printer data to be captured to disk in the MS DOS filename 'SAMPLE.BAS'. You probably will want to translate the characters. Then, load the program into memory, type:

```
'SELECT LIST 204(0)' < RETURN >
```

```
'LIST' < RETURN >
```

The program will then be saved onto disk in the MS DOS file.

- **Example 4 - Sending 'COLOR.BAS' program from the PC to the 2200**

'COLOR.BAS' is the color demonstration program included on the IBM PC disk. It was captured to the disk the same as in Example 3 above. First, as a terminal, press:

CLEAR < RETURN >

Choose Printer Control from the Main menu. Set the printer output to go a MS-DOS file 'COLOR.BAS' . Press F10 (or Exec on a Wang PC) when ready. Now type the Basic2 command:

SELECT LIST 204(0) < RETURN >

LIST < RETURN >

The COLOR program will be read off the PC disk, and typed into the 2200 memory. If you have a color monitor, it might be fun to run the COLOR program once it is loaded onto the 2200.

- **Example 5 - Converting a DATA 3500 Word Processing document to Ascii Text.**

First choose Printer Control from the Main Menu (or press Alt F8) and answer "Y" to the question "Print To Disk" and answer "Y" to the question "Use Translation Table", and fill in the name of the MS DOS file that you want to use. Then, as a terminal, start up DATA 3500 and select the document you want to be printed on a terminal printer. (The type of terminal printer should not support underlines). Then start the document printing. You should see the PC disk drive light flicker as the document is saved to disk in the PC file. After the data is captured, end the WT program by pressing Alt F10 or by choosing End Program from the Main Menu. *WT-DOC would be a better solution in this example because it would preserve formatting codes, see section 7A.*

- **Example 6 - Sending 'WTCOPY.BAS' from PC to 2200.**

This is a very good example because one requirement of WT2 is WTCOPY.BAS must reside on the 2200 to perform the additional file transfers. Now choose Ascii File Transfer from the Main Menu, (or press Alt F7) to start file transfer. Enter 'S' for send file, 'WTCOPY.BAS' for MS DOS Filename, '01' for Timing Pause, '10' for Timing Block, 'N' for Translate, then press F10 (or Exec) to continue. The file transfer will stop when it reaches the end of file, or when you press Alt F7 again.

4G Printer Control or Alt F8

The Wang 2200 series terminal support a "terminal printer", 2200 device address 204. The output that would normally go to this printer may be routed and translated by the WT program in a number of ways.

By choosing Printer Control from the WT Main Menu, (or by pressing Alt F8) an option screen of the printer information is displayed. (Additional online help is available by pressing F2).

WT - Terminal Printer Control		
Ignore Printer Data	Y	Y or N
Use Translation Table	Y	Y or N
Printer Set Up String		
Buffer Physical Printer		Y or N
Send Printer Data to disk		Y or N
MS DOS filename		

Modify Printer Translation Table	
Printer Table Entry #	0 000 <= Entry # <= 255
Printer Table Value	

RETURN - Next Field
F1 - Help
F2 - Repeat
F10 - Execute

Figure 4-8. The Terminal Printer Control Screen

Ignore Printer Data - If you answer "Y" to this question all of the output that would normally go to the printer will be ignored. Answering "N" means that the WT program will send the printer output to the PC printer, or to a MS DOS file.

Use Translation Table - As with the screen and the keyboard, there is a translation table that converts the incoming data from the 2200 to the PC character value(s). Answering "Y" to this question means that you want to translate the characters. Answering "N" means that the data will pass through transparently.

Printer Set Up String - Is a 20 character string that will be sent to the PC printer whenever that device is selected. This is a good way to switch the PC printer into a compressed or enhanced printing mode. To reproduce characters not found on the PC keyboard, enter the decimal value of the character in the format /nnn, where nnn is the decimal value. For example, the escape character would be entered as /027.

Buffer Printer - The MS DOS operating system will automatically buffer printer output in memory, especially if a lot of screen I/O is going on. For most applications, this is very handy. However, some special applications on the 2200 are designed not to be buffered, so you can change this by answering "N".

Send Printer Data to disk - A "Y" means that the WT program will send all printer data to the MS DOS file you designate. "N" means that the PC printer will be used. (Since the WT program uses the standard MS DOS printer handle, you can use the "MODE" command to route printer data to other printer ports than the normal printer PRN or LPT1.)

MS DOS Filename - Is the name of the file that the WT program will send the printer data to, if the send printer data to disk question has been answered "Y". This is also how the user directs where the output file is to reside, i.e. C:*directory**filename*.

The input area marked **Modify Printer Translation Table** is used to change around the default printer table. If you enter the decimal value of the 2200 printer character you want to modify in the Printer Table Entry #, you can then enter up to 9 characters to translate this character to in the Printer Table Value area, then press F10.

Some hints about using the PC printers :

- 1. The PC printer interface is more complex than the Wang 2200 interface, although the cables are similar. If the PC tries to use the printer when the printer isn't ready, the operating system will interrupt with the Abort, Retry, Ignore prompt. We chose to let the operating system do this so that you would still be able to redirect the printer output.
- 2. When printing to disk, the WT program buffers about 1K of data in memory, and periodically writes this down to disk. When it does so, a message is flashed
"Writing printer data to disk ...".
- 3. Some PC printers act strangely when they receive a HEX(0E) character - the character used by Wang for double sized characters. You may want to set the translation table to ignore this character (decimal 14).

- 4. The default printer table is "flat" except for character 13, the carriage return. By "flat" we mean that the received character and the translated character are the same values. The carriage return character is translated to a carriage return and a line feed so that a normal PC printer will work.
- 5. If you use a printer hex sequence that includes HEX(1A) (or decimal value 26, or Ctrl Z), it won't work. This is because MS DOS reserves Ctrl Z to mean End Of File. The WT program will automatically remove this character if it is going to the standard printer device.

4I Terminate & Stay Resident or Alt D

Frequently it is very useful to leave a terminal session for a few minute to check on something on the PC, and then return back to the terminal session.

WT supports a terminate and stay resident function by pressing Ctrl A, and choosing Terminate & Stay Resident, or by pressing Alt D. On the Wang PC you press Ctrl D. This means that the WT program will stay running in the "background" while you exit to the MS DOS prompt. WT will continue to communicate with the 2200 while you run another PC program.

```
WT is still active in background.  
Type EXIT to return to WT at any time ...  
  
The IBM Personal Computer DOS  
Version 3.20 (C)Copyright International Business Machines Corp 1981, 1986  
      (C)Copyright Microsoft Corp 1981, 1986  
  
C>_
```

Figure 4-10. The Terminate & Stay Resident Screen

You may run any other PC program or MS DOS function you wish, except for another communications program. Do not execute WT again while WT is also still in memory. Having two copies of the WT program in memory at one time will cause your PC to lock up.

Terminate and stay resident is a very memory intensive process, since WT will continue to use about 140k of memory in addition to the command processor.

WT assumes that the MS DOS file 'COMMAND.COM' exists on the default disk drive. If it does not exist, an error message will be displayed.

When you are finished and wish to return to the terminal session, enter 'exit' from the MS DOS prompt. This is similar to how the Wang PC implements the DOS Command Processor function from the Wang menu.

5 Special 2200 programming

5A 25th line display

Some third party 2200 terminals allow the user to program what is displayed on the 25th line of the screen. Since 2200 terminals only have 24 lines, and 25 lines are available on most displays now, this is a nice little feature.

To program WT to display your message on the 25th line, a special HEX sequence is used. The sequence is `PRINT HEX(0200xx0Eyy);"message"`, where `xx` is the display/restore byte, and `yy` is the color byte.

The display/restore byte can have two values:

`xx = 0A` to display a message,
`05` to restore to status display

The color byte can have any of eight values:

`yy = 00` bright
`02` bright, blinking
`04` bright, reverse
`06` bright, reverse, blinking
`80` normal
`82` normal, blink
`84` normal, reverse
`86` reverse, blinking

For example, the statement

```
10 SELECT PRINT 005(80) : PRINT HEX(02000A0E84);"HAVE FUN!"
```

will cause the bottom line to display the message HAVE FUN! in reverse video. The statement

```
20 PRINT HEX(0200050E);
```

will erase that message, and restore the normal 25th line status display.

5B Color control

To change the colors used on IBM PCs under 2200 program control, you must print a special HEX sequence in this format:

10 PRINT HEX(02 00 02 fb ur 0E);

where f is the foreground color, b is the background color, u is the underline color, and r is the reverse underline color. The color values all range from 0 to 7. For example, PRINT HEX(02 00 02 62 54 0E) would select brown foreground, green background, magenta underlines, and red reverse underlines. This example is a particularly revolting color combination.

0F at end of sequence acts like a standard one

There is an example program supplied called 'COLOR.BAS' on the IBM PC diskette. To load it into the 2200, use Alt F7 and answer 'COLOR.BAS' for the MS DOS file name to use.

5C Controlling the printer output device

By using one of four different control sequences to the printer device you can alter the files that the printer data is sent to. All the commands are in the form:

SELECT PRINT 204 : PRINT HEX(0200 0E);

All filenames are MS DOS filenames, with drive designations, paths, and extensions.

1. Create a MS DOS file of length 0. (This will erase an existing MS DOS file). This command is:

SELECT PRINT 204 : PRINT HEX(02000C);"filename";HEX(0E);

2. Test for existence of a MS DOS file. This command is:

SELECT PRINT 204 : PRINT HEX(02000B);"filename";HEX(0E);

If the file exists a character '1' is returned, or a character '0' if the file doesn't exist or it is a read only file.

3. Reroute printer output from existing device to an MS DOS file. This command is:

SELECT PRINT 204 : PRINT HEX(020008);"filename";HEX(0E);

Whatever condition the printer device was in before this HEX sequence was sent will be saved, the MS DOS filename will be opened to the end of the file, and any terminal printer data from that point on will be sent to the file untranslated.

4. Restore printer condition. This command is:

SELECT PRINT 204 : PRINT HEX(0200040E); This restores the

printer device to the condition it was before the:

PRINT HEX(020008);"filename";HEX(0E) sequence was sent.

5D Command Lines

The WT program can be invoked with two different types of command lines. One type is for automatic transmission of text files back to the 2200, the other is for sending start up commands to the 2200.

To send text files automatically, start the WT program by typing:

A> WT *filename* < RETURN >

where *filename* is a valid MS DOS file name, with wildcards permitted. The WT program will start up directly in file transfer mode, and send all the MS DOS files that match, and then quit. A demonstration batch file called 'TRANSMIT.BAT' is included on the WT diskette.

To start the 2200 with a command, start the WT program by typing:

A> WT *command* < RETURN >

where *command* can be something of the format 'CLEAR : LOAD RUN "START"'. The WT program will start up, reset the 2200, and type in the command, followed by a carriage return.

5E Setting the MXE board for 10 bit operation

This is a tip from Ed Clark. If you have an MXE board in your 2200, you can get rid of the parity bit being transmitted by altering a system file on the 2200. The advantage of this is that you now would be sending a 10 bit word, instead of an 11 bit word, so that you can use all modems and PBXs available for a 10 data bit word.

To change a Wang terminal to no parity you just turn switch 1 off on the baud rate switch block on the back of the terminal. To change the MXE board, you have to alter one byte in the system file "@MXE0". In that file there is a hex string (14 45 13 C1 15 EA). Change this to (14 44 13 C1 15 EA) and the MXE board will not send the parity bit. This one byte is usually located as the 33rd byte of the 45th sector of the "@MXE0" file. After you change this byte, reboot the 2200. The message "KEY SF" will look messed up, but everything else will run correctly.

6 Utility Programs

6A WTTRAN - Translate Wang 2200 Print Files To DIF

WTTRAN is a utility program supplied with the WT terminal emulation program. WTTRAN is used to convert Wang 2200 printer data that has been captured to disk into data interchange format (DIF). The DIF format is recognized by Lotus 1-2-3 and Symphony, dBase II and III, Visicalc, Supercalc, Multiplan, Multimate, and others.

WTTRAN is invoked with either a command line, as if from a batch file, or by entering the parameters when prompted. The syntax is the same as for Microsoft compilers. The entire command sequence is:

```
A > WTTRAN INFILE OUTFILE MAX_COLUMN BLANKS  
< RETURN >
```

The infile should be a valid existing MS DOS file that contains the Wang 2200 printer data. The outfile, if it already exists, will be erased, and the translated data copied into it. The max_column is the maximum width of a column to use, from 5 to 72 characters. Blanks is answered either Y or N, and is whether or not to include blank columns in the output file.

For example:

```
A > WTTRAN PRINTER.TXT WANGDATA.DIF 12 N < RETURN >
```

will take the printer data in the PRINTER.TXT and convert it to DIF format in the file WANGDATA.DIF, using a maximum column width of 12 characters, and ignoring blank columns.

The command line:

```
A > WTTRAN PRINTER < RETURN >
```

will use the default values infile = PRINTER.TXT, outfile = PRINTER.DIF, max_columns = 9, blanks = N.

To use this data with Lotus 1-2-3 you must then run DIF to WKS from the Translate menu. Choosing to translate by column gives the best results. Also set the spreadsheet to left justify labels.

Typically, most errors occur when either the infile or the outfile is not a valid MS DOS pathname.

WTTRAN breaks the printer data up into different rows and columns using the following logic:

1. A carriage return designates a new row.
2. Two spaces next to each other, or a tab character, designates a new column.
3. Leading and trailing spaces are removed from columns with non-blank data.

6B NIAKWA - Convert Niakwa compiler source to Wang 2200 format

Quite a few people are using the Niakwa Basic2C compiler on the PCs with great results. However, if you modify a program on the PC it is quite difficult to get the source code back onto the 2200. Supplied with both WT and WT2 is a filter program called 'NIAKWA' and a batch file called 'TRANSMIT' that greatly facilitate the transfer of the source format files back to the 2200.

The NIAKWA program accepts an input source code file name, which can have wildcard characters, and outputs a new file with the file name extension of '.WNG'. The new MS DOS file begins with :

(-reset-)

CLEAR

Next is the source program in 2200 text format. Finally, the end of the new WNG file is:

SAVE T "2200 filename"

SCRATCH T "2200 filename"

SAVE T () "2200 filename"

This new file can then be sent to the 2200 using Alt F7, or alternately the WT or WTCOPY program may be invoked with the command line:

A > WT *filename* < RETURN >

Invoking the WT or WTCOPY program in this manner will cause the program to immediately go into Ascii file transfer mode and transmit the text of the file.

A batch file called 'TRANSMIT' is included that demonstrates the effectiveness of this. An example would be if you had developed a new SPEED I module called 'RT', where all the source files on the PC begin with the letters 'RT'. To put this back onto the 2200, first make sure that the default 2200 disk drive does not contain some RT files already that are smaller than the new RT programs.

Invoke TRANSMIT with the command line:

```
A > TRANSMIT RT* < RETURN >
```

All the RT source code in the current PC directory will be transmitted to the 2200 and saved on the current 2200 default disk drive.

6C KEYPRINT - Display keyboard setup

Keyprint is a utility program included on your diskette if there is room. Keyprint displays to the standard MS DOS output device the current defined values of the WT keyboard. It is invoked with a command line of the format:

```
A > KEYPRINT < board definition file > < page width > < RETURN >
```

The default keyboard definition is 'KEYBOARD'. The default page width is 79. For example, the command

```
A > KEYPRINT < RETURN >
```

will display on the screen in 79 columns the current keyboard definition stored in the file 'KEYBOARD.KEY'. The command

```
A > KEYPRINT DATA3500 132 > lpt1 < RETURN >
```

will print on the main print in 132 column format the keyboard definition stored in the file 'DATA3500.KEY'.

7 Using WTCOPY for File Transfer

To use WTCOPY you must first transfer the WTCOPY.BAS file from the WT2 Utility diskette using Ascii file transfers, refer to section 4F example 6. Then you run the WT2 program from the PC and the WTCOPY program 2200 at the same time. Fortunately, this is very simple to do. First, on the PC, start the program by typing

A>WT2 <RETURN>

or

C>WT2 <RETURN>

The WT2 program should start up, and you'll see a registration screen. Press Alt R (or Help on the Wang PC) a couple of times until you see your standard 2200 greeting. Next, start the WTCOPY program on the 2200 by typing (as an example):

SELECT DISK D10 <RETURN>

LOAD RUN "WTCOPY" <RETURN>

From here on, everything is menu driven. The first screen that you see looks like this:

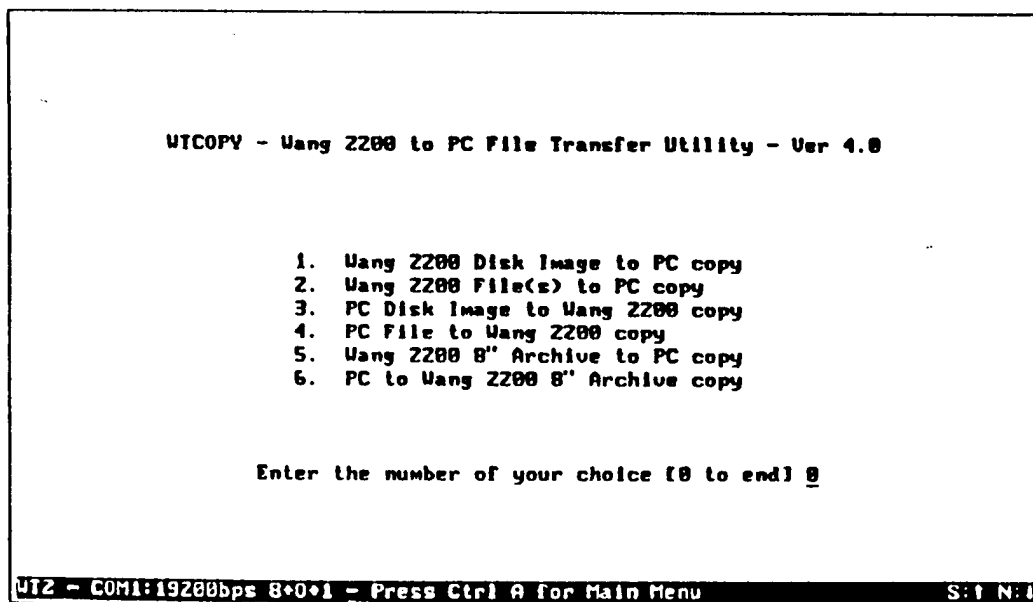


Figure 7-1. The WTCOPY Screen

Choice number 1 is used for transferring entire 2200 disk platters to a single MS DOS file on the PC. Choice 2 is for copying 2200 files to MS DOS files. Copying by file rather than by disk means that on the PC the BASIC-2 files appear as individual files named the same as on the 2200, rather than lumped together in one single file. Choice 3 is for copying MS DOS files that are in disk image over to the 2200. Choice 4 is for copying MS DOS files that are not in 2200 disk image format. Choices 5 and 6 are used in conjunction with *WT-DOC* which consist of *WT2* and *MacSoft Archive Disk Utility*.

The term "Disk Image" may be a new one for you, and it needs a note of explanation. Wang 2200 disks are formatted as a series of 256 byte sectors. Almost all 2200 application software takes advantage of the automatic disk cataloging feature, which creates and uses a catalog index. The catalog index is always the first few sectors on a disk, and it contains information about the size of the catalog area, the size of the index area, and the positions of all the files within the catalog. When *WTCOPY* talks about "Disk Image", it means that whatever data or programs you are copying have or will have some kind of catalog index sectors. If you are copying an entire 2200 disks, the catalog index is already there. If you are copying file by file, the catalog index will be created or removed, depending on the direction of the copy.

When copying single 2200 files to the PC, a one sector catalog index will be added to the front of the 2200 file as it is sent to the PC if disk image format is chosen.

When copying single MS DOS files back to the 2200, the first sector of data is assumed to be the catalog index if the MS DOS file is in disk image format, and so it will be ignored.

In both cases, if disk image format is not chosen, the files will be transferred back and forth without adding or subtracting any catalog index sectors.

If you choose '1' to copy an entire disk, the next screen looks like this:

```
WTCOPY - Wang 2200 to PC File Transfer Utility - Ver 4.0
Wang 2200 Disk Image to PC Copy

1. Wang 2200 Disk Address [blank to end] ***
2. MS DOS File Name
-----
3. Copy Blank Sectors [Y or N] ?      N
4. Maximum number of retries [ > 0 ]  810

WTZ - COM1:19200bps 8*0*1 - Press Ctrl A for Main Menu      S:1 N:1
```

Figure 7-2. The 2200 Disk Image to PC Copy Screen

The MS DOS File name must be a valid MS DOS file name, including if necessary the drive designation and directory. This will be the PC file that the data is stored in. If the copy blank sectors question is answered 'N' then only the catalog area that is filled with programs and data will be copied. Otherwise, the entire catalog area will be copied. The Maximum Error Retries is a parameter that governs how many errors in a row can be received until the WTCOPY program gives up on the transfer. If you want it to try forever, enter '999'.

This utility may take a long time to run, depending on the size of the disk. If possible, the program will compress repeated characters when transmitting to speed the process up.

The raw transmission rate can be calculated by the formula:

$$\text{time (sec)} = (\text{number of sectors}) * (1.0625) * (1.04) * (10) / \text{baudrate}$$

The factor 1.0625 comes from the error checking overhead, the 1.04 factor comes from line turnaround time and check sum calculation. The raw data rate is also slowed down by any extra screen I/O that is also occurring.

Once the file transfer session begins, the status line on the bottom of the PC screen will say 'File Transfer Mode - press Ctrl A to end'. If for some reason you need to abort the session, press Ctrl A. This will place the PC back into terminal mode. In terminal mode the keyboard function is returned to normal.

If you choose '2' to copy only selected files, the next screen looks like this:

```
WTCOPY - Wang 2200 to PC File Transfer Utility - Ver 4.0
Wang 2200 Files to PC Copy

1. Wang 2200 Disk Address [blank to end] ***
2. Wang 2200 File Name [* is wildcard] -----
3. MS DOS Directory
-----
4. Copy Scratched Files [Y or N] ?      N
5. Replace existing DOS files [Y or N]  N
6. Use Disk Image format [Y or N]      Y
7. Substitution characters [blank,?,*,.] ----
8. Maximum number of retries [ > 0 ]   010

WT2 - COM1:19200bps 8+0+1 - Press Ctrl A for Main Menu      S:↑ N:↓
```

Figure 7-3. The 2200 File to PC Copy Screen

This utility will search the disk catalog area for the 2200 files that match the given file name. The '*' is a wildcard character, so that any file that matches the other given characters will be copied.

MS DOS file names have a slightly different convention as far as allowable characters are concerned. The WTCOPY program will use the four characters you enter as substitutes for "*", "?", ".", and blanks.

If Copy Scratched Files is answered 'N', scratched files will not be copied. If the Replace existing MS DOS files question is answered 'N' then duplicate MS DOS file names will not be overwritten.

The MS DOS Directory will be where the file(s) are copied to. The complete MS DOS file name will be made by adding the 2200 file name to the MS DOS Directory name. Additionally, if the transfer is in disk image format, '.BS2' will be added to the MS DOS file name.

The Maximum Error Retries is a parameter that governs how many errors in a row can be received until the WTCOPY program gives up on the transfer. If you want it to try forever, enter '999'.

For example, if you wanted to copy all the TOM General Ledger files to the GLSUBDIR directory on the C drive of the PC, the disk address would be D10 (or the equivalent), the 2200 file name would be GL***** , and the MS DOS pathname would be C:\GLSUBDIR.

If you choose '3' to copy from the PC to the 2200 in disk image format, the next screen looks like this:

```
WTCOPY - Wang 2200 to PC File Transfer Utility - Ver 4.0
PC Disk Image to Wang 2200 Copy

1. Wang 2200 Disk Address (blank to end) 999
2. MS DOS File Name
-----
3. Ready to Scratch Disk (Y or N)      N
4. Maximum number of retries ( > 0 )  999

WTZ - COM1:19200bps 8*0*1 - Press Ctrl A for Main Menu      S: P N: J
```

Figure 7-4. The PC Disk Image to 2200 Copy Screen

This utility assumes that the MS DOS file that you want to copy is in disk image format, i.e. it has some sort of catalog index. This utility will also scratch the 2200 disk address given it, so **BE CAREFUL**.

The MS DOS File name should be in Disk Image format - i.e. with a catalog index. The utility does no checking to make sure that the catalog index is correct.

The Maximum Error Retries is a parameter that governs how many errors in a row can be received until the WTCOPY program gives up on the transfer. If you want it to try forever, enter '999'.

If you choose '4' to copy from the PC to the 2200, the next screen looks like this:

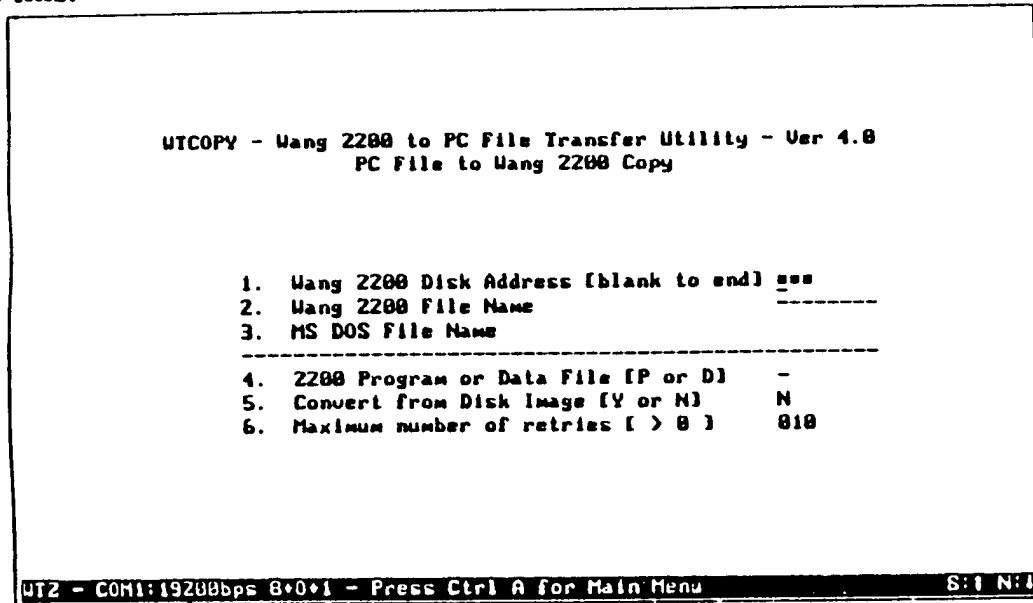


Figure 7-5. The PC File to 2200 Copy Screen

This utility only copies one file at a time from the PC to the 2200. The file transfer rate is also slower going back to the 2200 because the PC has to send the HEX values of any characters that are not represented on the 2200 keyboard. A 2200 file with the given file name will be created. If it already exists, you are prompted if you want to copy over it.

Because the 2200 makes a distinction between program and data files, and the PC does not, you must identify which type of 2200 file it is by entering a 'P' if it is a program, or 'D' if it is data.

Answering 'N' to the question "Convert from Disk Image format" assumes that the file as is exists on the PC is an exact copy of a 2200 file, and does not contain a catalog index. If the file is in disk image format, answering 'Y' to convert from disk image format will strip off the disk catalog index from the PC file as it is transferred.

The Maximum Error Retries is a parameter that governs how many errors in a row can be received until the WTCOPY program gives up on the transfer. If you want it to try forever, enter '999'.

7A Using MacSoft Archive Utility

There are two main word processing programs for the Wang 2200, DATA 3500 from TOM Software and Wang 2200 WP from Wang Labs. DATA 3500 word processing software also has two different file formats depending on the version. However, both word processing programs can read and write documents in Wang "Archive" format. Archive format is used by Wang to exchange documents on diskette between different Wang machines such as the Wang VS, OIS, and Alliance.

It turns out that the only diskette that the 2200 can use that other Wang machines can also understand is single side hard sector 8" diskettes. The disk drive to make those diskettes was only used on the earliest 2200 machines. For instance, the disk drive used in the LVP and CS model 2200s cannot be used to make archive disks for other Wang minis.

However the *MacSoft Archive Disk Utility* can format, read, and write the 5 1/4" 2200 diskette format. In addition, the *MacSoft Archive Disk Utility* can also prepare, read, and write 2200 "Disk Images" that are in archive format.

The term "Disk Image" refers to a type of file transfer done by the MacSoft WTCOPY utility. A "Disk Image" file is a single MS DOS file that corresponds to a 2200 disk platter. For example, you might have an MS DOS file called 'ARCHIVE.BS2' that contains all the information that was stored on 2200 disk 'D10'.

Therefore, if you have a 5 1/4" floppy disk drive on your 2200 you can directly read and write documents in archive format on your PC. If you do not have a 5 1/4" drive you can still exchange documents by using the MacSoft WTCOPY utility to move the disk images back and forth.

To move documents from the 2200 to the PC takes three steps, i.e.

1. Convert the 2200 documents to archive format using a 2200 utility.
2. Transfer the archive documents to the PC either by 5 1/4" diskette or by using MacSoft WTCOPY.
3. Convert the archive document to the PC format you want using *MacSoft Archive Utility*.

To move the documents from the PC back to the 2200 you need to just the reverse, i.e.

1. Convert the PC documents to archive format using *MacSoft Archive Utility*.
2. Transfer the documents either by 5 1/4" diskette or by MacSoft WTCOPY.
3. Convert from archive format to 2200 format using a 2200 utility.

The supported PC formats are currently : MultiMate, WordStar, Word Perfect, Wang PC, Microsoft Word, DisplayWrite, and Ascii Text.

7B Converting 2200 Documents to Archive Format

If you are using DATA 3500 the following directions explain how to create an Archive disk. (The directions for Wang 2200 WP are similar).

The first thing you must do is check to make sure that a disk unit number exists that you may write over with documents. To do this you need to run the 2200 program "WPCUSTOM" or on earlier versions of DATA 3500 the program "TECUSTOM". One of the prompts is for number of disk units. You may have to increase this. On the next screen is a list of the disk unit number, 2200 disk addresses, and the number of index sectors and catalog area. You need to have at least one disk that you can scratch. A good catalog index area to use is 28 sectors, and a total catalog size is 1024 sectors.

Once you have established a disk unit number that you can overwrite with documents, run DATA 3500. Choose 'Special Functions' from the main menu. There should be two functions on this menu called 'Write to Archive Disk' and 'Read from Archive Disk. Choose 'Write to Archive Disk'.

Next you are prompted to create an Archive disk. Choose this, and select the type of archive disk you have. If you have a 5 1/4" drive, choose that type. Otherwise, choose the 8" SSSD format even if you don't have that kind of disk drive.

REMEMBER - The disk unit you choose will have it's disk completely erased - so when you choose a disk unit:

MAKE SURE YOU MEAN IT !!!

Finally enter the document names that you want to transfer. You might need to change the default volume if the documents you want to move are not in the current one.

7C Transferring Archive Documents to the PC

If you created a 5 1/4" archive disk you just have to stick the diskette in your PC and run the *MacSoft Archive Disk Utility*. Otherwise you will have to run the MacSoft WTCOPY utility to transfer the documents as a disk image.

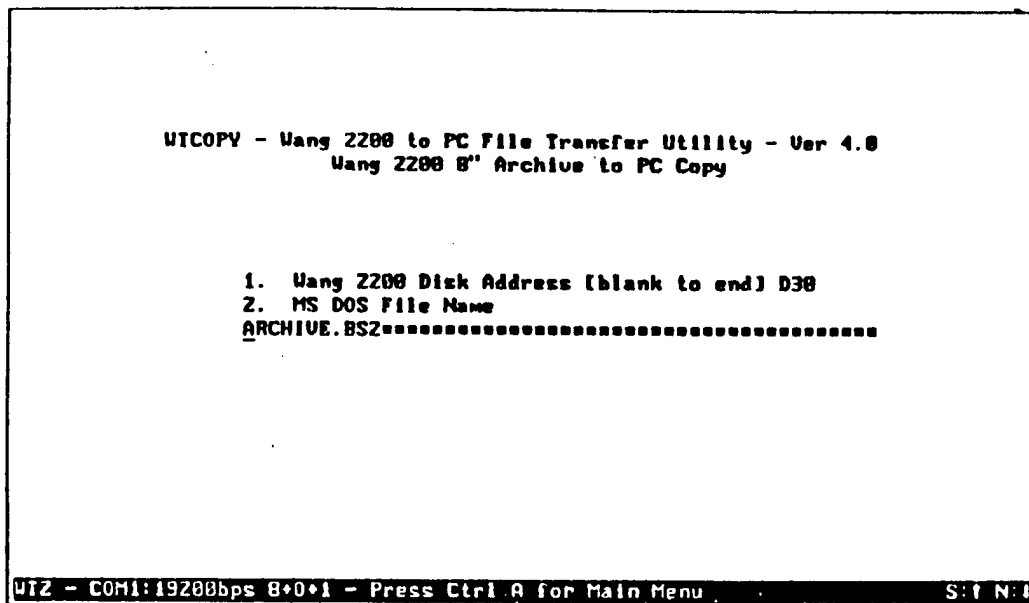


Figure 7-6. The Archive to PC Copy Screen

To transfer the disk image, run the WTCOPY utility from a PC using MacSoft WT2 Terminal Emulation, and choose item '5'. Archive Disk Image to PC Copy'. Enter the 2200 disk address and the PC file name to use (the default name is 'ARCHIVE.BS2'). Press Return to start the transfer. It should take about 8 minutes to transfer 256k of documents.

For PC to Archive Disk Image Copy select item '6' and fill in prompts.

7D Converting 2200 Archive Documents

Once the 2200 documents are in a format the PC can understand you need to run the *MacSoft Archive Disk Utility* to convert them. If you are using the 5 1/4" archive diskettes the MacSoft Archive Utility will automatically sense that they were done on the 2200 and will do the correct conversion. If you are converting archive documents from a disk image file you need to specify the name of the disk image.

The Archive Utility will show you a list of documents to choose from. You will probably want to push function key F1 to select all of them. The Archive Utility will read each document and convert it to the PC format you want.

7E Programming with WTCOPY

There are ten subroutines used in the WTCOPY program on the Wang 2200. These ten subroutines can be incorporated into your own programs, if you desire. They use only the variables beginning with 'M' to minimize any conflicts with your programs.

'100 - Begin File Transfer Session

Purpose: To set up both the Wang 2200 and the PC for a series of file transfers.

Parameters: GOSUB'100

Return: M = 0 if successful, M = 1 if PC not ready,
M = 2 if already in file transfer mode,
M = 5 if operator interrupted.

Example: GOSUB'100

Notes: This subroutine verifies that the correct software is running on the PC.

'101 - Create MS DOS file

Purpose: To create a new file on the PC with the given pathname.

Parameters: GOSUB'101(*pathname*)

Return: M = 0 if successful, M = 1 if already exists,
M = 2 if transmission errors, M = 3 if illegal MS DOS pathname, M = 5 if operator interrupted

Example: GOSUB'101("C:\SUBDIR\FILENAME")

Notes: If any other files were open when this subroutine was called, they will be closed normally. The pathname must be 63 characters or less.

'102 - Open MS DOS file for writing

Purpose: To overwrite an existing MS DOS file with the given pathname.

Parameters: GOSUB'102(*pathname*)

Return: M = 0 if successful, M = 2 if transmission error,
M = 3 if illegal MS DOS pathname, M = 4 if file name doesn't exist, M = 5 if operator interrupted.

Example: GOSUB'102("C:\SUBDIR\FILENAME")

Notes: If any other files were open when this subroutine was called, they will be closed normally. The pathname must be 63 characters or less. The existing file will be erased and it's disk space recovered.

'103 - Open MS DOS file for reading

Purpose: To read sector by sector an existing MS DOS file with the given pathname.

Parameters: GOSUB'103(*pathname*)

Return: M = 0 if successful, M = 2 if transmission problems, M = 4 if the file name does not exist, M = 5 if operator interrupted, M = 7 if file size is greater than Wang 2200 maximum (65536 sectors). If M = 0, M1 is the size of the MS DOS in units of Wang 2200 sectors (256 bytes).

Example: GOSUB'103("C:\subdir\filename")

Notes: If any other files were open when this subroutine was called, they will be closed normally. The pathname must be 63 characters or less. The last sector received may be padded with HEX(00) to round it off to an even sector.

'104 - Write sectors to the PC with error checking

Purpose: To write sectors to the PC disk with error checking for transmission problems. The maximum number of sectors is 10.

Parameters: GOSUB'104(*display type*, *number of sectors*)

Return: M = 0 if successful, M = 1 if file not open for writing, M = 2 if transmission problems, M = 3 if MS DOS file error, M = 5 if operator interrupted.

Example: GOSUB'104(1)

Notes: The display type is 0 = all data, 1 = nothing. The data must be packed in the sector buffer M1\$(256)1.

'105 - Rewrite the same sector to the PC with error checking

Purpose: To re-transmit the last sector data again if there were any transmission problems. Does not increment the block counter.

Parameters: GOSUB'105

Return: Same as '104

'106 - Read sectors from the PC with error checking

Purpose: To read sectors from the PC disk with error checking for transmission problems.

Parameters: GOSUB'106

Return: Sector data returns in M1\$(). M = 0 if successful, M = 1 if file not open for reading, M = 2 if transmission problems, M = 3 for MS DOS file error, M = 5 if operator interrupted, M = 6 if the end of the MS DOS file has been reached. M1 returns the number of sectors.

Example :GOSUB'106

'107 - Re-read sectors from the PC with error checking

Purpose: If transmission errors occur, this subroutine allows the same sector data to be re-transmitted until no errors occur. Does not increment the block counter.

Parameters: GOSUB'107

Return: Same as GOSUB'106

'108 - Close MS DOS file

Purpose: Close any open MS DOS files after reading or writing.

Parameters: GOSUB'108

Return: M = 0 if successful, M = 1 if no files open, M = 2 if transmission error, M = 3 if MS DOS file error, M = 5 if operator interrupted.

Example: GOSUB'108

Notes: Unlike Wang 2200 files, MS DOS files that are opened for writing must be closed after being written to, or else the size of the file becomes 0 bytes, and all the data has to be recovered with some utility (such as the Norton Utilities).

'109 - End file transfer session

Purpose: To signal the PC that the file transfer session has ended.

Parameters: GOSUB'109

Return: None.

Example: GOSUB'109

Notes: This subroutine signals the PC to begin acting as a normal 2200 terminal again with normal screen and keyboard controls.

7F Error Checking Protocol

The error checking protocol used by the WTCOPY subroutines is a modification of the standard Xmodem protocol invented by Ward Christiansen, with a few enhancements to take advantage of the capabilities of the Wang 2200.

All data that is transferred is sent to 2200 device address 204, or the terminal printer. This leaves device address 005, the terminal screen, for use by the Wang 2200 programmer for operating messages and input.

Each group of 2200 sectors of 256 bytes to be transmitted is put into a single data block. The data blocks are wrapped front and back with the error checking bytes to form the final communications block.

8 Program Notes

After writing this terminal emulation package we have a lot of respect for the engineers at Wang. The Wang 2200 is a solid little mini-computer that is extremely fast and reliable, and takes advantage of local intelligence whenever possible. Imagine writing a complicated operating system and feeling confident enough to put large chunks of it burned into PROMs.

One thing we found out when writing this program was that Wang uses compression techniques to speed up its data transmission rates. This is done in the following manner: an indicator byte, with decimal value 251, is followed by a count byte and, optionally, a value byte. If the count byte is less than 96, the Wang terminal writes out the value byte repeated count number of times. In other words, ten "A"s in a row are sent from the 2200 CPU as 251, 10, 65. If the count is greater than 96, but less than 192, there is no value byte because the value is assumed to be 32, a space. The spaces are repeated (count - 96) times. So ten spaces are sent out as 251, 106. Finally, a count byte greater than 192 means a special code, such as switch output device, or print slowly. For example, sending out a 251, 241 tells the terminal to send the following characters to the terminal printer, instead of to the screen.

Another interesting thing is that the 2200 Mux board keeps track of where the cursor is at any time on the screen, and sends out carriage returns and linefeeds when it is necessary to move the cursor to a new position. For example, if the cursor is in column 80 already, and two "A"s are printed, the Mux board will actually send out 65, 13, 10, 65. The first 65 is the "A" in the last column, the next 13 is the carriage return to bring the cursor to column 1, then next 10 is the linefeed to bring the cursor to the next line, and finally the 65 is second "A". This is different from the way other serial terminals work.

When output is routed to a terminal printer, the Wang CPU changes the line feed after any carriage returns to a decimal 0 character. This makes PC printers continue to write over the same line, since a PC printer requires a line feed to advance to the next line. Therefore, the WT printer translation table changes a carriage return into a carriage return and a linefeed.

Wang handles extended keystrokes in a different way as well. Pressing some special function keys on a Wang terminal sends out two characters instead of one. The first character has the decimal value of 253, and the second character represents the function key value. The PC also sends out two characters when a function key is pressed, a character with value 0, and then a character whose value ranges from 3 to 132.

Because of the different ways the two machines address the cursor, send extended keystrokes, and route output the WT program uses translation tables for every character that is transmitted or received. These translation tables are stored on disk in the files "KEYBOARD.KEY", "SCREEN.SCN", and "PRINTER.PRT".

Please send any suggestions for improvements to:

MacSoft
2920 "F" Street, Suite E14
Bakersfield CA 93301

or call

(805) 324-4291

Table 1 - 2200 Special Key Values

2200 Key	Value	IBM PC	Wang PC
(-reset-)	018,249,248 ^{12, F9, F8}	Alt R	Help
(-sf-0-)	253,000	Home	F1
(-sf-1-)	253,001	F1	F2
to			
(-sf-10-)	253,010	F10	F11
(-sf-11-)	253,011	Ctrl F1	F12
to			
(-sf-20-)	253,020	Ctrl F10	F21
(-sf-21-)	253,011	Shift F1	F22
to			
(-sf-30-)	253,030	Shift F10	F31
(-sf-31-)	253,031 ^{1F}	Alt F1	F32
(-enter-)	013 ^{0D}	Return	Return
(-tab-)	253,126 ^{7E}	Tab	Tab
(-btab-)	253,127 ^{7F}		
(-edit-)	189 ^{6D}	Esc	Cancel
(-sedit-)	253,080 ⁵⁰		
(-prev-)*	253,066 ⁴²	PgUp	Prev
(-sprev-)*	253,082 ⁵²		
(-nscrn-)*	253,067 ⁴³	PgDn	Next
(-snext-)*	253,083 ⁵³		
(-erase-)	253,072 ⁴⁸	End	Erase
(-serse-)*	229 ^{E5}		
(-delet-)*	253,073 ⁴⁹	Del	Delete
(-sdel-)*	253,089 ⁵⁹		
(-insrt-)	253,074 ^{4A}	Ins	Insert
(-recal-)*	253,079 ^{4F}		
(-dtab-)*	253,096 ⁶⁰		
(-cont-)	253,132 ⁸⁴	Alt C	
(-halt-)	019 ¹³	Alt H	Ctrl X
(-clear-)	129 ⁸¹	Alt Z	
(-load-)	161 ^{A1}	Alt L	
(-run-)	130 ⁸²	Alt G	Exec
(-gl-)*	253,124 ^{7C}		
(-sgl-)*	253,125 ^{7D}		
Load,Run		Alt S	Shift Exec
Underline	254,160 ^{A0}		

Table 1 (cont) - 2200 Special Key Values

<u>2200 Key</u>	<u>Value</u>	<u>IBM PC</u>	<u>Wang PC</u>
Dash	045		
[091		
]	093		
(-left-)*	253,077	4D	
(-sleft-)*	253,093	5D	
(-right-)*	253,076	4C	
(-srght-)*	253,092	5C	
(-up-)*	253,070	46	
(-sup-)*	253,086	56	
(-down-)*	253,069	45	
(-sdown-)*	253,085	55	

Table 2A IBM PC Character Set Differences

2200 Char	IBM Char	Description
16	131	a hat
17	136	e hat
18	140	i hat
19	147	o hat
20	150	u hat
21	132	a umlaut
22	137	e umlaut
23	139	i umlaut
24	148	o umlaut
25	154	u umlaut
26	133	a prime
27	138	e prime
28	151	u prime
29	142	A umlaut
30	153	O umlaut
31	154	U umlaut
94	24	up arrow
95	27	left arrow
96	248	degree
123	21	annotation
124	156	pound note
125	138	e dot
126	135	c mark
127	155	cent sign
128	32	space
129	4	diamond
130	16	tab
131	17	return
132	26	right arrow
133	28	decimal tab
134	179	vertical line
135	250	double dot
136	39	prime
137	96	left prime
138	94	accent

Table 2A (cont) IBM PC Character Set Differences

2200 Char	IBM Char	Description
139	254	square
140	19	double exclaim
141	18	vert dbl arrow
142	255	beta
143	20	paragraph

Table 2B Wang PC Character Set Difference

<u>2200 Char</u>	<u>PC Char</u>	<u>Description</u>
16	160	a hat
17	172	e hat
18	195	i hat
19	185	o hat
20	229	u hat
21	163	a umlaut
22	175	e umlaut
23	198	i umlaut
24	204	o umlaut
25	232	u umlaut
26	161	a prime
27	173	e prime
28	230	u prime
29	147	A umlaut
30	188	O umlaut
31	216	U umlaut
96	128	degree
123	222	annotation
124	240	pound note
125	173	e dot
126	169	c mark
128	32	space
135	249	double dot
136	247	tick mark
137	248	left prime
138	246	accent
139	135	square
140	136	double exclaim
141	137	vert dbl arrow
142	238	beta
143	223	paragraph

Table 3A Alternate 2200 - IBM PC Character Set Difference

<u>Wang Char</u>	<u>IBM Char</u>	<u>Description</u>
146	30	triangle
147	31	triangle
148	25	down arrow
149	170	mark
150	251	square root
151	250	degree
152	123	bracket
153	125	bracket
154	127	empty triangle
155	254	box
156-191	32	blank
192-207	255	blank
208-223	221	left half
224-239	222	right half
240-255	219	filled

Table 3B Alternate 2200 - Wang PC Character Set Difference

<u>2200 Char</u>	<u>PC Char</u>	<u>Description</u>
144	155	single dot
146	---	triangle
147	---	triangle
148	151	down arrow
149	---	mark
150	---	square root
151	128	degree
152	123	bracket
153	125	bracket
154	---	empty triangle
155	170	box
156-191	32	blank
192-207	32	blank
208-223	---	left half
224-239	---	right half
240-255	---	filled

Table 4 Wang PC Bios Changes

The Wang PC BIOS has been modified slightly with the Wang Font Utilities to enable the use of the 2nd function keys and also to display character graphics.

Here is a list of the keys and the values that are changed:

<u>Keystroke</u>	<u>Original Value</u>	<u>New Value</u>
2nd F1	FN 128	FN 001
2nd F2	FN 129	FN 002
.....
2nd F12	FN 139	FN 012
2nd F14	FN 141	FN 014
2nd F15	FN 142	FN 015
2nd F16	FN 143	FN 016
2nd Shift F1	FN 144	FN 017
2nd Shift F2	FN 145	FN 018
.....
2nd Shift F12	FN 156	FN 028
2nd Shift F14	FN 141	FN 030
2nd Shift F15	FN 142	FN 031
2nd Shift F16	FN 143	FN 032
2nd 0	48	FN 48
2nd 1	49	FN 49
.....
2nd 9	57	FN 57

Also four displayed characters were changed:

character 176 to a filled box,
character 177 to 1/3 bottom filled,
178 to 2/3 bottom filled,
179 to 2/3 top filled.

