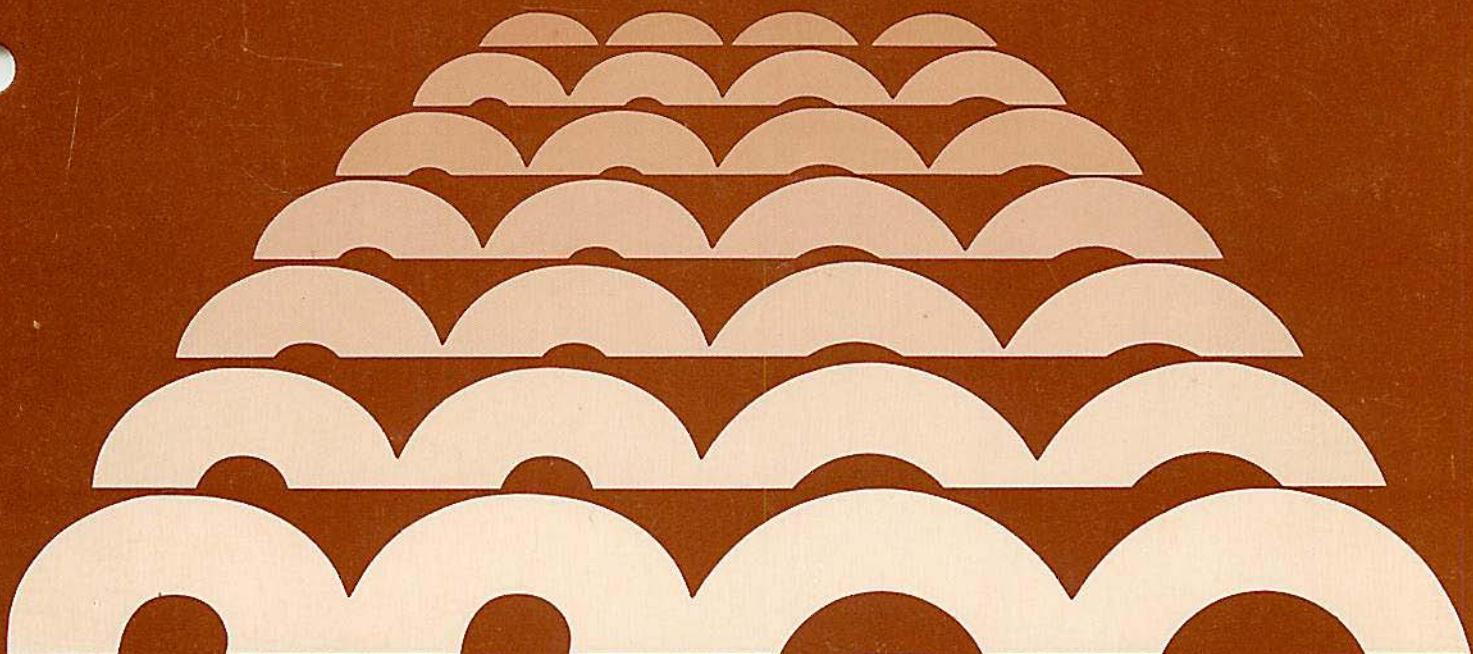# ASYNCHRONOUS I PACKAGE
OPERATORS GUIDE

(INTERIM)

2200

ASYNCHRONOUS I PACKAGE OPERATORS GUIDE

(INTERIM)

EMULATION PROGRAMS

TELETYPE

2741

ASYNCHRONOUS I PACKAGE

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CHAPTER 1 OVERVIEW

1.1 SUMMARY

With either the Model 2228B Communication Controller or the Model 2227B Communications Controller, a suitable modem, and the Asynchronous emulator package, a Wang computer system can transmit and receive data over telephone lines. Thus, the system can be linked readily to any host computer which communicates with terminals having the characteristics of a teletype or 2741.

1.2 THE MODEL 2227B AND 2228B COMMUNICATIONS CONTROLLERS

Physically, the Model 2228B communications controller is a double-card controller which plugs into any I/O slot in a System 2200 Central Processing Unit (CPU). To operate the controller and a Wang emulator program associated with the controller, the CPU must include, as a minimum, the $GIO statements in its BASIC language instruction set. The statement is standard in several CPU models and available in the form of an option for other models.

The Model 2228B controller has its own microprocessor and memory. Since space is reserved in memory for multicharacter input and output buffers, data transmission/reception operations performed by the controller with respect to a modem can overlap data input/output operations performed by the CPU with respect to the peripherals used for a communications application. The overlap feature increases data throughput capabilities and makes it possible for storage of received data during online operations.

The 2227B Communication Controller is physically like the 2228B Communications Controller, and again, the $GIO instruction must be included in the CPUs BASIC language instruction set. The 2227B Controller has space reserved in memory for multicharacter input and output buffers allowing for data transmission/reception operations performed by the controller with respect to a modem overlapping data input/output operations performed by the CPU with respect to the storage peripherals in use. The overlap feature increases throughput and allows online storage of received data.

The 2227B Communications Controller always supports asynchronous communications transmission and reception. The 2228B communications controller in conjunction with the Wang Asynchronous package, also provides asynchronous communications transmission and reception. Unlike the 2227B, the 2228B also supports a variety of synchronous protocols.

1.3 INSTALLATION

The following applies to both the 2227B and the 2228B Communications Controllers.

Whether the communications controller is being added to an already installed Wang system or is a part of a system yet to be set up, installation of the controller is the responsibility of a Wang service representative who should be notified when the controller arrives.

After the controller is inspected, diagnostically checked, and installed in the CPU, one end of the cable supplied with the controller is plugged into the connector on the controller. Normally, the other end of the cable is plugged into a modem.

Installation of a modem is not the responsibility of a Wang service representative.

1.4 MODEM CONSIDERATIONS

A modem may be rented from the telephone company serving the locality where a Wang system is installed or may be purchased from any one of several modem vendors. In either case, installation of a modem must be scheduled with the local telephone company since modems purchased from a vendor must be connected to the telephone network via telephone company installed data access arrangements (DAA). DAA's consist of a telephone handset and modem interface rented from the telephone company.

Normally, a modem or DAA is wired permanently to a wall; therefore, it is important to know the planned location of a Wang computer system before a telephone company representative arrives to install the equipment. Keep in mind that subsequent relocation of the Wang system any great distance may necessitate having the telephone company relocate the modem or DAA.

Acoustic couplers may be used in lieu of modems.

1.4.1 Compatible Modems

With either of the communications controllers, the following dial-up modems (or their equivalents) can be used.

Bell 103A Full duplex — up to 300 baud
Bell 103J Full duplex — up to 300 baud (replaces 103A)
Bell 202C Half duplex — up to 1200 baud
Bell 202S Half duplex — up to 1200 baud (replaces 202C)
Bell 212A Full duplex — 0-300 and 1200 baud.

An acoustic coupler may be used in lieu of 103A modem.

NOTE:

Ensure modem compatibility with the host computer before ordering.

1.4.2 Using a Null Modem (2227N)

If a Wang system is to be used as a terminal to another computer located in the same building within 124 feet, a modem is not required. Instead, an interface device called a "null modem" is available from Wang Laboratories for direct connection of two compatible systems. The null modem is a small unit with connectors on two sides.

For a "direct hookup" installation, a cable is connected between the communications controller in a Wang system and one side of the null modem. Also, a second cable is connected between the other side of the null modem and the other computer or terminal.

CHAPTER 2   CONFIGURATION GENERATION

2.1   GENERAL OPERATION

The Asynchronous diskette contains two emulators. To gain access to all the emulators, a "front-end" parameter selection module has been added. The function of this module is to:

1. Choose an Emulation (Teletype or 2741).
2. Specify User Parameters.
3. Save these Parameters in a disk file.
4. Allow the loading of an Emulator given a set of user-defined parameters (hereafter referred to as a *"configuration"*).

Upon entry to the package, the user has the option of *loading* a configuration, or *generating* a configuration. If the user chooses to generate a new configuration, the user is prompted for a choice of emulators, followed by a series of questions unique to the given emulator. These responses are then *saved* on disk under a user-prescribed description and control is returned to the beginning of the program. From here, the user may generate another configuration or load the configuration just defined (displayed in a menu under the user-prescribed description).

The question and answer procedure is unique yet provides easy display and operator flexibility. All questions are performed on one or two screens allowing both forward and backward "walking" through the questions.

To run the system:

1. Place the program diskette in the fixed drive 310.
2. Key CLEAR (EXEC)
3. Key SELECT DISK 310 (EXEC)

if on a Wang 2200, WCS, or PCS II:

4. Key LOAD DC F "START" (EXEC)
5. Key RUN (EXEC)

or if on a system 2200VP or 2200MVP

4. Key LOAD RUN (EXEC).

The CRT will blank and a menu will appear.

display

> WANG 2200 TELECOMMUNICATIONS EMULATORS   (date)
> TO OPERATE – Press S.F. KEY or DIGIT corresponding to name,
> or position # via RETURN or BACKSPACE and key RUN, DELETE or RECALL
>
>   # '1 CREATE A NEW CONFIGURATION

At this time the user must *create a configuration* to be saved on disk. This procedure involves the specification of parameters unique to his system. To CREATE A NEW CONFIGURATION key RUN or SF'1.

2.1.1   Emulator Selection

The CRT will blank and a menu will appear. (Note: On mini-diskette versions this menu will vary depending on which diskette is loaded. If only one emulator exists on that diskette, the screen will automatically proceed to the next step.)

display

>   # WHAT EMULATION?
> TO OPERATE – Press S.F. KEY or DIGIT corresponding to name, or
> position # .via RETURN, SPACE or BACKSPACE and key RUN
>
>   # '1 for Teletype
>   '2 for 2741

The user then chooses the desired emulator by pressing the appropriate Special Function key. The corresponding set of questions is then loaded and presented to the user in the following format:

display

PARAMETER	CURRENT SELECTION
# (Question #1)	(selected option from below)
(Question #2)	(selected option from below)
—etc.—	—etc.—

OPTIONS FOR – (Selected Question)	ACTIVE KEYS
1 (description 1)	—DIGITS—
2 (description 2)	—RETURN—
3 (description 3)	—BACKSPACE—
—etc.—	—RECALL—
	—RUN—

2.1.2 Parameter Selection

The # is always located to the left of the selected question. It is moved using the RETURN or BACK-SPACE key. The options for the selected question are displayed in the lower left corner of the screen. An option is chosen for the current question by keying the appropriate DIGIT for the option. When keyed, the current selection field to the left of the question will change to the corresponding description. By "walking'" through the questions and making the desired selections a configuration is generated. When all parameters are as desired, the RUN Key is pressed and control proceeds to the next screen. Note that the RUN key is only active when the first Question is selected. This forces the user to answer all questions, necessary because some questions are optional depending on the selection of previous replies. The following keys allow easy selection of the parameters:

DIGITS —   Allow selection from one option to another within a given question.

RETURN —   Advances to the next logical question. (Note that some questions are only asked based on previous replies).

BACKSPACE —   Backspaces to the previous question.

RECALL('15) —   Resets all the selections to their initial setting. This is especially useful when in RECALL mode.

RUN —   Active only when positioned at the first question, it is used when all the desired selections shown are correct. The prompting then proceeds to the next set of questions or the SAVE/RUN phase.

2.1.3 Saving a Configuration

The selection of parameters may take one or two screens, depending on the emulator chosen. After the RUN key is pressed on the *last* parameter screen, the user is prompted for saving or loading the configuration.

display

```
SAVE IT OR RUN?
TO RUN PRESS S.F. KEY OR DIGIT CORRESPONDING TO NAME OR
POSITION VIA RETURN AND BACKSPACE AND KEY RUN

  #    '1 FOR RUN CREATED VERSION
       '2 FOR SAVE CREATED VERSION
```

The following keys are then active:

'0   to abort and return to 'START'.

'1   to proceed to the loading of the specified emulator and parameters. The configuration is not saved on disk for later loading.

'2   to save the parameters on disk for later loading. The user is prompted for a description which is later displayed on the main menu.

display
SAVE THE PARAMETERS YOU HAVE GENERATED
EXISTING CALLS —

'2   FOR (user described calling sequences)
●
'n

THESE PARAMETERS

Emulator Type   =   (emulator name)
Input Capability   =   (input module description)
Output Capability   =   (output module description)

Key 1-40 byte   ....I....1....I....2....I....3....I....4
DESCRIPTION   =?   (prompt for user description)

Respond with desired description or SF '0 to abort configuration and return to main menu. Duplicate names are allowed since all configurations are positional and referenced by number.

2.1.4 Loading a Configuration

Once the user types a 40-byte description and keys RETURN, the main menu reappears.

display

WANG 2200 TELECOMMUNICATIONS EMULATORS Release 4.0. 4/07/78
TO OPERATE – Press S.F. KEY or DIGIT corresponding to name, or
position # via RETURN or BACKSPACE and key RUN, DELETE or RECALL

'1   CREATE A NEW CONFIGURATION
     '2   LOAD user defined configuration
     '3   LOAD another user defined configuration

To begin emulation using one of the above configurations the user keys function key 2 through n. The emulator is then loaded in and the emulation begins. Refer to the sections entitled "Operation of the Emulators" for operating instructions for a particular emulator. In the loading process, the parameters selected at configuration time will be displayed.

2.1.5 Other Functions

From the main menu, other special functions to maintain configurations may be performed. They include:

Deletion   —   a configuration may be deleted by positioning # to a desired configuration (using the SPACE, RETURN or BACKSPACE Key) and keying SF'9 (DELETE). The configuration is then deleted from both the menu and disk. Keying '9 from the first position will force the loading of the 9th configuration (if defined).

Recall   —   a configuration may be modified by keying SF'15 (RECALL) followed by the numeric key corresponding to the configuration to be modified. The parameters are then loaded and the parameter selection screen appears. When the parameters are changed, key RUN just as when creating a new configuration. The RUN/SAVE screen will appear. Specify SAVE and type a user description. It may be the same name or different. The old configuration is *not replaced* but *added.* To replace, simply delete the old configuration. (Note: duplicate names are allowed.)

Clear	—	all existing configurations may be deleted by keying RESET and SF'31. When RUN is again keyed, all configurations are deleted.
Setting CRT Length	—	the default CRT length is 64. If 80 column is desired, a modification to the START module is required. In the module START on line 12, change L=64 to L=80. L is a common variable and referenced by all the emulators; therefore, it need only be changed once in the start module.

2.2 TELETYPE CONFIGURATION OPTIONS

When Teletype emulation is selected for configuration from WHAT EMULATION?, the following parameters may be selected:

PARAMETER	SELECTIONS
?1 BAUD RATE	1 = 110 2 = 150 3 = 300 4 = 1200 5 = 7200 (null-modem)
?2 PARITY	1 = Even 2 = Odd 3 = None
?3 BITS PER CHARACTER	1 = 7 2 = 8
?4 STOP BITS	1 = 1 2 = 1.5 3 = 2
?5 MODEM OPERATION	1 = Full Duplex 2 = Half Duplex
?6 (HOST ECHO EACH CHARACTER) — asked if ?5 = 1, Full Duplex)	1 = No 2 = Yes

When RUN is keyed, a second screen will prompt for:

PARAMETER	SELECTIONS
?1 SEND FROM	1 = Keyboard only 2 = Disk
?2 (HOST REPLIES WITH) — asked if ?1 greater than 1	1 = LF 2 = LF — other 3 = Nothing
?3 RECEIVE TO	1 = CRT/line printer 2 = Disk, Dedicated 3 = Disk, Multiplexed
?4 (DISK ACCESS METHOD) — asked if disk is specified	1 = via Search, System over 8K 2 = via On Error, System to 8K

Meanings of Teletype Parameters:

Baud Rate	Select the desired baud rate. This is a function of the other device which is being communicated with and the modem being used.
Parity	Indicates whether a parity bit is included in each character sent and whether it is odd or even parity.
Bits per Character	Indicates the number of *data* bits excluding the start, stop and parity bits.
Stop bits	A stop bit is used to terminate a character. Normally 1 stop bit is used (i.e., a termination level for a time interval equal to one bit). Optionally, the stop bit may be longer as 1.5 or 2 (twice) the normal interval.
Modem Operates	Normally full duplex is used for 300 bps and half duplex for 1200 bps. It is, however, a function of the modem and the receiving device.
Host Echo Each Character	If in full duplex, some host will echo each character sent. If this is done, specify Yes (#2).
Send From	If sending from disk is required, specify #2, which allows both keyboard and disk. If no disk send is required, specify #1.
Host Replies With	When sending from disk, the emulator waits between records before sending the next record. If the host does not reply to a record (terminated by a CR), specify #3. If reply is with 1 character, specify #1; if more than one character, specify #2.
Receive to	If disk receive is not required, specify #1. If disk receive is to be active, select #2 or #3, depending on the configuration being used. On an MVP or multiplexed disk configuration, use #3, else #2.
Disk Access Method	If disk is specified, the emulator takes over 8K of memory. To reduce this to 8K, the on error method may be used, which will terminate on an error if a file name is not found. Normally, #1 is selected.

2.3. 2741 CONFIGURATION OPTIONS

When 2741 is selected, the following parameters are selectable:

PARAMETER	SELECTIONS
?1 CODE SET TO BE USED	1 = Correspondence 2 = BCD 3 = EBCDIC
?2 TRANSMISSION RATE	1 = 134.5 Baud 2 = 300 Baud 3 = 1200 Baud 4 = 7200 (null-modem)
?3 SEND FROM	1 = Keyboard only 2 = Disk
?4 RECEIVE TO	1 = CRT/line printer 2 = Disk, Dedicated 3 = Disk, Multiplexed
?5 (DISK ACCESS METHOD) – asked if disk is specified	1 = via Search, System over 8K 2 = via On Error, System to 8K

Meanings of 2741 Parameters:

Code set to be used	Different networks use different character sets. Choose Correspondence, BCD, or EBCDIC.
Transmission Rate	Select the desired baud rate, which is determined by the modem and receiving device.
Send From	If sending from disk is required, specify #2, which allows both keyboard and disk send. If no disk send is required, choose #1.
Receive to	1 = CRT/line printer 2 = Disk, Dedicated 3 = Disk, Multiplexed
Disk Access Method	1 = via Search, System over 8K 2 = via On Error, System to 8K
Disk Access Method	If disk is specified, the emulator takes over 8K of memory. To reduce this to 8K, the on error method may be used, which will terminate on an error if a file name is not found. Normally, #1 is selected.

CHAPTER 3   OPERATING THE TELETYPE AND 2741 EMULATORS

3.1   PERIPHERAL CONSIDERATIONS

Before going online to transmit and/or receive data via a Wang system equipped with the Model 2228B or Model 2227B communications controller and the emulator programs, an operator should know the following:

— Is data to be transmitted from a storage device? If so, which peripheral is to serve as the input device?
— Is received data to be stored? If so, which peripheral is to serve as the storage medium?
— Is the configuration already generated to satisfy the above needs?

3.2   DATA CONSIDERATIONS

Each emulation program provides the capability to:

— Send data from the keyboard to the host computer using the full range of symbols and control keys (to include the escape key and the break key).
— Send data stored on disk.
— Output received data to the CRT. The CRT is always an active output media.
— Output received data to the line printer, in conjunction with data output to the CRT.
— Store received data on disk, in conjunction with data output to the CRT.

NOTE:

The operator, through special function key activation/ deactivation, chooses which of the above send/receive combinations are to be active at any given point in time. Keyboard send/CRT only on receive is always the default condition.

NOTE:

The emulation package emulates a teletype or 2741 protocol in that each character keyed is immediately transmitted. There is no provision for line buffering of keyboard inputted data.

The nature of the teletype and 2741 dictates terminal operator/host computer interaction through the operator's keyboard and display (CRT). Each line of data sent to the host is terminated by a carriage return code. The host normally reacts interactively in one of the following ways:

— Echoes each received character from the terminal.
— Responds to each received line (data stream terminated by a carriage return code) from the terminal with a line feed followed by one or more characters.
— Provides no response to each received line from the terminal.

The Wang emulator package is designed to handle each of the above conditions which may occur in communicating with a host computer. The host computer's response is identified by the operator through the parameter setting module. The emulator needs this information only when sending from disk in order to know when to send the next record.

As previously mentioned, data may be transmitted from a storage device and/or may be received to a storage device. To accomplish this task, Wang Laboratories has defined a "communications format" (see Appendix B). This format optimizes data throughput for particular input devices. The appropriate input data format must be used when data is stored for subsequent transmission.

```
┌─────────────────────────────────────────────────┐
│                     NOTE:                          │
│                                                    │
│  The format allows variable length record packing of a disk │
│  sector. In this way minimum storage area is used. │
└─────────────────────────────────────────────────┘
```

3.3 THE CONTROL KEYS

The system is loaded when a menu of control keys is displayed. These keys vary based on the emulator running and the options selected. The definitions of the common control keys follow. Any control keys unique to teletype or 2741 are explained separately.

— 'O — This key recalls the main menu display. The key is inactive while data is being received. When batch data is being sent from storage, the key identifies an abort transmission request.

— '1 — This key calls the ATTENTION subroutine (a subroutine which allows the operator to ready the receive storage device, i.e., select device address of disk, open file, etc.). The key is inactive while data is being received and/or while batch data is being sent from storage. This key is active only if disk receive was selected at configuration time.

— '2 — This key activates the SEND from storage sequence. Once keyed, prompts relating to the storage media, i.e., device address, etc., are provided. The key is inactive during reception of data from the host and/or during batch transmission of data from a storage device. This key is active only if disk send was selected at configuration time.

— '3 — This key activates/deactivates the printer for printed output of received data. The key is inactive during batch transmission of data.

— '4 — This key activates/deactivates the storage of received data on the storage device. If active, all data received will be output to the disk. The key is inactive during receive or batch send operations and should therefore be activated prior to the reception of data to be stored. This key is active only if disk receive was specified at configuration time.

```
┌─────────────────────────────────────────────────┐
│                     NOTE:                          │
│                                                    │
│  The CRT is always active during a receive operation. │
│  Therefore, even if another peripheral is activated, the │
│  received data will be displayed. Also, only one extra │
│  peripheral may be active at any given time. In other words, │
│  the combination on output of received data can never be │
│  CRT, printer and storage device.                  │
└─────────────────────────────────────────────────┘
```

— '5 — This key signals the closing of a storage receive file. The key is only active when the communications line is "quiet." If data is output to a storage device, the data is stored sequentially for the duration of storage being selected as an output device. However, at the time storage is deselected, the file is not closed (an operator may wish to store additional data within the same file). The file is closed only when '5 is keyed. This key is active only if disk receive was specified at configuration time.

```
┌─────────────────────────────────────────────────┐
│                     NOTE:                          │
│  Once a file is closed, a new file is automatically opened. │
└─────────────────────────────────────────────────┘
```

During a batch transmission of data from a storage device, the only keys active are '0 (the ABORT key) and the RETURN/EXEC key. The RETURN/EXEC key is active in the event the line terminator transmitted by the system at the end of a batch line is received distorted. If that happens, a carriage return would renew the cycle of batch data transmission. Remember, a teletype protocol does not provide for any error checking except parity, if so optioned. In a batch environment, teletype is not considered to be nearly as reliable as the bisynchronous protocols such as 2780, 3780, 3741, or HASP.

NOTE:

If a batch line is transmitted from storage and that line is received incorrectly by the host computer, there are no provisions for re-transmission of that line in teletype or 2741 protocol. It is a visual check environment. One host may return an "INVALID CHARACTER RE-ENTER" in recognition of a parity error, while another may send "ERROR, RE-ENTER LINE." In view of the many varied visual error responses a host may provide, and the added possibility that even the error message may have character distortion, the emulation program does not in any way attempt to isolate re-transmission requests from the host computer.

The following control keys are unique to *Teletype* emulation:

— '13 — The ESCAPE key. This key creates the escape code for normal teletype operations. The key is inactive during reception of data and/or transmission of batch data.

— '14 — The BREAK key. This key activates the break signal for normal operations. The key is inactive only during batch transmission of data since here it would have no significant meaning.

— '15 — The CONTROL key. This key activates the "control" feature of normal teletype. Once '15 is keyed, the next alpha key struck is transmitted by keying '15 and then a capital alpha character A through Z as a control character. If '15 is keyed and followed by a key other than an alpha character, the result is a deactivation of the control feature. Again, this key is inactive during reception of data and the transmission of batch data. A list of control characters appears in Appendix A.

NOTE:

If a control "A" and a control "B," for example, must be sent sequentially, the operator sequence would be to key '15, the letter "A," '15, and then the letter "B."

The following control keys are unique to *2741* Emulation:

- '6 — DISPLAY AND SET TAB STOPS. This key places the user in a mode allowing the setting of tab stops. A sample terminal line is displayed with a "." designating a character position and a "T" in a tab stop position. The SPACE and BACKSPACE key allow positioning within the record. A new tab stop is inserted by pressing a "T" and deleted by pressing LINE ERASE. When the desired tab stops are set, key RETURN. The user is asked if these are to be saved as defaults. If "Y" is specified, the settings are saved on disk for future runs of the emulator. If "N" is specified, the values are good only for the duration of *this* emulation.

- '12 — The TAB key. Used to generate a tab character. Note that when keyed, the cursor doesn't tab over. The tab stops are only referenced on received tab characters.

- '13 — The UPSHIFT key. Upshift key generates an upshift character by transmitting a HEX 'OE'.

- '14 — The DOWNSHIFT key. Downshift key generates a downshift character by transmitting a HEX 'OF'.

- '15 — The BREAK key. This key activates the break signal for normal operations. The key is inactive only during batch transmission of data since here it would have no significant meaning.

3.4 KEYBOARD ENTERED DATA

Once a line connection is established and the proper parameter settings have been selected, the program is acting as a teletype or 2741. The keyboard is always active on send, and the typing of data results in the display of the typed data and the transmission of the data, character by character. For example, if the letter "A" is keyed, the letter "A" is displayed on the CRT and is also transmitted to the host computer. In addition to the normal type keys and the special function keys previously discussed, the following four keys are also active:

- SIN(or the upper case "(" — This key displays and transmits an open bracket: "["

- COS(or the upper case ")" — This key displays and transmits a close bracket: "]"

- PI or the upper case "/" — This key displays and transmits a backward slash: "\"

- EXP(or the upper case "-" — This key displays and transmits a left arrow: "←"

3.5 TRANSMISSION/RECEPTION CONSIDERATIONS

The following steps are necessary before going online for data transmission/reception:

- Ensure that the correct BAUD rate has been selected for compatibility with the host computer.

- Ensure that the correct parity, number of start and data bits and echoing parameters have been set if using Teletype.

- Ensure that the correct character code has been selected if using 2741.

- If received data from the host computer is to be stored, ensure that the proper storage media has been generated.

15

Further, if a storage media is to be used (either for transmission or reception of data), keep in mind that the data will be read/written in the standard Wang telecommunications format as described below and in Appendix B:

— The storage/read array is an alphanumeric dimensioned (4)62. For example — I$(4)62.

— Byte one (1) of the storage array has the following meaning:

HEX(00) = Not last sector/block of file.

HEX(FO) = Last sector/block of file.

— Byte two (2) of the storage array contains the binary count of the number of bytes used within the array plus one. The count automatically includes the first two bytes since they will always be used.

— Bytes three (3) to the end of the storage array contains the data records stored sequentially with the binary count of each record (one byte count) immediately preceding the record.

For example, if the file contains two records of the form "11111" and "222," a hexprint of the storage array would reveal the following:

FOOD053131313131033232323220202020202020202020.....

Where,

— FO = last sector of record.

— OD = 12 bytes used within the array since the second byte of the array is the number of bytes used (12) plus one. In this example, byte two must therefore equal 13 (12 — 1).

— 05 = 5 data bytes following since the binary count of the record precedes the record.

— Bytes four through eight contain the first record since the record count was five. The first record is therefore "11111."

— 03 = 3 data bytes following.

— Bytes ten through twelve contain the second record since its record count is three. The second record is therefore "222."

— There are no other records to be extracted from the storage buffer since the total number of bytes used (as specified in byte two of the storage buffer) has been exhausted.

Subroutines for reading, writing and listing files in TC file format are provided in the TC Support Utilities Package (Rel. 2.0).

3.6 ESTABLISHING A CONNECTION

Once the sytem is loaded and the appropriate parameter settings have been made (or the default values are being used), the system is ready to interact with a host computer. To effect that interaction, a connection must be established between the host computer and the terminal (the Wang 2200). The connection is made through an appropriate modem. After a line connection has been established, sign-on procedures and interactive communications are accomplished via the keyboard and CRT (or through one of the other selected medias).

APPENDIX A
TELETYPE CONTROL KEYS

HEX	CONTROL	KEY
01	SOH start of header	'15 FOLLOWED BY "A"
02	STX start of text	'15 FOLLOWED BY "B"
03	ETX end of text	'15 FOLLOWED BY "C"
04	EOT end of transmission	'15 FOLLOWED BY "D"
05	ENQ inquiry	'15 FOLLOWED BY "E"
06	ACK acknowledgement	'15 FOLLOWED BY "F"
07	BEL bell	'15 FOLLOWED BY "G"
08	BS backspace	'15 FOLLOWED BY "H"
09	HT horizontal tab	'15 FOLLOWED BY "I"
0A	LF line feed	'15 FOLLOWED BY "J"
0B	VT vertical tab	'15 FOLLOWED BY "K"
0C	FF form feed	'15 FOLLOWED BY "L"
0D	CR	'15 FOLLOWED BY "M"
0E	SO	'15 FOLLOWED BY "N"
0F	ST	'15 FOLLOWED BY "O"
10	DLE delete	'15 FOLLOWED BY "P"
11	DC1	'15 FOLLOWED BY "Q"
12	DC2	'15 FOLLOWED BY "R"
13	DC3	'15 FOLLOWED BY "S"
14	DC4	'15 FOLLOWED BY "T"
15	NAK neg. ack.	'15 FOLLOWED BY "U"
16	SYN sync. char.	'15 FOLLOWED BY "V"
17	ETB end trans. block	'15 FOLLOWED BY "W"
18	CAN	'15 FOLLOWED BY "X"
19	EM	'15 FOLLOWED BY "Y"
1A	SUB	'15 FOLLOWED BY "Z"
1B	ESC escape	'15 FOLLOWED BY "SIN(" — OR '13 ONLY
1C	FS field skip	'15 FOLLOWED BY "PI"
1D	GS group skip	'15 FOLLOWED BY "COS("
1E	RS	'15 FOLLOWED BY "1"
1F	US	'15 FOLLOWED BY "EXP("

NOTE: The effect of the control key is to turn off the second bit (HEX '40) of the following character.

APPENDIX B
THE TC FILE FORMAT

The "telecommunications (TC) file format" for disk data files is defined as follows:

1. Records are packed into a one-dimensional alphanumeric array having four elements, each 62 bytes long, e.g., DIM A$(4)62. The array is saved into a single sector by using the DATA SAVE DC or DATA SAVE DA statements.

2. In packing the TC records into the array, element boundaries are ignored; the array is treated as if it were simply 248 contiguous bytes of storage.

3. Within the 248 bytes of storage, three types of control bytes are used (see x, y and z in the following diagram).
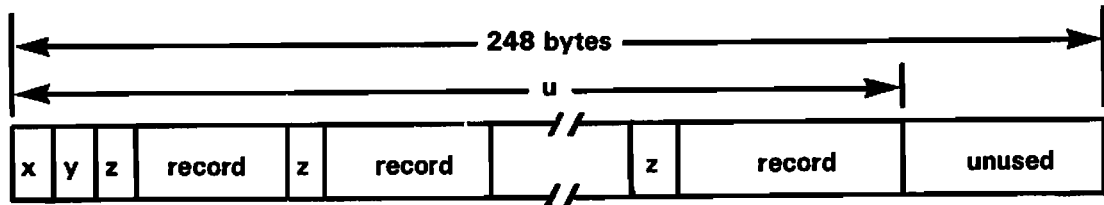
x   =   a one-byte hexadecimal code indicating whether the sector is or is not the last sector in the file; in particular x = HEX(F0) denotes "is the last sector", x = HEX(00) denotes "not the last sector."

y   =   a one-byte hexadecimal value denoting "the number of used bytes plus one" in the array. For example, in the diagram, y is the hexadecimal equivalent of u + 1.

z   =   a one-byte hexadecimal value preceding each record to denote "the record length in bytes." For example, if the record contains 39 bytes, z = HEX(27) since $(27)_{16} = (39)_{10}$.

record   =   one complete record with trailing spaces truncated (except in the first record) — individual records do not overlap from one 248-byte array to the next.

Data Entry 1's SAVE or SAVE N command does not truncate trailing spaces in the first record of a file. Thus, the length of the first record is always 80 or 128 bytes.

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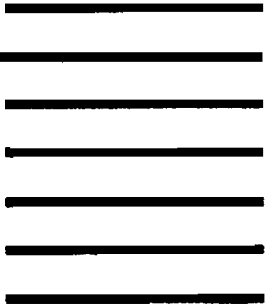(Please tape. Postal regulations prohibit the use of staples.)

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