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WANG 3275 BSC EMULATOR WITH MODEL 2228C COMMUNICATIONS CONTROLLER

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1. INTRODUCTION

Wang's 3275 BSC Emulator, in conjunction with a 2228C communications controller, allows a Wang system with a 2200T, VP, or MVP central processor to emulate an IBM 3275 Display Station (Model 2)* with or without a 3284 Printer (Model 3)**. The software facilitates communications between the Wang system and host computers which store data under Information Management System (IMS), Customer Information Control System (CICS), or other programs accessible by the 3275 BSC protocol. Features of the software include the following:

- . 1,920-character display capability, using any Wang 24-line by 80-characters-per-line cathode ray tube (CRT) screen
- . emulation of the unbuffered, 40-characters-per-second printing capability of a 3284 Printer (Model 3, using any Wang printer
- . information handling by the Wang system and its operator on a field-by-field basis in accordance with the host-supplied attribute byte for each field (an attribute byte defines the characteristics of the field's contents)
- . screen formatting, field checking, and field protection corresponding to the attribute bytes for the display data
- . transmission on a record/block basis using the BSC point-to-point contention protocol over dial-up or non-pollled leased lines.
- . a line speed of 1200, 2000, 2400, or 4800 bits per second (bps), depending upon the modem used with the controller.

* There are four IBM 3275 display station models: Models 1 and 2, designed for Binary Synchronous Communications (BSC) procedures, plus Models 11 and 12, designed for Synchronous Data Link Control (SDLC) procedures. Model 1 and 11 have a 480-character screen capacity; Models 2 and 12 have a 1,920-character capacity.

** There are three 3284 printer models. Models 1 and 2 have 480-character and 1,920-character print buffers, respectively. Model 3 has no print buffer; it attaches to a 3275 display station and uses its buffer.

2. INSTALLATION

2.1 MINIMUM SYSTEM REQUIREMENTS

The following items are required for use of the 3275 emulator:

1. A 2228C Synchronous Telecommunication controller.

NOTE:

The 2228C is fully upward compatible with the 2228B.

2. One of the following CPU's or their equivalent:
 - . 2200T with 16K of RAM
 - . 2200VP with 17K of RAM
 - . 2200MVP with 17K of RAM
3. A workstation with a 24 X 80 CRT display (1920 character display).

NOTE:

The 3275 emulator will not support the Wang 16 X 64 CRT or the smaller IBM 480-character screen capacity of the IBM 3275 Display Station, Model 1.

4. Any Wang print inorder provide for IBM 3284 printer support.
5. A T.C. cable (WL #220-0113).
6. Wang 3275 BSC Emulator diskette (WL #701-2356)
7. Appropriate Synchronous Modem (provided by the customer). Refer to Section 2.3.

NOTE:

A PCS II, WCS/15, or Disk workstation equipped with an Option 62B will not be supported by the 3275 emulator. Therefore, no enhanced version of the Option 62B controller will be released.

2.2 INSTALLATION OF A 2228C

The installation of a 2228C into a 2200T, 2200VP, or 2200 MVP CPU chassis is accomplished with the following steps:

1. Before installing the communications controller into the local 2200 CPU, set the device address switches located on the 7223 P.C. Board to Hex 1C, as specified on the controller's mounting bracket (set switches 3, 4, 5 ON and all others OFF).
2. Also, before installing the controller, check that the revision level of the PROM on the 7223C board is the most recent revision level. At present, the PROM revision level is:

2228C 378-4001 (located on 7223C PCB)

If the PROM is not the most recent revision level, order the correct PROM from Customer Engineering stockroom in Billerica before installing the unit.

3. Install the communications controller into any CPU I/O slot.

NOTE:

INSTALLING A 2228C CONTROLLER IN A 2200 VP CHASSIS

The 2228C controller is slightly larger than other system 2200 controllers. When installing this controller in a 2200 VP, choose an I/O slot away from the fan. It will be seen that the 2228C does not fit next to the fan; it will almost contact the hub. Simply install this controller in any I/O slot away from the fan.

4. If off-line diagnostics are available, connect the T.C. loop back connector to the 2228C for off-line checkout. Refer to Section 4.1.
5. If off-line diagnostics run successfully, clear the 2200 memory and load the 3275 emulator program in the 2200. See Section 3 for the 3275 emulator program operating instructions.
6. Connect the communications controller to the modem with the TC cable that is provided. Connect the cable from the RS-232-C female connector located on the controller mounting bracket to RS-232-C female connector on the modem (for most BELL modems, this connector will be labeled "CUST. EQUIP.').
7. If desired, run the on-line system checkout as described in Section 4.2; otherwise, the system is ready for on-line telecommunications link-up with a remote host.

2.3 MODEMS

The modem, or dataset, used with system may be rented from the telephone company or purchased from any one of several modem vendors. If the modem is purchased from a commercial modem vendor, then it may be connected to the switched telephone network in one of two ways, depending upon the modem selected. As of June 1, 1977, the telephone companies will provide dial-up telephone lines with data jacks to allow direct connection of FCC certified modem equipment to the telephone line. If this is the case, then ensure that the telephone company has installed the data jack before installing the TC option. If the modem is not a certified modem for direct connection, then the modem must be connected to the telephone network via telephone company installed data access arrangement (DAA). The DAA consists of a telephone handset and a modem interface rented from the telephone company. Usually a modem, data jack, or DAA is permanently wired to a wall; therefore, it should be installed as close as possible to the Wang computer system.

NOTE:

Ordering of a modem, DAA, or data jack for a Wang Customer is not the responsibility of a Wang Salesman nor is the installation of these devices the responsibility of a Wang Serviceman. Refer to Table 2.2 for a list of the options that must be selected for each modem.

The modems used at both ends of a communications line must be compatible. For example, if a BELL 201C type modem is used at one end, another BELL 201C or equivalent must be used at the other end (not a 201A, 208B, 202C, or 202S). The modems listed in Table 2.1 or their equivalent may be used.

Compatible Modems for the 3275 Software

Short haul modems may be used for connections up to 25 miles (40.2 km) over nonpolled, private lines. For connections over common carrier telephone lines, the following modems may be used:

<u>Modem</u>	<u>Line Speed</u>
(Bell type of equivalent)	
212A	1200 bps (with restrictions)
201A	2000 bps (dial-up line)
201B	2400 bps (nonpolled leased line)
201C	2400 bps (dial-up/nonpolled leased line)
208A	4800 bps (nonpolled leased line)
208B	4800 pbs (dial-up line)

Usually, modem which support higher line speeds are more expensive; however, expense is not the only criterion to use when choosing a modem.

A modem must be compatible with the host system's communications requirements, also. For example, although Wang's 3275 software supports use of a Bell 212A modem (strapped for synchronous, internal timing at 1200 bps), this modem operates only in the full duplex mode and is not suitable for a host system which requires true half duplex operation. If a host system requires active Request to Send (RTS) and Clear to Send (CTS) modem signals, the continuous CTS signal presented by the 212A modem is not acceptable.

Sometimes a facility has several telephone numbers representing separate lines for communications, but the modem characteristics and line speed associated with these telephone lines may differ. The Wang system user who is responsible for coordinating communications with a particular facility should determine which telephone numbers are appropriate, and these numbers should be posted near the Wang system for the convenience of other users who may need to communicate with the host system.

NOTE:

Modems used at both ends of a communications line must have the same characteristics, including the line speed. Do not expect to communicate with a remotely located host system if the modem connected to the Wang system is not compatible with the 3275 software and the remote system.

TABLE 2.1
SYNCHRONOUS BELL MODEMS

<u>BELL MODEM</u>	<u>SPEED (bps)</u>	DESCRIPTION
201A	2000 bps	- obsolete - half-duplex (dial-up or 2-wire private line) - full-duplex (4-wire private line)
201B	2400	- half-duplex (2-wire private line) - full-duplex (4-wire private line)
201C	2400	- half-duplex (dial-up or 2-wire private line) - full-duplex (4-wire private line)
208A	4800	- half-duplex (4-wire private line) - full-duplex (4-wire private line)
208B	4800	- half-duplex (dial-up line)
212A	1200	- full-duplex (dial-up line) - also operates in asynchronous mode

TABLE 2.2
REQUIRED MODEM OPTIONS

<u>BELL MODEM</u>	<u>OPTIONS</u>
201A or 201B	<ul style="list-style-type: none">. internal transmitter timing. EIA electrical interface. half-duplex circuit type. carrier controlled by Request-to-send (RTS). without new Sync
201C	<ul style="list-style-type: none">. internal transmitter timing. EIA electrical interface. 2-wire data set line interface. switched carrier control. Request-to-send (RTS)/ Clear-to-send (CTS) delay of 150ms (dial-up operation). without new Sync. AB (signal ground) connected to AA (frame ground)
208A	<ul style="list-style-type: none">. internal transmitter timing. switched carrier control. switched Request-to-send (RTS). without new Sync. CC (Data Terminal Ready) indication of Analog loopback ON. AB (signal ground) connected to AA (frame ground)
208B	<ul style="list-style-type: none">. internal transmitter timing. CC (Data Terminal Ready) indication of Analog loopback ON. AB (signal ground) connected to AA (frame ground)

TABLE 2.2 (Continued)

212A

- . internal transmitter timing
- . synchronous 1200 bps operation
- . high speed mode
- . CB (Clear-to-Send) and CF
(Carrier Detect) indications
common
- . CC (Data Terminal Ready)
indication of Analog loopback ON
- . AB (signal ground) connected to
AA (frame ground)

2.4 MODEM INTERFACE (RS-232-C)

The 2228C controller conforms to the nationally recognized EIA RS-232-C and the internationally recognized CCITT V.24 standards for voltage levels and pin connections (refer to PRODUCT SERVICE TELEPROCESSING GUIDE, page 76). The signal polarity and the voltage of driven and detected signals are as follows:

<u>Logic Level</u>	<u>Applied Voltage</u>	<u>Detected Voltage</u>
0 or ON (Spacing)	+8 vdc	+5 to +15 vdc
1 or OFF (Marking)	-8 vdc	-5 to -15 vdc

The pin assignments are listed in Table 2.3 with both the EIA and the CCITT designations given for the circuit associated with each pin. Also, the signal descriptions and sources are included in the table.

TABLE 2.3
RS-232-C CONNECTOR PIN ASSIGNMENT

<u>PIN</u>	<u>EIA</u>	<u>CCITT</u>	<u>SIGNAL DESCRIPTION</u>	<u>SOURCE</u>
1	AA	101	Protective Ground	
2	BA	103	Transmitted Data	Controller
3	BB	104	Received Data	Modem
4	CA	105	Request to Send	Controller
5	CB	106	Clear to Send	Modem
6	CC	107	Data Set Ready	Modem
7	AB	102	Signal Ground	
8	CF	109	Received Line Signal Detector	Modem
9*				
10*				
11	SCA	120	Secondary Request to Send	Controller
12	SCF	122	Seccdary Rec'd Line Sig. Det.	Modem
13*	SCB	121	Secondary Clear to Send	Modem
14*	SBA	118	Secondary Transmitted Data	Controller
15	DB	114	Trans. Signal Element Timing	Modem
16*	SBB	119	Secondary Received Data	Modem
17	DD	115	Receiver Signal Element Timing	Modem
18*		124	Select Frequency Groups	Controller
19	SCA	120	Secondary Request to Send	Controller
20	CD	108.2	Data Terminal Ready	Controller
21*	CG	110	Signal Quality Detector	Modem
22*	CE	125	Ring Indicator	Modem
23*	CH/CI	111/112	Data Signalling Rate Selector	Controller/ Modem
24*	DA	113	Trans. Signal Element Timing	Controller
25*			Unassigned	

*Denotes signals not used by the 2228C

2.5 CONVERSION OF 2228B to 2228C

In order to convert a 2228B to a 2228C, ECN 9214 must be performed.

NOTE:

For a customer unit, the 2228B is NOT field upgradeable, however, a trade-in can be arranged through a salesperson.

ECN 9214:

parts required - 1 2K PROM (WL #378-4001)

ON PCB 7233 (Refer to Figure)

1. Remove the existing 1K PROM (WL #378-2060R3) at location L6.
2. Unsolder and remove the 24 pin I.C. socket at location L6.
3. On the component side of the board, cut the etch connecting L6-18 to L6-20.
4. Insert and solder the 24 pin I.C. socket back into location L6.
5. On the non-component side of the board, add a wire jumper from L6-20 to L7-1.
6. Insert the 2K PROM (WL #378-4001) into the 24 pin I.C. socket at location L6.
7. Change the E-REV from 1 to 2.

3. OPERATING INSTRUCTIONS

3.1 INTRODUCTION

The general applications performed by 3275 display stations include the following: data entry, order entry, inquiry/response, and inquiry with data base update. While performing such functions, a 3275 display station communicates with a host system under its control.

Since a 3275 display station cannot function independently, it becomes effective primarily for offices where extensive access to a host system is required. On the other hand, a Wang system with the 3275 emulation software becomes effective for offices where local processing capability is a primary need and interaction with host computers is a secondary need.

When communications with a host system is desired, the Wang system user loads the 3275 software into memory and establishes a connection with the host using the procedures described in this section. While the Wang system is online to the host system, several keys on the keyboard have new meanings and provide special functions associated with the 3275 protocol. The CRT is formatted into protected and unprotected fields, determined by the application program operating in the host system. In typical 3275 programs, several fields may be highlighted when displayed; however, dual intensity screen displays are not implemented by the 2200T, VP, or MVP central processors. Instead, the 3275 software optionally provides a special symbol (a diamond) to mark each highlighted field presented by the host system; this feature is easily enabled or disabled by the operating using one of the specially defined keys. Cursor positioning is controlled by the application program and optionally by the operator.

All the special functions and operator controls for Wang's 3275 software are described in this section. This information should be used in conjunction with operational information which must be provided by the host data center which is to support 3275 BSC communications with the Wang system.

3.2 SOFTWARE BACKUP

Before attempting to use the 3275 software for the first time, copy the software to another diskette and carefully label the duplicate platter. Use of duplicate software ensures that the master software received from Wang Laboratories is always available as a backup system.

Instructions for copying the contents of one platter onto another platter, if both platters are mounted in a dual drive unit, are given in the Disk Reference Manual supplied with Wang systems. (See COPY statement.) Also Wang's Integrated Support System (ISS) software includes a utility which can be used to copy the 3275 software to a disk cartridge, if desired.

3.3 CUSTOMIZING THE SOFTWARE

The 3275 software diskette contains a source code module documented with REM statements for the convenience of experienced BASIC language programmers or Wang system vendors who may wish to create a customized version of the 3275 software. This module is named EM3270S. Remember, however, that modifications to the software become the responsibility of the person who modifies the software; such modifications are not supported by Wang Laboratories.

3.4 LOADING THE SOFTWARE

To load the software, mount the diskette containing the 3275 Emulation on the F drive; then, proceed as follows:

1. Key CLEAR and RETURN.
2. Enter SELECT DISK xyy (replacing xyy by the proper address, usually 310) and key RETURN.
3. Enter LOAD DC F "START" and key RETURN; then, key RUN and RETURN -- or, if using a system with Wang's BASIC-2 instruction set, key LOAD RUN.

A "loading message" appears on the CRT while the 3275 Emulation is being loaded. No operator action is necessary until a prompt appears or the screen becomes blank.

If the software is being loaded for the first time, another message prompts the operator to supply the following informaton:

1. the terminal ID (see Section 3.5) and
2. the CPU type (i.e., T, VP, or MVP).

After this information is supplied, it is saved on the software platter (make sure that the diskette has a write protect tab on it or a disk error will occur); then, the software is automatically reloaded.

When the screen becomes blank, the operator should establish a connection with the host system (see Section 3.6). Meanwhile, the screen remains blank until formatted with field attribute characters sent by the host system.

3.5 SPECIFYING THE TERMINAL ID

The terminal ID is not an arbitrary input value for the 3275 software; it is a unique code assigned by the host system. Therefore, prior to attempting to communicate with a host system not previously accessed by the 3275 emulation software, request an ID number from the data center personnel. The number should have eight hexdigits, with 86 as the leading digits. If no ID is required by the host, set the ID value to "32323232" for the 3275 software.

Normally, the terminal ID is set only once at installation where the 3275 software is used for communications with only one host system. If necessary, the terminal ID may be reset at any time after loading the software (or during its execution) by keying SF'29 (Reset Terminal ID).

3.6 ESTABLISHING A CONNECTION

When the CRT becomes blank after the software is loaded, the operator normally dials the telephone number of the host system unless the Wang system is connected to only one host system and no telephone is involved. After dialing a host system, listen for a ringing sound or busy signal. When a high-pitched sound interrupts the ringing sound, depress the DATA button on the modem telephone and key ENTER on the Wang keyboard. The software then transmits the terminal ID to the host.

The host system usually responds by requesting a signon message from the Wang system. Like the terminal ID, the signon message and its precise format is prescribed by the host data center. Unless a correct signon message is sent by the operator, no communication with the host system is possible.

3.7 SCREEN FORMATS AND SPECIAL CONDITIONS

After the operator establishes a connection with the host and properly signs on, the host sends field attribute codes which determine the screen format for displayed data from the host (these codes also control data entry and its image display). At this time, the keyboard is unlocked and the operator may input information for the unprotected (modifiable) fields displayed by the host. The cursor may appear at the beginning of the first modifiable field on the display or at the bottom of the display, depending upon the host's program. Also, the host may highlight unprotected or protected fields; if so, each highlighted field is denoted on the Wang CRT by a diamond (◆) placed at the beginning of the field--if the highlighting feature is enabled. Initially, the highlighting feature is disabled; however, as indicated in Table 3.1, the EDIT key may be used to enable or disable the highlighting feature, as preferred.

During formal 3275 communications, the host system locks and unlocks the keyboard. When the host locks the keyboard, Wang's 3275 software displays a "KEYBOARD LOCKED" message in the lower right corner of the CRT. If the host fails to unlock the keyboard, the operator may do so by pressing Special Function key '0 (3275 Reset). Remember, however, that the keyboard may become locked (without a message displayed on the screen) when the printer is busy under the following circumstances:

- . The host has sent data to the printer (perhaps indicated by a message) but no printing is occurring--if so, select the printer if not currently selected.
- . The printer is printing but a new screen display has appeared-- if so, intermittently try the keyboard until it becomes active again. (A temporary keyboard lock may be imposed by the Wang software to eliminate problems which could arise if data entry overlaps the initial phase of the printing operation.)

3.8 SPECIAL 3275 EMULATION KEYS

When the 3275 software is loaded into memory, some keys are assigned unique functions related to 3275 communications. Table 3.1 lists these Wang keys in the first column, the corresponding 3275 key or function in the second column, and a description of the function in the third column. Also, Figure 3.1 shows the keyboard layout for Wang's Model 2226 Console (used with the 2200T and VP central processors) and includes suggested overlays to aid an operator during 3275 emulation. With two exceptions, as noted in Table 3.1 these overlays apply to the same keys on a Model 2236D Interactive Terminal used with a 2200MVP central processor. Figure 3.2 diagrams special function strips for 3275 communications with a host system. One function strip is appropriate for the 2226 keyboard, and the other for 2236D keyboards.

Table 3.1.
Special 3275 Emulation Keys

<u>Wang key</u>	<u>3275 Function</u>	<u>Description</u>
RUN	ENTER	Sends a filled screen to the host.
CLEAR	CLEAR	Clears the entire screen and notifies the host.
STMT NUMBER or FN (on MVP)	Tab →	Tabs the cursor to the next unprotected field. (Note: The Wang key depends upon the keyboard in use.)
LINE ERASE	Back Tab ←	Tabs the cursor to the beginning of either the current or the previous field.
RETURN	New Line ↵	Moves the cursor to the first unprotected field on the next line.
PRINT or CONTINUE (MVP)	Field Mark	Generates a field mark. (Note: The Wang key depends upon the keyboard in use.)
EDIT	Highlight	Enables the highlighting feature (if disabled) or disables it (if enabled). When enabled, a diamond (◆) precedes each highlighted field; when disabled, no diamonds appear. (Note: Initially, this feature is disabled; otherwise, only the presence or absence of diamonds reveals whether highlighting is currently enabled or disabled.)
SF'0	3275 Reset	Terminates the insert mode, if active, or disables a keyboard locked condition. (Note: Do <u>not</u> use the Wang Reset button.)
SF'1, SF'2, SF'3	PA keys	Each program Attention (PA) key sends only a code to request program action--codes may differ at each installation.
SF'4-SF'7, SF'16-SF'23	PF KEYS	Program Function (PF) keys are similar to PA keys, but each PF key sends both a coded request and the screen data.
SF'8	ERASE INPUT	Erases all unprotected fields. (Note: Software search time may produce a few seconds delay, depending upon the number of fields being erased.)
SF'9	DELETE	Deletes the character at the current cursor position and shifts the remainder of the field to the left.

(Table 3.1 is continued on the next page.)

Table 3.1 (Continued)
Special 3275 Emulation Keys

<u>Wang Key</u>	<u>3275 Function</u>	<u>Description</u>
SF'10	INSERT	Activates the insert mode, allowing characters to be inserted in a field <u>in front of the current cursor position.</u> (SF'0 terminates the mode.)
SF'11	CURSOR UP (↑)	Moves the cursor up one line, regardless of the field formats.
SF'12	CURSOR RIGHT (→)	Moves the cursor one position to the right, regardless of the field format.
SF'13	CURSOR LEFT (←)	Moves the cursor one position to the left, regardless of the field format.
SF'14	CURSOR DOWN (↓)	Move the cursor down one line, regardless of the field format.
SF'15	DUP	Generates a unique dup character which is interpreted by the host.
SF'24	ERASE EOF	Erases characters from the current cursor position to the end of the field.
SF'25	_	Generates an underscore (_).
SF'26	¢	Generates a cent sign (¢).
SF'27		Generates a vertical bar ().
SF'28	¬	Generates a not sign (¬).
SF'29	SET TERMINAL ID	Interrupts the 3275 emulation and prompts the operator to supply an ID and the CPU type (T, VP, or MVP). The ID, obtained from the host, always consists of eight hexdigits--beginning with "86"; if no ID is required by the host, set the ID to "32323232". The ID and CPU responses are saved on the software platter, and the emulation is automatically reloaded.
SF'30	RESTART	Reloads the start module prior to establishing another connection. (Note: Since the ID is transmitted just once after the software is loaded, this key is useful when establishing a second connection.)
SF'31	TEST REQUEST	Sends a special function which is interpreted by the host.

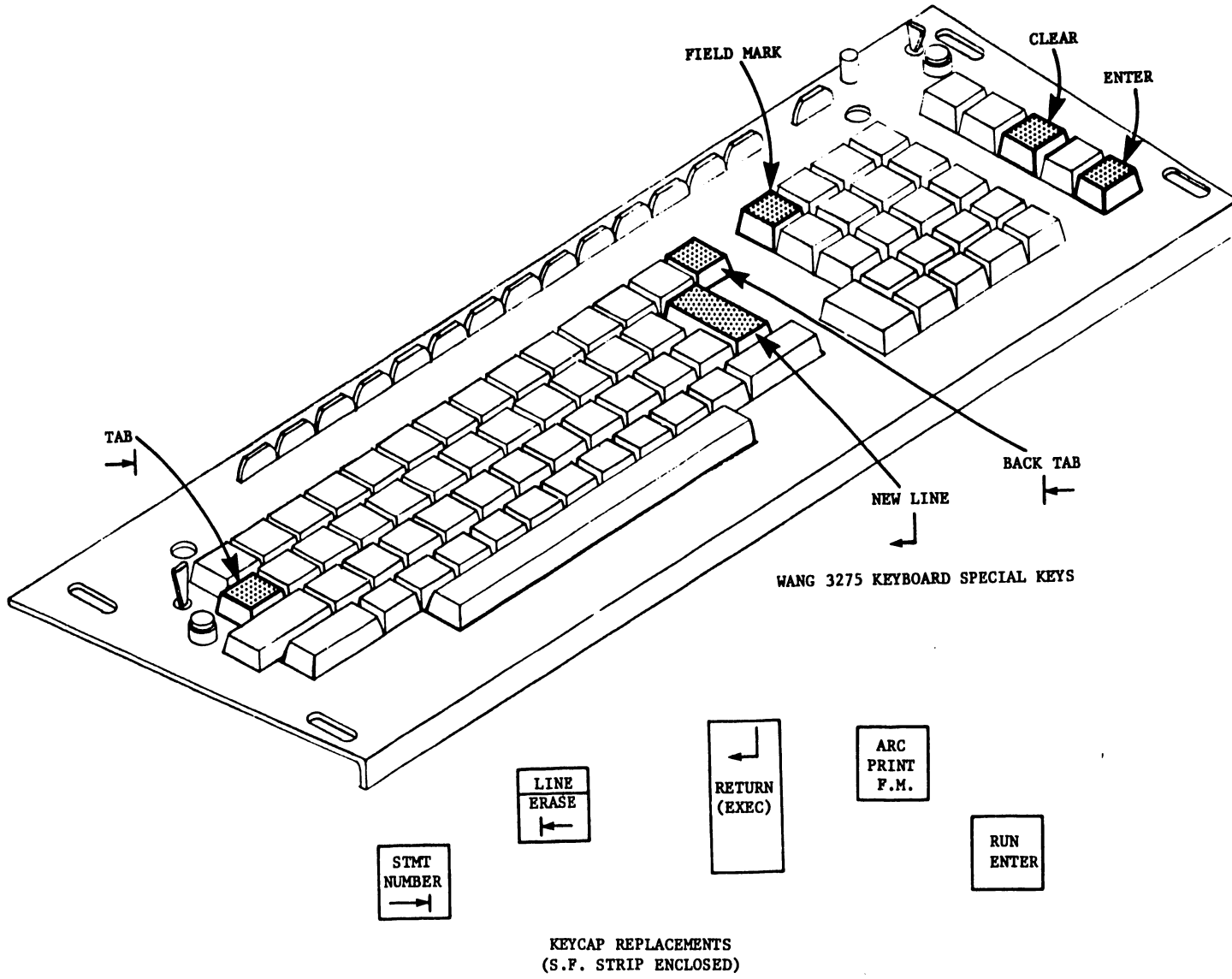


FIGURE 3.1 WANG KEYBOARD LAYOUT FOR 3275 EMULATION

UPPERCASE KEYBOARD FUNCTIONS	PF5 '16	PF6 '17	PF7 '18	PF8 '19	PF9 '20	PF10 '21	PF11 '22	PF12 '23
LOWERCASE KEYBOARD FUNCTIONS	3275 '0 RESET	PA1 '1	PA2 '2	PA3 '3	PF1 '4	PF2 '5	PF3 '6	PF4 '7

EOF '24	'25	¢ '26	'27	┌ '28	SET '29	RESTART '30	TEST '31	HIGHLIGHT EDIT
ERASE '8	DELETE '9	INSERT '10	- - - '11	→ '12	TERM ID ← '13	← - - - '14	REQUEST '15	
INPUT	DEL	INS	↑	→	←	↓	DUP	

3275 FUNCTION STRIP FOR 2226 TERMINAL
(TAPE-END-TO END)

	PF5	PF6	PF7	PF8		PF9	PF10	PF11	PF12
	3275 RESET	PA1	PA2	PA3		PF1	PF2	PF3	PF4

3275 FUNCTION STRIP FOR 2236 TERMINAL
(TAPE END-TO-END)

ERASE EOF	—	¢			┌	SET TERMID	RESTART	TEST REQUEST	HIGHLIGHT INTERACTIVE TERMINAL
ERASE INPUT	DEL	INS	↑		→	←	↓	DUP	

FIGURE 3.2 SPECIAL FUNCTION STRIPS FOR 3275 EMULATION

4. DIAGNOSTICS

4.1 OFF-LINE DIAGNOSTICS

The off-line diagnostics available for the 2228C communications controller are the same diagnostics presently used for the 2228B communications controller. They are found on the 2200 PERIPHERAL DIAGNOSTIC DISKETTE (WL #701-2180B). The operating instructions for these diagnostic programs are explained in SERVICE BULLETIN NO. 77 in Section 4.1. Please note that the menus for the diagnostic programs do not contain any references to the 2228C, so the 2228C should be tested as if it were a 2228B.

4.2 ON-LINE SYSTEM CHECKOUT

At the time of this writing, the IBM 370 at the Wang Data Center in Burlington, MA is not programmed to communicate with an IBM 3275 BSC display terminal. Until such time that this feature is provided, the only on-line system checkout that can be performed is with the customer's host system.

5. WANG 3275 EMULATOR

5.1 OVERVIEW

The 3270 emulator permits a 2200T, VP, or MVP system to emulate the bisync communications protocol of the 3270 terminal family. The emulated screen size is 1920 characters. The communications code set is EBCDIC. (Refer to Table 5.1) Transmission rates of up to 9600 bits/sec are supported.

This release of the 3270 emulator will support the point-to-point communications protocol of the single-station 3275. Later releases will support the multipoint protocol.

The primary purpose of the 3270 emulator is to provide Wang computer systems with a method of accessing IBM 370 resident Information Management System (IMS) or Customer Information Control System (CICS) data bases. The communication control program or application program using the emulator is expected to be tailored to a specific application, and therefore a simple test program is provided which can be used as a point of departure by the installer of the system. This test program couples a workstation on the Wang computer to the communication line such that the workstation operates as much as possible like a 3270 terminal. It is emphasized that this program is intended as a test program and a sample program for use by the person installing the system and does not support to full 3270 device emulation.

The communication control program maintains an image of the 1920 byte emulated screen. The program transfers the screen image to the communications processor whenever it wants the screen to be read by the remote host. The communications processor then transmits the relevant portions of the screen image, waits for the remote host to update the screen image, and then returns it to the communication control program. The communications processor performs all transmit and receive message processing, requiring that the communication control program deal only with the screen image format.

Details of 3270 operation beyond those contained in this Service Bulletin are contained in the following IBM publications:

GA27-2749 IBM 3270 Information Display System Component Description
GA27-3004 General Information - Binary Synchronous Communications

TABLE 5.1
IBM EBCDIC CODE SET

		HIGH ORDER HEX DIGIT																
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
LOW ORDER DIGIT	0	NUL	DLE			SP	&	-						{	}	\	0	
	1	SOH	DC1			RSP		/		a	j	~		A	J		1	
	2	STX	DC2		SYN					b	k	s		B	K	S	2	
	3	ETX	DC3							c	l	t		C	L	T	3	
	4									d	m	u		D	M	U	4	
	5	HT	NL	LF						e	n	v		E	N	V	5	
	6			ETB						f	o	w		F	O	W	6	
	7			ESC	EOT					g	p	x		G	P	X	7	
	8									h	q	y		H	Q	Y	8	
	9		EM							i	r	z		I	R	Z	9	
	A					c	!	!	:									
	B	VT				.	\$,	#									
	C	FF				<	*	%	@									
	D	CR	IGS	ENQ	NAK	()	-	'									
	E		IRS			+	;	>	=									
	F		ITB	BEL			~	?	"									PAD

BSC DATA LINK CHARACTERS

BEL Bell
 CR Carriage Return
 DLE Data Link Escape
 ENQ Enquiry
 EOT End of Transmission
 ESC Escape
 ETB End of Text Block
 ETX End of Text
 HT Horizontal Tab
 ITB Intermediate Text Block
 NAK Negative Acknowledgement
 NUL Null
 PAD Trailing Pad Character
 SOH Start of Header
 STX Start of Text
 SYN Synchronous Idle

3270 Control Characters

DUP	Duplicate
EM	End of Medium
EUA	Erase Unprotected to Address
FF	Form Feed
FM	Field Mark
IC	Insert Cursor
NL	New Line
NUL	Null
PT	Program Tab
RA	Repeat to Address
SBA	Set Buffer Address
SF	Start Field
SUB	Substitute

IBM 2780 CONTROL CHARACTERS

EM	End of Media
SP	Space

IBM 3780 CONTROL CHARACTERS

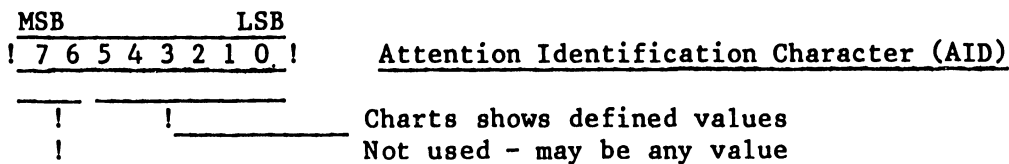
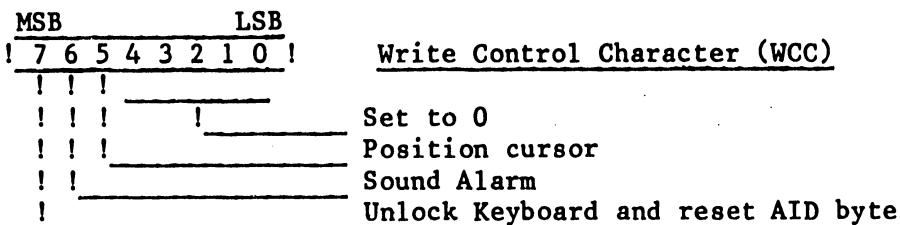
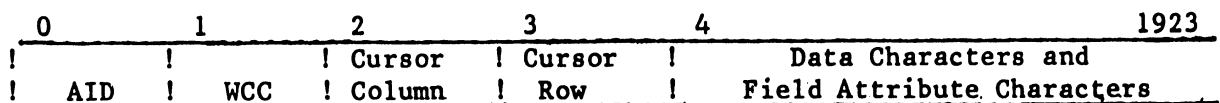
DC1	Device Select Printer
DC2	Device Select Punch
DC3	Device Select Punch
FF	Form Feed
IGS	Interchange Group Separator
IRS	Interchange Record Separator
LF	Line Feed
NL	New Line
SP	Space
VT	Vertical Tab

BSC DATA LINK CONTROL SEQUENCES

ACK 0	Positive Acknowledgement 0 (DLE X'70')
ACK 1	Positive Acknowledgement 1 (DLE /)
DLE EOT	Disconnect Sequence for a Switched Line
RVI	Reverse Interrupt (DLE @)
TTD	Temporary Text Delay (STX ENQ)
WACK	Wait-Before-Transmit Positive Acknowledgement (DLE ,)

5.2 INTERCHANGE DATA FORMAT

The data interchanged between the communications processor and the main computer is a 1920-byte screen image with a 4-byte prefixed control field. Byte 0 contains an "attention identification character" (AID). Byte 1 contains a Write Control Character (WCC). Byte 1 is set when the screen image buffer is transferred from the communication control program to the communication processor. In response to an unsolicited request for data, the communications control program should set the AID to hex '20' (unsolicited). Byte 2-3 define the cursor row (1-24) and column (1-80) positions. Bytes 4 through the end of the data area contain the screen image data which consists of data characters and field attribute characters. The format of a field attribute character in the received message is different from the interchange field attribute character, for compatibility with the 2200VS workstation.



	0x	1X	2X	3X
x0			unsolicited	TEST REQ key
x1	PF 13 key			PF 1 key
x2	PF 14 key			PF 2 key
x3	PF 15 key			PF 3 key
x4	PF 16 key			PF 4 key
x5	PF 17 key			PF 5 key
x6	PF 18 key		card reader	PF 6 key
x7	PF 19 key			PF 7 key
x8	PF 20 key		printer	PF 8 key
x9	PF 21 key			PF 9 key
xA	PF 22 key			PF 10 key
xB	PF 23 key		PA 3 key	PF 11 key
xC	PF 24 key		PA 1 key	PF 12 key
xD			CLEAR key	ENTER key
xE			PA 2 key	light pen
xF				

5.3 PROTOCOL BETWEEN CONTROLLER AND COMMUNICATION CONTROL PROGRAM

The operation of the emulator essentially consists of the buffer image shuttling back and forth between the controller and the communication control program. The communication control program updates the buffer image and notifies the controller that the buffer has output pending. Then the controller will then transmit data from the buffer contents be transferred to it as many times as necessary (normally one) during the process. When the controller receives a reply message which contains a write control character having the "unlock keyboard" bit set it will request that the buffer contents be returned to the communications control program, which when performed, complete the cycle.

The 2200 must continually monitor the controller by executing a QUERY STATUS statement or utilize the soft interrupt to notify it whenever a status condition exists which requires action. Status conditions requiring action are error conditions, send data request, and receive data requests. The way in which the 2200 program must communicate with the controller is defined by a state transition view of the 2200 program logic.

The 2200 is viewed by the controller as having three states - busy, ready, and transaction pending:

Busy: In the busy state the 2200 may indefinitely suspend monitoring status and servicing requests from the controller in order to perform other processing. It is the initial state assumed by the controller. Execution of the ENABLE RECEIVE statement places the 2200 in the ready state.

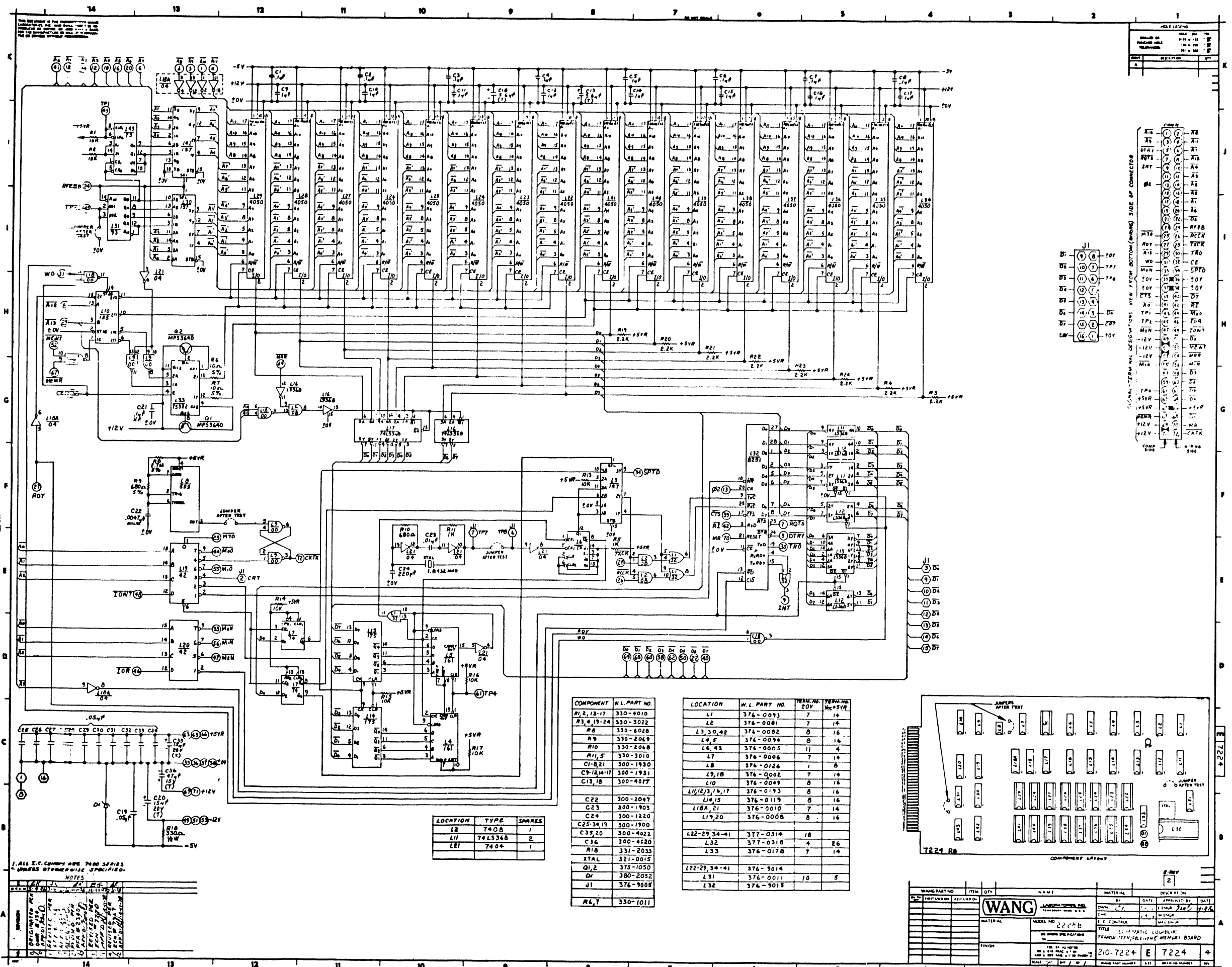
Ready: In the ready state the 3275 "device" buffer is updated by the 2200. During this state the 2200 may receive from the controller an unsolicited request to send data. It must respond to the request within 1.5 seconds or a procedure error will result. The response may be:

- a) DISABLE RECEIVE which places the 2200 in the busy state;
- b) SEND DATA which supplies the requested data and places the 2200 in the transaction pending state.

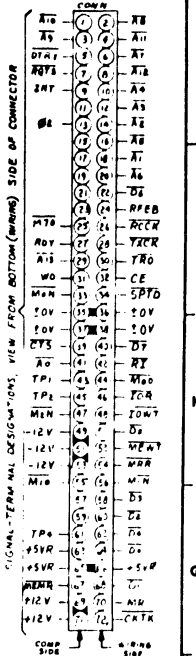
The 2200 may enter the busy state at any time by executing the DISABLE RECEIVE statement, or may enter the transaction pending state by executing the SEND REQUEST statement.

Transaction pending: In the transacting pending state the 2200 must not modify the "device" buffer contents. The controller may request the 2200 to send data, possibly more than once. The 2200 must respond within 1.5 seconds to the request by executing a SEND DATA statement or a procedure error will result. When the 3275 "device" buffer in the controller has been updated and the transaction completed, the controller will invite the 2200 to receive the data. The 2200 must respond to this request within 1.5 seconds by executing a RECEIVE DATA statement or a procedure error will result. This response places the 2200 in the ready state.

6. ELECTRONIC SCHEMATICS



REV	DESCRIPTION	DATE
1	INITIAL	11/15/68
2	REVISION	11/15/68



ALL I.C. COMPONENTS ARE 7000 SERIES UNLESS OTHERWISE SPECIFIED.

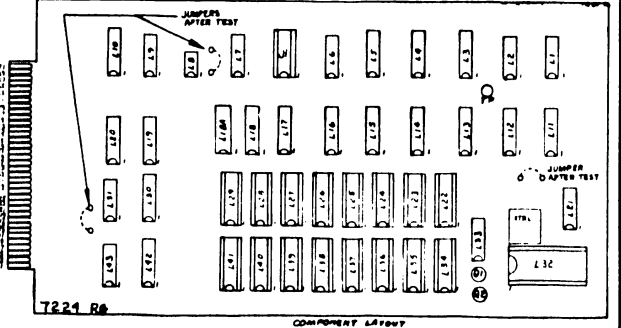
NOTES:

1. ALL I.C. COMPONENTS ARE 7000 SERIES UNLESS OTHERWISE SPECIFIED.
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. ...
10. ...
11. ...
12. ...
13. ...
14. ...

LOCATION	TYPE	VALUES
L8	T408	1
L11	T41348	2
L81	T404	1

COMPONENT	W.L. PART NO.
R1, 2, 13-17	330-4010
R3, 4, 19-24	330-3022
R8	330-6028
R9	330-2049
R10	330-2048
R11, 5	330-3010
C1, 8, 21	300-1930
C9, 12, 14-17	300-1931
C13, 18	300-4017
C22	300-2047
C23	300-1903
C24	300-1820
C25-34, 19	300-1900
C35, 20	300-4022
C36	300-4020
R18	331-2033
XTAL	321-0015
Q1, 2	375-1050
D1	380-2052
J1	376-9008
R6, 7	330-1011

LOCATION	W.L. PART NO.	QTY	PERM. NO.	PERM. NO.
L1	376-0093	7	14	
L2	376-0081	7	14	
L3, 30, 42	376-0082	8	16	
L4, 8	376-0094	8	16	
L6, 43	376-0005	11	4	
L7	376-0006	7	14	
L8	376-0126	1	8	
L9, 18	376-0002	7	14	
L10	376-0049	8	16	
L11, 12, 14, 17	376-0193	8	16	
L14, 15	376-0119	8	16	
L18A, 21	376-0010	7	14	
L19, 20	376-0008	8	16	
L22-29, 34-41	377-0314	18		
L32	377-0318	4	26	
L33	376-0178	7	14	
L22-29, 34-41	376-9014			
L31	376-0011	10	5	
L32	376-9018			



WANG PART NO.	ITEM	QTY	NAME	MATERIAL	DESCR BY	DATE
210-7224						
7224						

END