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1400XL TELECOMMUNICATOR
Cartridge

External Reference
Specification

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ORIGINAL

August 4, 1983

C O M P A N Y C O N F I D E N T I A L

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1.0 PURPOSE

1.1 Introduction and Product Description

The 1400XL Telecommunicator (COM14) is an intelligent terminal emulator program. It allows an ATARI 1400, with its integral modem capability, to send and receive data over standard telephone lines. ASCII, the American Standard Code for Information Interchange, is the code used by COM14.

1.2 Consumer Profile

COM14 will be used to communicate with most computer systems with telephone answering capabilities. It will implement CompuServe's VIDEOTEX standard. That is, it will correctly respond to the special control codes and escape sequences that are defined in that standard.

2.0 APPLICABLE DOCUMENTS

ATARI CENTRAL -- Functional Requirements Specification

CompuServe Terminal Information System Standards

CompuServe 'A' Protocol Description

(All of these documents are available in the APC Software Library.)

3.0 REQUIREMENTS

3.1 Interfaces

3.1.1 Physical Interface

COM14 shall require use of an ATARI 1400XL or 1450 XLD computer.

A printer shall be supported as an option. The printer may be any ATARI printer or any printer that connects to the printer port of the ATARI 1400 XL or 1450 XLD Interface Module.

3.1.2 Definitions

ASCII: ASCII stands for American Standard Code for Information Interchange. It is a standardized code that permits machines made by different manufacturers to communicate with one another.

BACKGROUND PIXEL: In the context of this manual this refers to the pixels in medium and high resolution modes that are the color that the screen clears to upon a clear screen command.

BAUD: The unit measurement of communications speed, usually measured in bits-per-second.

CompuServe: A personal computing and information service that provides computer programs, data bases, and information services to its customers.

Decimal: The number base that most people are used to working with. This number base used ten symbols to display any number; 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. The decimal system has a base of 10.

DUPLEX: A method of operation of acommunications circuit in which each end transmits and receives.

FULL-DUPLEX: A communication system in which each end can simultaneously transmit and receive. With regard to terminals, full duplex means that characters typed are not displayed locally until they are 'echoed' back to the terminal from the host computer.

HALF-DUPLEX: A communications system capable of sending and receiving data in either direction, but not simultaneously. With regard to terminals, half duplex means that characters typed are both transmitted and displayed

locally, e.g. the "host" computer does not "echo" characters.

FOREGROUND PIXEL: In the context of this manual it refers to the pixels that are used to draw the pictures on the background.

HEXADECIMAL: A number base (16) frequently used by programmers. This number base uses sixteen symbols to display a digit; 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F.

LOCAL: In this text it refers to commands that come from the keyboard and perform their function without being transmitted to the remote computer.

MARK: Signal equivalent to binary 1. Also the 'standby' state of an asynchonous modem.

ORIGINATE MODE: Originate mode on the modem indicates the terminal is initiating the communications link.

OVERSCAN: Some Television sets only display the central part of the picture. This is done as a simple way of avoiding a black border around the picture.

PARITY: Parity is a method of error checking binary numbers. The highest bit in a byte is often used for parity.

PIXEL: This word comes from the contraction of two words; picture element. This term is used to refer to the smallest unit of a graphical image.

REMOTE: In this text it refers to a command that arrives at the ATARI through the modem and RS-232 interface.

RS-232: For communication between computers and computer related equipment the industry standard is the Electronic Industries Association RS-232 standard. This Standardized method

was adopted by the EIA to insure uniformity of interface between data communications equipment (DCE) and data processing terminal equipment (DTE). The ATARI 850 Interface Module is equipped with four RS-232 interface ports.

SPACE: Signal equivalent to binary 0.

XOFF: The ASCII signal to stop sending data. XOFF is CONTROL S.

XON: The ASCII signal to begin sending data. XON is CONTROL Q.

3.1.3 Machine/Machine Interface

There are no special requirements.

3.2 Functional Description

3.2.1 STARTUP Procedures

Only one screen display shall be unique to the COM14 executive. A STARTUP display requesting the user to enter a telephone number to dial shall be shown at power-up and when [SYSTEM.RESET] is pressed. The user shall respond with the telephone number of the CompuServe Information Service or other time sharing computer service. The user may enter, as part of the telephone number, any printable character. However, only the digits 0-9 will actually be dialed by COM14. A vertical bar (shift-=) may be entered to cause a three-second pause during the dialing process. After the user has completed the telephone number, either the RETURN key or the START key may be pressed to begin the dialing procedure. If RETURN is pressed, COM14 will dial using the DTMF method. START may may be pressed to use the line-pulse method of dialing.

COM14 shall automatically dial the requested number and wait for a carrier tone from the remote computer. When carrier is acheived, the screen color shall change to green, and COM14 shall say 'online'. If carrier is not acheived within approximately 20 seconds, the telephone line shall be disconnected, and the user shall be told to press [SYSTEM.RESET] to re-dial the number.

The user may bypass the automatic dialing sequence by pressing RETURN at the telephone number prompt. If no digits have been entered when RETURN is pressed, COM14 will assume that the user manually dialed the telephone numbe . A message will be displayed asking the user to hang up the phone, and COM14 will wait for carrier tone verification as described above.

If the carrier signal is lost during a session with the remote computer, a message shall be displayed telling the user to press [SYSTEM.RESET] to try again.

3.2.2 The Keyboard and Generated Codes

With the exception of the CAPS/LOWR, SHIFT, CTRL, HELP, the function keys, and ATARI key, COM14 shall, in response to a key depression, generate a character that is transmitted to the remote computer. Diagram 1 shows the standard ATARI keyboard with the labels that

are printed on the keytops. Diagram 2 shows the codes which shall be generated by COM14 when a given key is depressed. An explanatio of Diagram 2 follows:

The keys SHIFT, CTRL, and CAPS/LOWR shall not generate a code themselves but shall be used in conjunction with another key. The SHIFT and CTRL keys shall be held down while another key is depressed. The CAPS/LOWR key shall be a mode change switch and as such shall be depressed alone or with the shift key. The CAPS/LOWR mode shall remain in effect until changed by the CAPS/LOWR key or until power is turned off. The CAPS/LOWR key is discussed further in a subsequent paragraph.

When the SHIFT key shall be depressed with another key the combination produces a "shift character". When the CTRL key shall be depressed with another key, the combination produces a "control code". Thus an 'a' depressed by itself shall produce an unshifted or lower case 'a'. An 'a' key with the SHIFT key shall produce a shifted or upper case 'A'. Likewise the 'a' key together with the CTRL key shall produce a control-A.

The letters A-Z in Diagram 2 shall be fundamentally different from the other keys. In addition to the SHIFT and CTRL Keys, the letter keys shall generate different keycodes based on the state of the CAPS/LOWR key. The CAPS/LOWR switch shall have the capability of locking the letters into upper case regardless of whether the shift key is currently depressed. The keyboard shall be placed in lower case mode by depressing the CAPS/LOWR key by itself and in upper case mode by depressing the CAPS/LOWR key while holding down the shift key. The CTRL key shall be unaffected by the state of the CAPS/LOWR switch. Holding down both the CTRL and SHIFT keys at the same time shall be an invalid operation and shall not produce any characters.

All of the other keys in Diagram 2 show three rows of numbers and/or dashes. Each two digit number shows the hexadecimal code which shall be produced by pressing that key either alone or in combination with one of the special keys. The bottom value for a given key corresponds to the character produced when that key shall be depressed by itself. The middle value shows the code produced if the SHIFT key shall be depressed with that key. The top value corresponds to the code produced by using the CTRL key with that key.

Dashes in any of the positions indicates that no keycode shall be produced for that combination.

Table 1 contains the characters by name, decimal code, hexadecimal code, keystroke, and meaning. Certain codes shall be producible by more than one keystroke combination.

The ATARI 1400 has 10 additional function keys organized in row across the top of the keyboard. The START, SELECT, and OPTION keys shall be ignored by the COM14 software. The function keys 1 through 4 may be pressed in conjunction with SHIFT and CTRL to control various attributes of COM14.

The valid combinations involving the FUNCTION keys shall be:

KEY	FUNCTION
F1	Toggle the printer ON or OFF. If a printer is not connected to the 1400, COM14 shall 'say' PRINTER NOT READY.
SHFT-F1	Toggle word-wrap ON or OFF.
CTRL-F1	LOCK or UNLOCK keyboard activity. When the keyboard is LOCKed, COM14 will not accept any keys from the keyboard until CTRL-F1 is pressed again.
F2	Toggle telephone audio ON or OFF.
SHFT-F2	Toggle voice feedback feature ON or OFF.
CTRL-F2	Toggle key-click feedback ON or OFF.
F3	Change the screen's background color.
SHFT-F3	Change the screen's background brightness.
CTRL-F3	Change the screen's text brightness.
F4	Set screen margins for 37 characters.
SHFT-F4	Set screen margins for 40 characters.
CTRL-F4	Set screen margins for 32 characters.

The HELP key may be pressed by the user at any time to display these function key operations.

The INVERSE VIDEO key shall be ignored by COM14.

The NUL (HEX 00) code is not normally needed by a terminal and shall not be transmitted.

Every other ASCII code specified in Table 1 shall be transmitable.

Any key that is held down shall repeat automatically. The BREAK key shall send a control-C and shall return the screen to the default width and mode (37 character text mode).

NOTE: The BREAK key, if pressed while the SHIFT key is pressed shall not transmit a control-C. Instead, it shall generate a 1/2 second break signal.

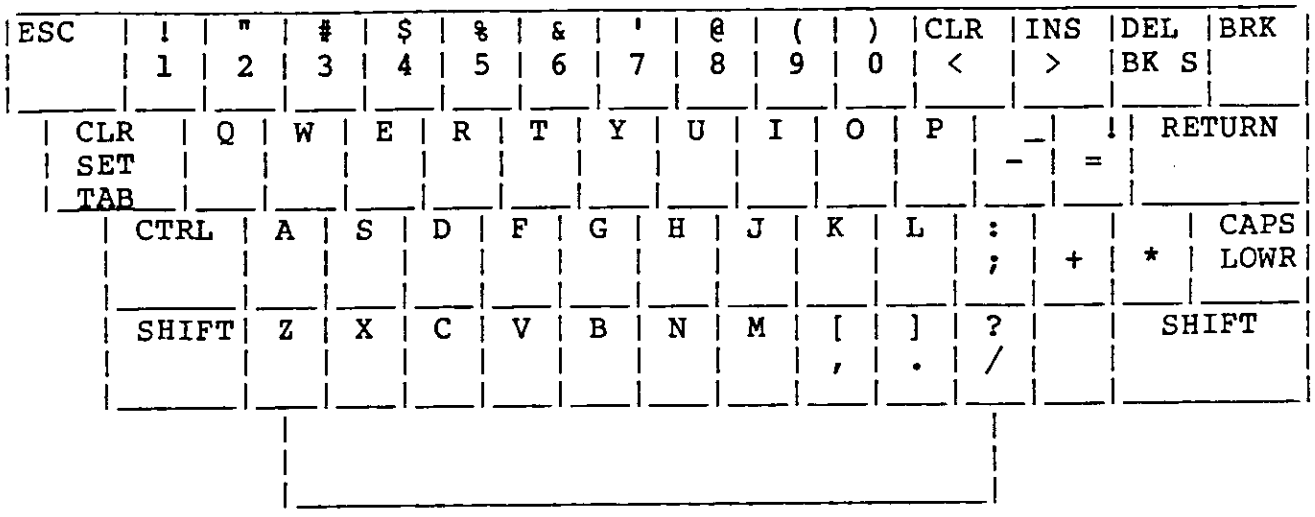


DIAGRAM 1.

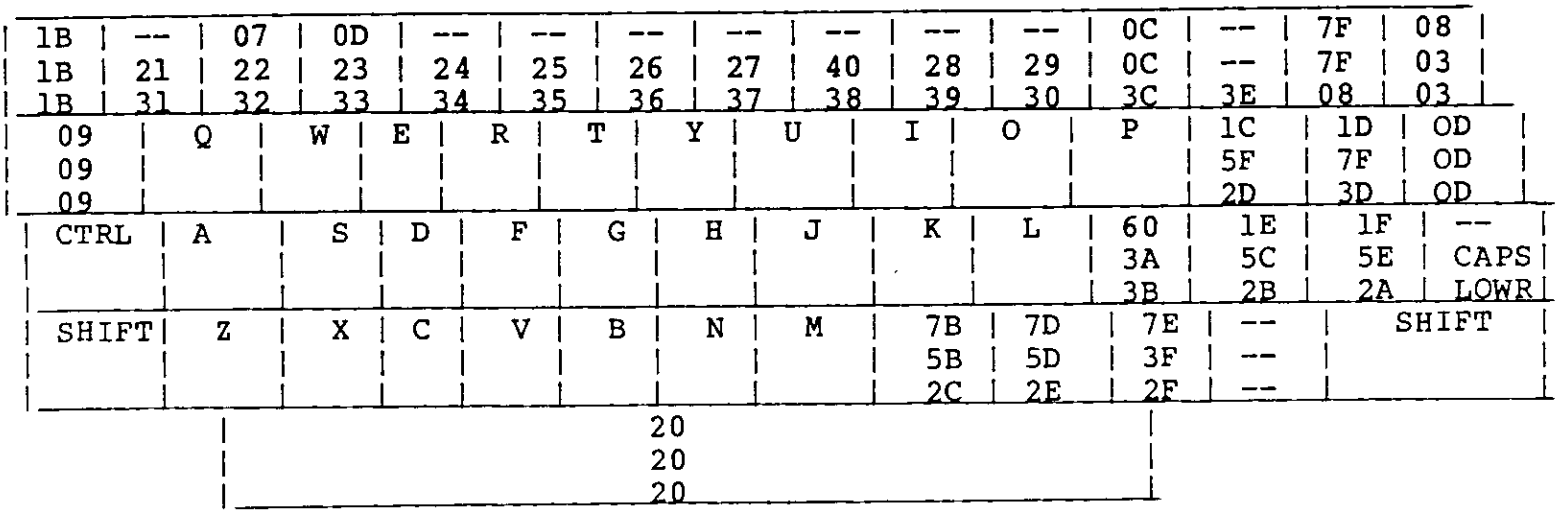


DIAGRAM 2.

CHARACTER	DEC	HEX	KEYSTROKE	ASCII
NUL	0	00	---	NUL
SOH	1	01	CONTROL A	START
STX	2	02	CONTROL B	START
ETX	3	03	CONTROL C	END O
			BREAK	
EOT	4	04	CONTROL D	END O
ENQ	5	05	CONTROL E	ENQUI
ACK	6	06	CONTROL F	ACKNO
BEL	7	07	CONTROL G	BELL
			CONTROL 2	
BS	8	08	CONTROL H	BACKSP
			BACK S	
HT	9	09	CONTROL I	HORIZO
			TAB	
			SHIFT TAB	
			CONTROL TAB	
LF	10	0A	CONTROL J	LINE F
VT	11	0B	CONTROL K	VERTIC
FF	12	0C	CONTROL L	FORM F
			SHIFT <	
			CONTROL<	
CR	13	0D	CONTROL M	CARRIA
			RETURN	
			SHIFT RETURN	
			CONTROL RETURN	
			CONTROL 3	
SO	14	0E	CONTROL N	SHIFT
SI	15	0F	CONTROL O	SHIFT
DLE	16	10	CONTROL P	DATA LI
DC1	17	11	CONTROL Q	DEVICE
DC2	18	12	CONTROL R	DEVICE
DC3	19	13	CONTROL S	DEVICE
DC4	20	14	CONTROL T	DEVICE
NAK	21	15	CONTROL U	NEGATIV
SYN	22	16	CONTROL V	SYNCHRO
ETB	23	17	CONTROL W	END OF
CAN	24	18	CONTROL X	CANCEL
EM	25	19	CONTROL Y	END OF
SUB	26	1A	CONTROL Z	SUBSTIT
ESC	27	1B	ESC	ESCAPE
			SHIFT ESC	
			CONTROL ESC	
FS	28	1C	CONTROL -	FILE SE
GS	29	1D	CONTROL =	GROUP S
RS	30	1E	CONTROL +	RECORD
US	31	1F	CONTROL *	UNIT SE

GENERATED CODES
TABLE 1

CHARACTER	DEC	HEX	KEYSTROKE
SP	32	20	SPACE
			SHIFT SPACE
			CONTROL SPACE
!	33	21	SHIFT 1
"	34	22	SHIFT 2
#	35	23	SHIFT 3
$	36	24	SHIFT 4
%	37	25	SHIFT 5
&	38	26	SHIFT 6
'	39	27	SHIFT 7
(	40	28	SHIFT 9
)	41	29	SHIFT 0
*	42	2A	*
+	43	2B	+
,	44	2C	,
-	45	2D	-
.	46	2E	.
/	47	2F	/
0	48	30	0
1	49	31	1
2	50	32	2
3	51	33	3
4	52	34	4
5	53	35	5
6	54	36	6
7	55	37	7
8	56	38	8
9	57	39	9
:	58	3A	SHIFT ;
;	59	3B	;
<	60	3C	<
=	61	3D	=
>	62	3E	>
?	63	3F	SHIFT /

GENERATED CODES
TABLE 1 (Continued)

CHARACTER	DEC	HEX	KEYSTROKE	ASCII DEFINITION
@	64	40	SHIFT 8	COMMERCIAL AT
A	65	41	SEE NOTE 1	UPPERCASE A
B	66	42	SEE NOTE 1	UPPERCASE B
C	67	43	SEE NOTE 1	UPPERCASE C
D	68	44	SEE NOTE 1	UPPERCASE D
E	69	45	SEE NOTE 1	UPPERCASE E
F	70	46	SEE NOTE 1	UPPERCASE F
G	71	47	SEE NOTE 1	UPPERCASE G
H	72	48	SEE NOTE 1	UPPERCASE H
I	73	49	SEE NOTE 1	UPPERCASE I
J	74	4A	SEE NOTE 1	UPPERCASE J
K	75	4B	SEE NOTE 1	UPPERCASE K
L	76	4C	SEE NOTE 1	UPPERCASE L
M	77	4D	SEE NOTE 1	UPPERCASE M
N	78	4E	SEE NOTE 1	UPPERCASE N
O	79	4F	SEE NOTE 1	UPPERCASE O
P	80	50	SEE NOTE 1	UPPERCASE P
Q	81	51	SEE NOTE 1	UPPERCASE Q
R	82	52	SEE NOTE 1	UPPERCASE R
S	83	53	SEE NOTE 1	UPPERCASE S
T	84	54	SEE NOTE 1	UPPERCASE T
U	85	55	SEE NOTE 1	UPPERCASE U
V	86	56	SEE NOTE 1	UPPERCASE V
W	87	57	SEE NOTE 1	UPPERCASE W
X	88	58	SEE NOTE 1	UPPERCASE X
Y	89	59	SEE NOTE 1	UPPERCASE Y
Z	90	5A	SEE NOTE 1	UPPERCASE Z
[	91	5B	SHIFT ,	LEFT BRACKET
\	92	5C	SHIFT +	BACKSLASH
]	93	5D	SHIFT .	RIGHT BRACKET
	94	5E	SHIFT *	CIRCUMFLEX
_	95	5F	SHIFT _	UNDERSCORE

NOTE: If the CAPS/LOWR mode is set to CAPS then both the shifted key and the unshifted key will produce an uppercase letter. If the CAPS/LOWR mode is set to LOWR then the uppercase letter will only be produced for the key when it is shifted while the unshifted key will produce the lowercase letter.

GENERATED CODES
TABLE 1 (Continued)

CHARACTER	DEC	HEX	KEYSTROKE	ASCII DEFINITION
	96	60	CONTROL ;	GRAVE ACCENT
a	97	61	CONTROL 2	LOWERCASE A
b	98	62	SEE NOTE 2	LOWERCASE B
c	99	63	SEE NOTE 2	LOWERCASE C
d	100	64	SEE NOTE 2	LOWERCASE D
e	101	65	SEE NOTE 2	LOWERCASE E
f	102	66	SEE NOTE 2	LOWERCASE F
g	103	67	SEE NOTE 2	LOWERCASE G
h	104	68	SEE NOTE 2	LOWERCASE H
i	105	69	SEE NOTE 2	LOWERCASE I
j	106	6A	SEE NOTE 2	LOWERCASE J
k	107	6B	SEE NOTE 2	LOWERCASE K
l	108	6C	SEE NOTE 2	LOWERCASE L
m	109	6D	SEE NOTE 2	LOWERCASE M
n	110	6E	SEE NOTE 2	LOWERCASE N
o	111	6F	SEE NOTE 2	LOWERCASE O
p	112	70	SEE NOTE 2	LOWERCASE P
q	113	71	SEE NOTE 2	LOWERCASE Q
r	114	72	SEE NOTE 2	LOWERCASE R
s	115	73	SEE NOTE 2	LOWERCASE S
t	116	74	SEE NOTE 2	LOWERCASE T
u	117	75	SEE NOTE 2	LOWERCASE U
v	118	76	SEE NOTE 2	LOWERCASE V
w	119	77	SEE NOTE 2	LOWERCASE W
x	120	78	SEE NOTE 2	LOWERCASE X
y	121	79	SEE NOTE 2	LOWERCASE Y
z	122	7A	SEE NOTE 2	LOWERCASE Z
	123	7B	CONTROL ,	LEFT BRACK
	124	7C	SHIFT =	VERTICAL LINE
	125	7D	CONTROL .	RIGHT BRACE
	126	7E	CONTROL /	TILDE
DEL	127	7F	SHIFT BACK S CONTROL BACK S	DELETE

NOTE 2: If the CAPS/LOWR mode is set to LOWR then the unshifted key depressed by itself will produce a lowercase letter. If the CAPS/LOWR mode is set to CAPS then the uppercase letter will be produced regardless of the SHIFT key.

GENERATED CODES
TABLE 1 (Continued)

3.2.3 File Transfer Capability

COM14 shall have an error free file transfer protocol which shall transfer files from the ATARI 810/1050 disk drives directly to CompuServe and vice-versa. Since this transfer shall be under a protocol, any 'noise' on the line shall be detected and corrected. The program to do the file transfers and the information on how to use it shall be found on the CompuServe Information Service.

3.2.4 Object File Down-Load Capability

COM14 shall contain a machine language object file loader which shall allow future Aersions of the COM14 to be downloaded from CompuServe.

3.2.5 COM14 Implementation of the VIDEOTEX Standard

COM14 shall implement the following features of the VIDEOTEX standard. Appendix A provides details except as noted.

TWO TEXT/GRAPHIC MODES
- Pure text - 32 columns by 24 rows
- Semigraphics 4 - 32 columns by 24 rows with block graphics

RELATIVE CURSOR MOVEMENT
- Cursor up
- Cursor down
- Cursor left
- Cursor right

DIRECT CURSOR POSITIONING (See also Appendix B.)

SCREEN CLEARING
- Clear to end of line
- Clear to end of page
- Clear entire page

HOME CURSOR

DISABLE DISPLAY

ENABLE DISPLAY
- All cursor positioning and screen clearing commands shall work in both text and semigraphics modes and

shall deal with pixels instead of cursor positions where applicable.

CONTROL CODES
The control codes BEL, BS, HT, LF, VT, FF, and CR shall perform their standard functions. (See Appendix C.)

PRINTER SUPPORT
The ability to turn the printer on and off both locally and remotely.

TERMINAL INTERROGATION
COM14 shall, upon receiving the proper command code, identify itself to the remote computer.

BREAK ON WORD BOUNDARY
Words shall not be split in two at the end of a line but shall be moved in their entirety to the next line down.

3.2.6 COM14 Differences from the VIDEOTEX Standard

There shall be two classes of differences between the VIDEOTEX standard and the COM14. The first, Class 1, shall be composed of details of the standard that cannot be implemented fully or in part on the ATARI either because of memory or hardware restrictions. The other, Class 2, shall involve extensions to the standard that make use of a particular feature of the ATARI.

3.2.6.1 Class 1 Differences

The only Class 1 difference shall be in Semigraphics 4 mode. The VIDEOTEX standard assumes a screen size of 16 rows of 32 columns. Semigraphics 4 shall contain both text and colored block graphics. The full set of 96 printable ASCII characters shall be displayable while in Semigraphics 4 as well as two by two color graphics. Each character on the screen shall be an ASCII Printing character or a two pixel high and two pixel wide block character. This implies a maximum number of pixels in the horizontal of 64 and in the vertical a maximum of 32. The color shall, however, only change on character boundaries. Each block character shall be one of the following 8 colors or black:

GREEN, YELLOW, BLUE, RED, BUFF, CYAN, MAGENTA, AND ORANGE

It is not possible to generate all the required colors, so COM14 shall automatically make some color substitutions. Three colors and black shall be available. Incoming color information shall be automatically remapped according to Table 2.

COLOR SENT	MAPPED COLOR
BLACK	BLACK
GREEN	BLUE
YELLOW	WHITE
BLUE	BLUE
RED	ORANGE-RED
BUFF	WHITE
CYAN	BLUE
MAGENTA	ORANGE-RED
ORANGE	ORANGE-RED

COLOR MAPPING TABLE
TABLE 2

Additionally, four character codes in Semigraphics 4 mode shall be used in a special way to support color graphics. The table below lists the four characters and their Semigraphics 4 translation.

RECEIVED CHARACTER	TRANSLATED
LEFT CURLY BRACE	LEFT BRACKET [
VERTICAL BAR	BACKSLASH
RIGHT CURLY BRACE	RIGHT BRACKET]
TILDE	CIRCUMFLEX

Note that the translation shall only occur in Semigraphics 4 and only to characters that shall be received while in this mode. Characters already on the screen shall not be translated. There shall be no other differences in the other modes, and text mode displays all 96 printable ASCII characters with standard symbols.

3.2.6.2 Class 2 Differences

As was mentioned earlier Class 2 differences shall be extensions to the standard resulting from the unique features of the ATARI personal computer. When COM14 is executed, the default column width shall be 37 characters. This means that the working video area shall be restricted to 37 columns of the 40 columns that the ATARI can display. A two character left-hand margin and a one character right margin shall be established. This shall accommodate most television sets which "clip" the edges of the display. COM14 shall also support a user-selectable 32 character display mode. This shall be useful for several reasons: (1) by using just 32 columns the width in both screen modes shall precisely match the VIDEOTEX standard, (2) the narrow screen mode shall center the active region on the screen with four character positions of background color on both sides.

The full 40-character screen width shall also be selectable in both pure text and Semigraphics 4 modes.

The number of horizontal rows shall be 24 in both narrow and wide screen modes for both pure text and Semigraphics 4.

There shall be two ways of controlling the width of the screen, locally and remotely. Function key F4 shall be used to control the width locally. The screen shall be made narrow (32 characters) by pressing CTRL-F4. The screen shall be reset to the default 37 character width by pressing F4 without holding down SHIFT or CTRL.

The screen width shall also be alterable from a remote computer by sending the following ESCAPE sequences.

<ESC><ESC>N	CHANGE TO NARROW (32 character) screen mode
<ESC><ESC>W	CHANGE TO WIDE (37 character) screen mode

Notice that the 'N' and 'W' are upper case. Trying to change to a mode that is already active shall have no effect. Changing a screen width mode shall erase the current display and send the cursor to home position.

The 40-character text mode shall only be locally selectable and shall be accomplished by holding down the SHIFT key and pressing function key F4. This mode shall be primarily useful when using a monitor or projection TV as the display device.

APPENDIX A

ESCAPE SEQUENCES

COM14 shall respond to certain ESCAPE sequences for cursor control and other functions. Except where noted, these sequences shall be generated only by programs running on the computer to which the ATARI is communicating and shall not work locally. The following is a list of the ESCAPE sequences and the functions they shall perform. **Note the difference between upper and lower case; this is very important!!**

<ESC>A	Move up one line
<ESC>B	Move down one line
<ESC>C	Move right a space
<ESC>D	Move left a space
<ESC>e	Disable the display
<ESC>f	Enable the display
<ESC>GN	Change to normal (text only) mode
<ESC>G4	Change to Semigraphics 4 mode
<ESC>H	Home cursor
<ESC>I	Interrogate terminal
<ESC>J	Clear to end of page
<ESC>j	Clear page
<ESC>K	Clear to end of line
<ESC>Y lin col	Direct cursor/pixel position see Appendix B to calculate line and column
<ESC><ESC>N	Change to narrow screen width May be changed locally be depressing the ATARI key.
<ESC><ESC>W	Change to wide screen width May be changed locally by depressing the ATARI key with the SHIFT.
<ESC>P0	Turn the printer off.
<ESC>P2	Activate printer in normal character mode.
<ESC>P3	Activate printer in condensed character mode. **
<ESC>P4	Activate printer in proportional character mode. **

** These requests will be supported on an ATARI 825 printer only.

APPENDIX B

HOW TO CALCULATE LINE AND COLUMN

The cursor shall be movable directly to any position on the screen by absolute positioning. The sequence to do this is:

<ESC> Y lin col

When 'lin' shall be the ASCII character whose value is the line number +31 and 'col' shall be the ASCII character whose value is the column number + 31. If the line specified is too large for the screen, the cursor shall be positioned at the bottom line. Similarly, if the column specified is too large, the cursor shall be positioned at the last column. For example; the following sequence shall position the cursor at the 4th line and the 10th column:

<ESC> Y #)

Note that the character '#' has the ASCII value of 35 which is 31 + 4 and the character ')' has the ASCII value of 41 which is 31 + 10. The largest lin or col value that is definable in one byte in the standard is 254 which is 31 + 223. If the value that is to be transmitted exceeds this value then the following shall be done. For either a lin or col over 223 subtract 224 from it until a value of less than 224 is obtained. Then for every successful subtraction a 255 shall be sent followed by the remainder of the subtraction. The remainder shall be offset by 31 as was explained above. For example; the following sequence shall position the cursor at the 4th line and the 225th column:

<ESC> Y # <255> !

Note that the character '#' is the same as before and does not change because of the larger column value. The <255> and the '!' are added together to form the column number which is 255-31 + 33-31 or 223 + 2 = 225.

APPENDIX C

CONTROL CODES

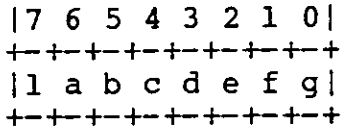
COM14 shall respond to the following control codes:

control-G	BELL	Ring the bell
control-H	BACKSPACE	Destructive backspace
control-I	TAB	Move to next tabe stop
control-J	LINE FEED	Cursor down one line
control-K	VERTICAL TAB	Cursor down 8 lines
control-L	FORM FEED	Clear screen
control-M	RETURN	Move cursor to start of line

APPENDIX D

TRANSMISSION OF SEMIGRAPHICS 4 INFORMATION

In Semigraphics 4 the parity bit shall be used to distinguish between graphic and ASCII characters. If the parity bit is zero, the character shall be a standard ASCII character. If the parity bit is one, the character shall be a graphic character. The format of a graphic character is:



Bits "abc" shall define the color as follows:

000 - green
001 - yellow
010 - blue
011 - red
100 - buff or white
101 - cyan
110 - magenta
111 - orange

As has been mentioned earlier, COM14 shall map these transmitted colors to the ones that it can produce.

Bits "defg" shall define the graphics character as a set of four picture elements. A one bit shall set a picture element to the specified color. The bits shall map to the picture elements as follows: