

**TeleVideo®**  
VT100.net

# OPERATORS REFERENCE HANDBOOK



**TVI®-912B and TVI®-920B**  
**TVI®-912C and TVI®-920C**

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**TVI-912/TVI-920 SERIES  
VIDEO DISPLAY COMPUTER TERMINAL  
OPERATOR'S MANUAL**

**1.0 GENERAL FEATURES**

- Standard 96 ASCII Character set displayable
- 1920 Character display
- 24 lines x 80 characters
- 9 transmission rates from 75 to 9600 bps
- 14-key numeric keypad
- 6 separate cursor control keys
- Local or remote control of conversation/block mode
- Single-key edit operations (TVI-920 only)
- Page, field, or line edit
- Blinking fields
- Blank fields
- Dual intensity
- Reverse video
- Underline fields
- Field tab/backtab
- Typewriter tabs
- Storable tabs
- Protect mode
- Self-test mode
- Cursor addressing & cursor read
- 15-cps repeat. Typamatic keyboard
- Standard RS232, point-to-point 20ma current loop
- Non-glare etched screen
- 115/230 VAC 50/60 Hz Refresh
- Serial printer port

**1.1 Options**

- Second page memory, 1920 characters

## **2.0 GENERAL DESCRIPTION**

The TeleVideo TVI-912/TVI-920 terminals are compact smart terminals. They are the result of state-of-the-art design improvements which allow them to offer high level performance at extremely low cost. The TVI-912/TVI-920 terminals are compatible with most computers.

Standard features include editing capability, protected field, addressable cursor, micro-processor control, line and character insert/delete, upper and lower case characters and tabbing. Switchable transmission rates ranging from 75 to 9,600 baud are standard. Also included as standard is a buffered serial printer port. A 1,920-character second page display memory is optional on all models.

## **3.0 SPECIFICATIONS**

### **3.1 Monitor**

Size: 12 inches (diagonally measured)  
Phosphor: P4, non-glare read-out

### **3.2 Displayed Character Set**

96-character ASCII upper and lower case alphabet  
Number of lines: 24  
Characters per line: 80  
Screen capacity: 1,920  
Dual intensity  
Blinking fields  
Secure fields (non-display)  
Inverse video  
Underlined fields

### **3.3 Character Font**

7 x 10 dot matrix with 12 x 10 resolution

### **3.4 Key Board Format**

### **3.5 Editing Features**

Clear screen to space or null  
Typeover  
Character insert and character delete  
Line insert and line delete  
Absolute cursor addressing  
Erase to end of page  
Erase to end of line or field  
Line edit

### **3.6 Cursor Controls**

→, ←, ↑, ↓, New line, Home, Tab, Back Tab

### 3.7 Formatting Features

- Tab
- Back tab
- Column tab set
- Blinking field
- Inverse video
- Underline
- Dual intensity
- Protected field

### 3.8 Parity

Even, Odd, Mark, Space or No Parity.

### 3.9 Repeat

15-cps auto-repeat

### 3.10 Transmission

Conversation mode: Full or half duplex  
Block mode: Formatted information transmitted by line or page, protected and unprotected data, or unprotected data only.

### 3.11 Interfaces

- Standard RS232 point-to-point
- 20ma current loop
- RS232 to printer port

### 3.12 Data Rates

9 speeds: 75, 110, 150, 300, 600, 1200, 2400, 4800, 9600

### 3.13 Dimension

Height:	13-1/4"	33.66 cm
Width:	16-1/8"	40.96 cm
Depth:	20-1/16"	50.96 cm

### 3.14 Weight

30 lbs.     13.95 kg

### 3.15 Operating Environment

Ambient temperature range (non-condensing): 0°C to 50°C (32°F to 122°F)  
Maximum relative humidity: 95%.

### 3.16 Power Requirements

115 VAC at 0.5 amps/230 VAC at 0.25 amps, 50/60 Hz, 55W

## 4.0 INTERCONNECTION

### 4.1 Interconnection Steps

- Step 1: Making sure the power switch on the terminal is turned OFF, plug the terminal power cord into grounded outlet.
- Step 2: Connect the cable from the remote computer or modem to the interface connector (P3).

### 4.2 Main Interface Connector (EIA RS232C Connector Pin/Signal List)

Pin No.	Signal Name	Bell System Code
1	Frame Ground	AA
2	Transmit Data Output	BA
3	Receive Data Input	BB
4	Request to Send Output	CA
5	Clear to Send Input	CB
6	Data Set Ready (opt.) Input	
7	Signal Ground	AB
8	Carrier Detect Input	
20	Data Terminal Ready Output	CD
25	Current Loop +	
13	Current Loop - Transmit*	
12	Current Loop +	
24	Current Loop - Receive*	

\*Internal Strap Options for Active/Passive. (See page 25 "Jumper Options").

### 4.3 Printer Interface

Pin No.	Signal Name
1	Frame Ground
3	Serial Data (RS232)
4	Printer Ready (Jumper Select)
6	Terminal Ready
7	Signal Ground
8	Terminal Ready (Jumper Select)
20	Printer Ready



## **5.0 INSTALLATION**

### **5.1 Local Installation**

The TVI-912/TVI-920 with a standard communications interface (RS232) can be cabled directly to a local computer.

### **5.2 Remote Installation**

The TVI-912/920 can communicate with remote computers using a modem connected between the TVI-912/920 and the communication lines.

### **5.3 Terminal TURN-ON Procedure**

- Step 1. First make sure that ON/OFF switch at the rear of the terminal is in OFF position.
- Step 2. Plug the terminal cord into a grounded 115VAC outlet.
- Step 3. Set the ON/OFF switch to ON position; the beep will sound.
- Step 4. Cursor will appear at its home position in approximately 20 seconds.
- Step 5. If the cursor does not appear at the "home" position, press HOME key. If the cursor still does not appear, check if the brightness control is properly adjusted.

## **6.0 FUNCTIONAL DESCRIPTION OF TVI-912/TVI-920**

### **6.1 Keyboard**

The TVI-912B has a 84 key keyboard comprised of alphanumeric characters, symbols and control keys to perform its full operation.

The TVI-920B has a 103 key keyboard which adds 11 special function keys, six editing keys, and two transmission keys.

The TVI-912C has a 82 key keyboard, in a standard typewriter style, with alphanumeric characters, symbols, and control keys.

The TVI-920C has a 101 key keyboard, in a standard typewriter style, that adds 11 special function keys, six editing keys and two transmission keys.

### **6.2 Contrast Control**

The brightness of displayed data on the screen can be adjusted by means of a control knob on the rear of the TVI-912/TVI-920.

### **6.3 Transmission Rates**

The TVI-912/TVI-920 meets the standard transmission rates of computer interfaces, telephone data lines, and modems with 9 speeds: 75, 110, 150, 300, 600, 1200, 2400, 4800 or 9600 baud. Speed is selected by means of switches on the rear of the terminal.

### **6.4 Mode Selection**

The TVI-912B/TVI-920B selects Block Mode with CTRL/ESC. The TVI-912C/TVI-920C selects Conversation or Block Mode by operation of the Block/Conversation key in conjunction with the "Control" or "Shift" key.

#### **6.4.1 Conversation Mode**

**Half Duplex:** In Half Duplex mode, the TVI-912/TVI-920 sends and receives data in only one direction at a time. Characters are displayed on the screen and transmitted to the computer at the same time as they are typed from the keyboard. TVI-912/TVI-920 receives and displays data simultaneously.

**Full Duplex:** In Full Duplex, TVI-912/TVI-920 sends and receives data in both directions simultaneously. Characters are transmitted as they are typed, but they are not displayed. The typed characters are echoed from the computer back to the terminal, then they are displayed on the screen.

#### **6.4.2 Block Mode**

In Block Mode, TVI-912/TVI-920 sends and receives data in complete blocks. Data up to a full screen can be entered by operator. In this mode, characters are stored and displayed but not transmitted until a special code sequence is received by the terminal, or by the depression of a "send" key on the TVI-920. The edited data can be transmitted partially or completely. This mode is utilized for fast transmission of large blocks of data.

### **6.5 Protect Mode**

In Protect mode, those character positions designated as protected (lower intensity) cannot be modified. The cursor cannot enter a protected field. The cursor will be advanced across the protected field to the next unprotected position. The cursor may be back-spaced across a protected field. (All protected characters are identified by half intensity.)

## 6.6 The Cursor

The cursor of TVI-912/TVI-920 is a reverse video block, rectangular-shaped marker on the screen which indicates the entry spot for the following character to be typed. When typing, the cursor moves from left to right. If the cursor is placed over a character already displayed, the character is changed into a reverse image inside the cursor. The cursor can be moved up, down, left, right or home by pressing a cursor motion key. Any desired cursor position in the display area can be obtained using an absolute cursor address of Y (line) and X (column) combination.

## 6.7 Editing Functions

Clear screen to spaces or nulls  
Character typeover  
Clear unprotected positions  
Character insert and character delete  
Line insert and line delete  
Erase to end of line or field with spaces or nulls  
Erase to end of page with spaces or nulls

## 6.8 Formatting Capabilities

**Tabs:** When in protect mode, the tabs, forward and back, are set using columns of protected characters. The TVI-912/TVI-920 also offers typewriter-style tab when not in Protect mode. Up to 80 tab positions may be set without loss of character location.

**Field Reverse:** The data can be displayed as black characters on a white background.

**Field Blinking:** Blinking fields can be designated over areas of the display and the designated areas blink on and off, at a 2 Hertz rate.

**Field Blanking:** Blank fields can be designated over areas of the display. The areas are blanked, although the characters are still entered into display memory, i.e., can be used to enter code names, etc.

**Field Protection:** Protected fields can also be designated. The protected fields appear at a reduced intensity and, once designated as protected fields, cannot be over-written unless the TVI-912/TVI-920 is removed from Protect mode.

## 7.0 OPERATION OF TVI-912/TVI-920

### 7.1 Keyboard Function

The TVI 912/TVI-920 keyboard contains alphanumeric keys to enter data, and function keys (control keys) for controlling operation. For all the definitions of keyboards and control codes, please refer to Quick Reference Guide (page 31).

Control Keys and Functional Description as follows:



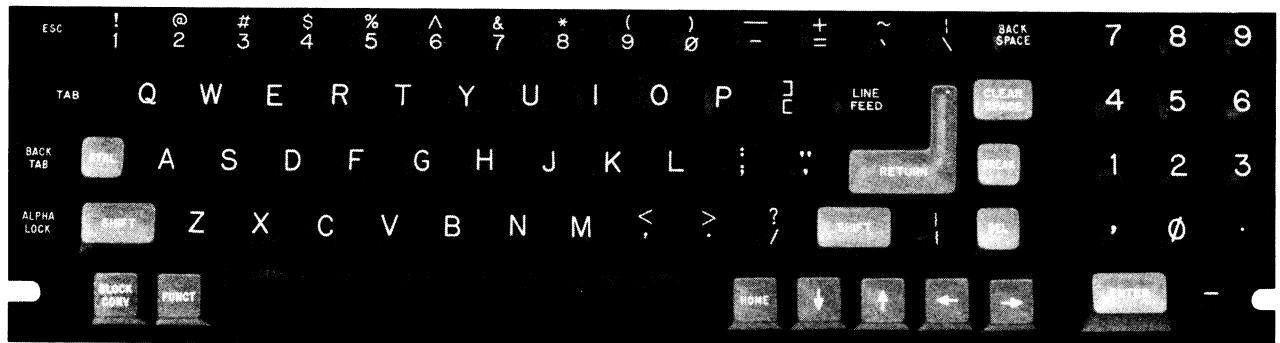
TVI®-920B Keyboard



TVI®-920C Keyboard



TVI®-912B Keyboard



TVI®-912C Keyboard

### 7.1.1 Control Keys - Functional Description

Control Keys		Functional Description
CLEAR SP	(ALL)	Performs a local clear space when depressed. Transmits a CTRL/Z when depressed with shift in Conversation Mode. If in Half Duplex, will also clear screen to spaces along with transmitting. CTRL/Z when received by the terminal, performs a clear unprotected to spaces.
CHAR INSERT ESC Q	(920) (ALL)	Moves character in the cursor position and all succeeding characters to the right by one position. If no protected field is encountered between the cursor and the end of the line, this operation terminates at the end of the line and the last character in the line is lost. If a protected field is encountered, and Protect Mode is on, the operation will terminate at the end of the unprotected field at which the cursor rests, and the last character in that field is lost.
CHAR DELETE ESC W	(920) (ALL)	Deletes character in cursor position. If no part of the line is protected, characters following the cursor are moved to the left. If the line has a protected field, only the characters from the cursor to the protected field are moved to the left. This operation terminates at the end of the line, if no protected fields are on the line.
LINE INSERT ESC E	(920) (ALL)	Inserts a line of nulls between the line above the cursor and the line where the cursor is positioned. At this time, the line where the cursor was located and all following lines move one line downwards. The cursor is positioned at the start of the new line. The bottom line of the screen is lost. If in Protect mode, no operation is performed.
LINE DELETE ESC R	(920) (ALL)	Deletes completely the line where the cursor is located. All following lines move one line upwards. Cursor is positioned at the start of the line. If in Protect mode, no operation is performed.
LINE ERASE ESC T, (ESC t)	(920) (ALL)	Erases all character positions from cursor to the end of the line where the cursor is located and replaces with Space Codes (ESC T) or Null Codes (ESC t) if shifted (TVI-920 only). If in protected mode, the operation will end at the first protected location to the right of the cursor.
PAGE ERASE ESC Y, (ESC y)	(920) (ALL)	Erases all character positions from cursor through end of display and replaces with Space Codes (ESC Y), or Null Codes (ESC y) if shifted (TVI-920 only). If Write Protect is on, protected spaces or nulls will be written. (Note that if the entire page is protected in Protect Mode, the cursor will stop in the Home position and no further character may be entered until an unprotected area is made available, or Protect Mode is turned off.)
CTRL	(ALL)	Modifies the code transmitted by pressing another key.

ESC	(ALL)	This key generates the standard ASCII ESC (IBH). Receipt of this code causes the following character to be interpreted as a Function command. This key does not repeat.
RUBOUT DEL	(912B, 920B) (912C, 920C)	This key is effective only in Conversation Mode. Computer normally interprets "RUBOUT" as a character erase code.
BREAK	(ALL)	Transmits the TTY break signal.
TAB CTRL/I	(ALL) (ALL)	In Protect Mode, TAB key moves the cursor forward to the first unprotected character following a protected field. If there is no following unprotected character, the cursor moves to the "home" position. If not in Protect Mode, the cursor is moved to the next column Tab location. If no more Tabs are set, the cursor does not move. (Transmits CTRL/I.)
BACKTAB ESCI	(ALL) (ALL)	In PROTECT MODE, "BACK TAB" key moves cursor backwards to the first character position of its field. If cursor is at the first character position of its field, it moves to the first character position of the previous field. If cursor moves through "home", it comes to rest at the last unprotected position on the screen. In conversation mode, no action is taken. (Does not transmit code.)
HOME CTRL/ ^	(ALL)	Moves cursor to the first character position of the top line of the display. If the "home" position is protected, cursor moves to the first unprotected position following (if Protect Mode is set). Transmits ASCII RS code (IEH).
PAGE NEWLINE CTRL/_	912B, 920B (ALL)	Moves the cursor to the first character position of the next line. If that position is protected, cursor moves to the first unprotected position (Transmits CTRL/_.)
SHIFT/PAGE NEWLINE ESC K	(912B, 920B) (ALL)	Displays alternate page. Cursor does not move. (Shift/Page-Newline does not transmit a code.)
↑,CTRL/K	(ALL)	↑ This key moves cursor to the next higher line.
↓,CTRL/J	(ALL)	↓ This key moves cursor to the next lower line.
←,CTRL/H BACKSPACE	(ALL) (912C, 920C)	← This key moves cursor to next position to its left.
→,CTRL/L	(ALL)	→ This key moves cursor to the next position to its right.
<p>For all of the above keys, the cursor will advance forward to the next unprotected position if the character space to be moved to is protected and Protect Mode is on. (Transmits corresponding control code.)</p>		

TABSET ESC 1	(912B, 920B) (ALL)	If in Protect Mode, writes vertical column of protected spaces in the column containing the cursor. Column begins in row containing the cursor and extends through bottom row. If not in Protect Mode, a typewriter TAB is set. Will not change any protected characters.
SEND LINE ESC 4	(920) (ALL)	“ESC 4” or SEND LINE key causes unprotected characters (EXCEPT NULLS) in the displayed line containing the cursor to be transmitted, if in Protect Mode. All characteristics are transmitted beginning at the start of the unprotected field up to the position the cursor was in when SEND LINE was requested.
SHIFT/SEND LINE ESC 6	(920) (ALL)	“ESC 6” key causes all characters (EXCEPT NULLS) in the displayed line containing the cursor to be transmitted. All characters are transmitted beginning at the start of the line up to the position the cursor was in when SEND LINE was requested.
SEND PAGE ESC 5	(920) (ALL)	“ESC 5” or SEND PAGE key causes unprotected characters (EXCEPT NULLS) of the displayed page to be transmitted. All characteristics are transmitted from the beginning of the first unprotected field up to the cursor position when SEND PAGE was requested.
SHIFT/SEND PAGE ESC 7	(920) (ALL)	“ESC 7” causes all characters (EXCEPT NULLS) in the displayed page to be transmitted. All characters are transmitted from the beginning of the page up to the cursor position when SEND PAGE was requested.
PRINT ESC P	(912B, 920B) (ALL)	Enables output to the hard copy printer, which is optional. PRINT key pressed causes each line to be transmitted to the printer, followed by a CR, LF, NUL sequence, from the beginning of the page to the cursor position. The last character will be followed by CR, LF, NUL. If in Protect Mode, the protected (half intensity) character will be replaced by spaces (used with pre-printed forms).
LINE FEED CTRL/J	(ALL) (ALL)	This key moves cursor to the next lower line. If new position is protected, cursor skips forward to the first unprotected position.
RETURN CTRL/M ENTER	(ALL) (ALL) (912C, 920C)	Moves cursor to the first character position in the line which it rests, or to the first unprotected position of the line if in PROTECT MODE.
SHIFT	(ALL)	Selects upper character indicated on another key. This key is also used to change operation of special keys.
ALPHA LOCK	(ALL)	Locks upper case for alpha characters only. Does not affect numeric or special keys.

SPACE BAR	(ALL)	Causes a blank space to appear on the display. It also causes ASCII space code (20H) to be transmitted in Conversation Mode.
ESC )	(ALL)	“ESC )” turns on half intensity, and all characters typed thereafter, until reset, will be designated as protected, if Protect Mode is on.
ESC (	(ALL)	Half intensity is turned off by “ESC (“.
PROT MODE (OFF) ESC’	(912B, 920B) (ALL)	Protected characters shown in lower intensity, but protection is not effective. The characters written with half intensity on will be treated the same as all other characters by all editing functions.
SHIFT/PROT MODE (ON) ESC &	(912B, 920B) (ALL)	Protect Mode is set and half intensity characters are protected from over-writing or erasure. In Protect Mode, the cursor cannot stay in a protected character position unless all positions are protected. In that case, the cursor will appear in the Home position.
CTRL/ESC SHIFT/BLOCK- CONV ESC B	(912B, 920B) (912C, 920C) (ALL)	Sets the Terminal in Block Mode. When in Block Mode, the typed characters are displayed and stored, but not transmitted until a send function is activated. Data may still be received and displayed in Block Mode.
CTRL/BLOCK- CONV ESC C	(912C, 920C) (ALL)	Sets the Terminal in Conversation Mode. When in Conversation Mode, characters typed are transmitted either in half or full duplex.
ESC @ (EXTENTION MODE)	(ALL)	Causes * all characters received at the modem port to be transmitted out the printer port (at the same baud rate). CRT screen continues to be updated. * except ESC A.
ESC A PRINT MODE)	(ALL)	Enables page print only. Characters received at the modem port will not be transmitted out the printer port.

## 7.2 Function Keys

Special function transmission is still possible in Block Mode, and does not affect the contents of the display screen.

Operation of 11 keys (F1 to F11) on the TVI-920 causes transmission of the following three-code sequence:

1. SOH (Control-A)
2. One of 11 characters “@” through “J” (Hex 40 through 4A) or “” through “j” (Hex 60 through 6A) if used with SHIFT.
3. Carriage Return (control-M)



On the TVI-912/TVI-920, operation of the "FUNC" key with another character key will cause transmission of the following sequence:

1. SOH (Control-A)
2. ASCII Alphanumeric code for character key pressed
3. Carriage Return (control-M)

### 7.3 Numeric Key Pad

The numeric key pad has keys to write numerals from 0 through 9, comma, period, ENTER, and —. These keys are affected by SHIFT just as the normal numeric keys.

### 7.4 ON/OFF Switch

This ON/OFF switch is located on the rear of the terminal. This two-position Switch controls AC power to the terminal. Setting the switch to ON position resets terminal circuits, positions cursor at "home", and clears display memories to unprotected spaces.

### 7.5 TVI-912/TVI-920 Controls

The ON/OFF and other manual controls are located on the rear of the terminal.

Contrast Control: Desired character brightness relative to screen background can be selected by this control.

Conversation Mode Switch: Full or Half-Duplex Conversation Mode operation can be selected by this switch and it is located inside the terminal (accessible from the rear of the terminal).

Baud Rate Switch: This 10-position switch selects transmission rate at one of nine standard speeds from 75 baud to 9600 baud. **(ONLY ONE SWITCH MAY BE DOWN AT A TIME.)**

	6 = 600
2 = 9600	7 = 300
3 = 4800	8 = 150
4 = 2400	9 = 75
5 = 1200	10 = 110

### 7.6 Attribute Codes

Setting or Resetting Visual attribute (Blink, Blank, Reverse or Underline) always overrides any previous Visual attributes set. Therefore, to add an attribute to any that already exist in the character locations beyond which the cursor rests, all the attributes desired must be started at that point.

#### EXAMPLE A

Assume a full screen of Reverse Video. You wish to have the bottom half of the screen Underlined and Reverse Video.

Position the cursor at line 11, column 80. Issue to the TVI-912/TVI-920 ESC j, then backspace to the same position and issue ESC I. The bottom half of the screen only is now Reverse Video/Underlined.

To eliminate any single attribute that exists with others, the attributes that are to remain must be set again, and then the undesirable attribute turned off with the appropriate ESC Sequence.

#### EXAMPLE B

Assume a full screen of only Reverse Video. You want to display a Page Heading of Underline Reverse Video in the center of the second line.

Position the cursor one space before where the new attribute is to be set. Issue ESC j (Start Reverse Video), then backspace to the same position and issue ESC l. The screen will now be Reverse Video/Underline from that point to the bottom of the page. Now position the cursor one space past the desired end of the Reverse Video, Underlined Field and issue ESC j, backspace and issue ESC m. The screen will now be Reverse Video with an underline/Reverse Video Field on the second line.

To display more than one Visual attribute over the same area, position the cursor one space prior to the location at which the attributes are to be displayed and issue the appropriate ESC sequence for the first attribute to be set. To set the second attribute, position the cursor over the same location used to set the first attribute (or piggyback) and issue the next proper ESC sequence. Continue this until all desired attributes are set.

All Visual attributes set (except Half Intensity—see page 11) will be displayed from the location at which they were set, to the end of the page, or until they encounter another attribute set code. This will act as a terminator for the above mentioned attribute(s).

To keep attributes from being erased in Protect mode, they should be set in Write Protect.

#### EXAMPLE C

Assume No attribute on screen and cursor in home position.

Issue "Write Protect On" code (ESC ) ) then attribute set code i.e., ESC j for Reverse Video. Then reset Write Protect (ESC ( ) and set Protect mode (EXC &) or "Shift Prot" on keyboard. Now depress "Clear Space" key. The screen should still be in Reverse Video. If screen clears at no attributes at all, repeat above procedure.

If Blink or Blank is on with Reverse Video, Underline, or both and it is to be turned off, Reverse Video, Underline, or both must be reset at the start of the non-blinking/non-blanking field before ESC q is issued. When setting more than one attribute use the following order: Reverse, Underline, then Blink.

When Video attributes are transmitted to the computer via the Send command, or to the printer by print commands, the following bit map indicates the codes which will be sent.

	0	0	0	B4	B3	B2	B1	B0
BIT	7	6	5	4	3	2	1	0
					B3	B2		
					0	0		BLANK
					0	1		NOT ALLOWED
					1	0		NORMAL VIDEO
					1	1		BLINK

B1: START REVERSING VIDEO

B0: START UNDERLINE

If Bit 4 is set, then B3, B2 indicate the start of a new intensity field; otherwise, B3 and B2 have no effect. Bits 0, 1 indicate the start or end of reversing or underline field. (1=START, 0=END).

### 7.7 Block Mode/Conversation Mode Message Transmission

Send Line Unprotected: (ESC 4 or SEND LINE)

Cursor moves to the first character position of the line. All following unprotected characters (except NULLS) up through the previous cursor position are transmitted, followed by a RETURN code. Each protected field is indicated by an FS code.

Send Line All: (ESC 6 or SHIFT/SEND LINE)

Cursor moves to the first character position of the line. All following characters (except NULLS), protected or unprotected, up through to the previous cursor position are transmitted, followed by a RETURN code. Protected fields are bracketed by ESC ) and ESC ( sequences.

Send Page Unprotected: (ESC 5 or SEND PAGE)

Cursor moves to "home" position. All unprotected characters on the display (except NULLS) up through the previous cursor position are transmitted, followed by a RETURN code. Protected fields are indicated by an FS code. The last character on a line is followed by a US code.

Send Page All: (ESC 7 or SHIFT/SEND PAGE)

Cursor moves to "home" position. All characters except NULLS up through the previous position are transmitted, followed by a RETURN code. Protected fields are bracketed by ESC ) and ESC ( sequences. The last character on a line is followed by a US code.

### 7.8 Conversation Mode Transmission

Half-Duplex (Conversation Mode rear panel mode switch to HALF position) Keyboard input causes graphics and control codes to be transmitted, character by character, and causes characters to appear on the display. Operation of an edit or command key causes specified action to occur on the display but no codes are transmitted.

Full-Duplex (Conversation Mode, rear panel mode switch to FULL position) Keyboard input causes graphics and control codes to be transmitted, character by character, but graphics are displayed only upon receipt from the remote computer. Operation of an edit or command key causes specified action to occur on the display but no code is transmitted.

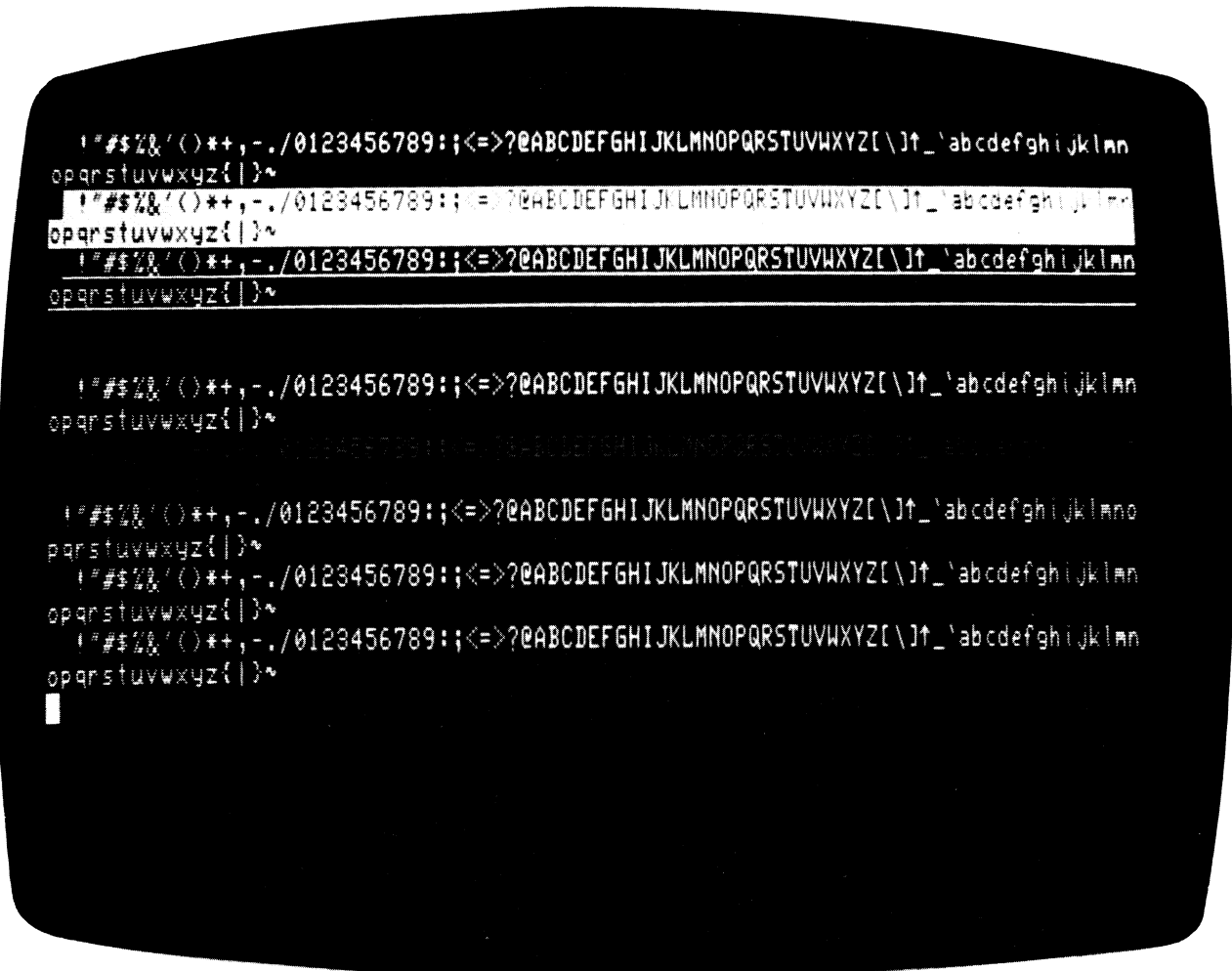
## 7.9 Self Test Mode

The Self Test Mode may be used to verify proper operation of the video display circuitry, the serial interfaces, UART, and control processor. The test consists of the transmission of the complete displayable character set, with all attributes (e.g., inverse, underline, protect) exercised. Terminal must be CONFIGURED in RS-232-Levels, i.e., S5-6 Down and S5-7 Up.

To invoke the test, perform the following operation:

1. Disconnect any interface connectors to other devices (P3, P4).
2. Clear screen of all characters.
3. Connect a jumper between P3-2 and P3-3.
4. Momentarily short the two pins next to the connector on the keyboard.
5. The display test pattern will be generated. (Note that the display will update only after 100 characters have been transmitted – this may be a significant delay at slower BAUD rates.)
6. After all test patterns have been displayed, the BELL will sound.
7. Verify the test pattern as shown.

### 7.9.1 TVI-912/TVI-920 Test Pattern



## 8.0 PROGRAMMING THE REMOTE COMPUTER

TVI-912/TVI-920 can be fully controlled by the remote computer. The remote computer can execute all the control functions that are performed from the keyboard. The computer controls the TVI-912/TVI-920 by transferring the appropriate ASCII codes over RS232 or current loop interface.

### 8.1 CTRL Functions

When executing a control function at the remote computer, the following rule applies: complement bit 7 of the code for the character which is typed while pressing the CTRL key. This generates the same code produced by striking the character key while pressing the CTRL key.

### 8.2 ESC Functions

To execute an escape sequence function from the remote computer, transmit the ASCII ESC code followed by the character code.

### 8.3 Additional Remote Functions

In addition to the keyboard controls described in previous pages, the remote computer can perform the following functions:

ESC # (Disable Keyboard): Disables all keyboard functions (Remote function only).

ESC " (Enable Keyboard): Restores keyboard control (Remote function only).

ESC =(LOAD CURSOR, CURRENT PAGE): The next two characters following the ESC = represent the absolute line and column (Y and X) coordinates which are used to position the cursor. For character representation of the coordinate values, refer to the Operator's Quick Reference in the last page of this manual.

ESC ? (Read Cursor): Causes the line and column (Y and X) coordinates of the cursor, followed by a CR code (expressed as three ASCII characters), to be transmitted to the remote terminal.

\*ESC – (LOAD CURSOR AND PAGE): The next three characters following ESC – represent the absolute page, line and column coordinates which are used to position the cursor.

\*ESC / (READ CURSOR AND PAGE): Causes the page, line and column coordinates to be transmitted to the host system followed by a CR code.

\* Later models only with A49B1 or A49C1 ROM.

The same codes are used for control of the TVI-912/TVI-920 either from the keyboard or by the remote computer with the exception of ESC #, ESC " .

## 9.0 WORD STRUCTURE

The TVI-912/TVI-920 uses USASCII. This is a 7-level code, but the TVI-912/TVI-920 carries 8 bits in memory for each character position on the screen, that is, 7 bits to identify the character and the 8th bit to identify if it is protected.

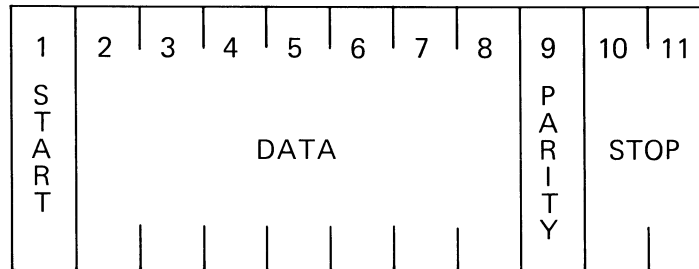
Asynchronous transmission means each character is transmitted as a single self-contained message with a start bit, stop bits and a possible parity bit.

When the start bit is received, a clock is started to clock in the remainder of the word (character). The word structure can be strapped to transmit and accept either one or two stop bits. Generally, baud rates of 110 and lower use 2 stop bits, and rates of 150 and higher use 1 stop bit. TVI-912/TVI-920 automatically transmits 2 stop bits at 110 baud.

If 8 data bits are selected bit 8 will be zero.

The parity bit is added to the transmission for error detecting. If parity is used, it follows the character. Normally, "even" parity is used for asynchronous transmission and odd parity for synchronous transmission. Even parity adds a 0 or 1 to the character to make the total number even. This is checked by the receiver to see if something was lost in transmission. Some computers do not have the ability to check for even or odd parity but do expect that transmission time to be filled with 1 or 0. This leaves 5 possibilities for parity: 1) none; 2) even; 3) odd; 4) zero; 5) one (sometimes called true). The TVI-912/TVI-920 does not allow for zero and true parity with an 8 bit word.

**Bit Structure of Serial Data Word**



**Switch Settings of S2 For Common Word Structures**

5	6	7	8	9	Data Bits	Parity	Stop Bits
U	D	D	U	X	7	No	1
U	U	D	U	X	7	One	1
U	U	U	U	X	7	Zero	1
D	D	D	U	U	7	Even	1
D	D	D	U	D	7	Odd	1
D	U	D	U	U	7	Even	2
D	U	D	U	D	7	Odd	2
D	D	U	U	U	8	Even	1
D	D	U	U	D	8	Odd	1

U = Up, D = Down, X = Either Up or Down

## 10.0 SERIAL PRINTER INTERFACE

TVI-912/TVI-920 Serial Printer Interface controls an auxiliary serial printer to make a permanent copy of data displayed on the screen. This interface can be used with most RS-232 compatible serial printers currently available in the market, including both character-by-character and buffered printers. The interface buffers the data input from the computer to make it available for editing and additions from the terminal prior to printing. This interface also permits the printer to be operated at a different baud rate from the computer input rate.

### 10.1 Interface Connector

The printer interface is a 25-pin connector P4 located on the rear of the control board (accessible from the rear of terminal). The P4 signal/pin is described as follows:

Pin No.	Description
1	Frame Ground
3	Serial DATA (RS232)
4	Printer Ready (Jumper Select)
6	Terminal Ready
7	Signal Ground
8	Terminal Ready (Jumper Select)
20	Printer Ready

### 10.2 Transmission Rate

The transmission of information to the printer can be at any one of the rates available for TVI-912/TVI-920-to-computer communication.

### 10.3 Print Modes

**Page Format Mode:** This mode (selected by ESC A) allows the printer to print data exactly as displayed on the screen. A page format transmission is actuated by pressing the PRINT key at the desired print operation stopping place. The cursor then moves to "home" position, a CR LF NULL is transmitted, followed by the data on the screen. Upon transmitting the last character on each line, the terminal sends CR LF NULL sequence before moving to the next line.

When the cursor reaches the previous cursor position (stored when the print was initiated), the operation is terminated and final CR LF NULL is transmitted. (The character under the cursor is sent.)

Page Format print operations may be controlled in any one of two ways.

1. Internal, No Delay – Data flow is continuous without any delay between characters or lines.
2. External, Printer Ready – The TVI-912/TVI-920 monitors the state of the Printer Ready line (P4, pin 20 or pin 4) to determine availability of the printer to accept data. Data is transmitted continuously as long as the printer is ready. This method is normally used with buffered printers which accept a full line of data before printing.

In Protected Mode, all data displayed in reduced intensity will be transferred to the Printer as spaces, thereby allowing the use of pre-printed forms.

In Print Mode, Nulls will be sent as spaces to facilitate forms entry operation.

Extention Print Mode: This mode (selected by ESC @) will enable data received at the modem port (P3) to be output on pin 3 of P4. While in this mode, receipt of a print command will interrupt the data from P3 and print the page, then, reconnect the data from P3 to P4.



## 11.0 SECOND PAGE MEMORY OPTION

**11.1** This option allows access to one additional 1920 character memory space for usage identical to the Standard Page. With this option installed, the user has the capacity of viewing more than 1 set of 24 lines x 80 characters. Operation of this second page is described below.

### 11.2 Alternate Page

To view an alternate page of data, the memory may be swapped by issuance of ESC K from either the keyboard or incoming from the modem port (P-3).

When this is performed, the data currently displayed will be transferred into memory and replaced with all data stored in the alternate page. If no data has been previously stored in the alternate page, the screen will be blank with the exception of the cursor. The cursor will rest in the same location on the alternate page as it was on the previous page when the action was initiated. If the position the cursor is to rest in on the new page is protected, the cursor will automatically jump to the next unprotected position available. If there are no unprotected positions available, the cursor will go to the home position and rest there as described in Section 7.1.1. Only one page may be viewed or acted upon at any one time.

### 11.3 Auto Flip (ESC v=ON, ESC w=OFF)

Auto Flip, when turned on with an ESC v puts the TVI-912/TVI-920 in a mode whereby when a downward vertical motion is attempted by the cursor from the last enterable line on the current page, the Alternate Page will automatically be displayed (automatic "New Page") and any data will be entered on the new page. A clear unprotected to spaces will be performed and the cursor will rest in the first unprotected location.

If the terminal is in Scroll Mode when Auto Flip is enabled, scrolling is inhibited or over-ridden by Auto Flip.

If the terminal is in Non-Scroll or Protect Mode, the Auto Flip works as described above.

To return to normal operational mode, issue the TVI-912/TVI-920 an ESC w.

In no case can more than the displayed page be transmitted by send line or send page, nor can any other than the displayed page be printed.

If the second page option is not installed, a clear unprotected to spaces will be performed on the current page.

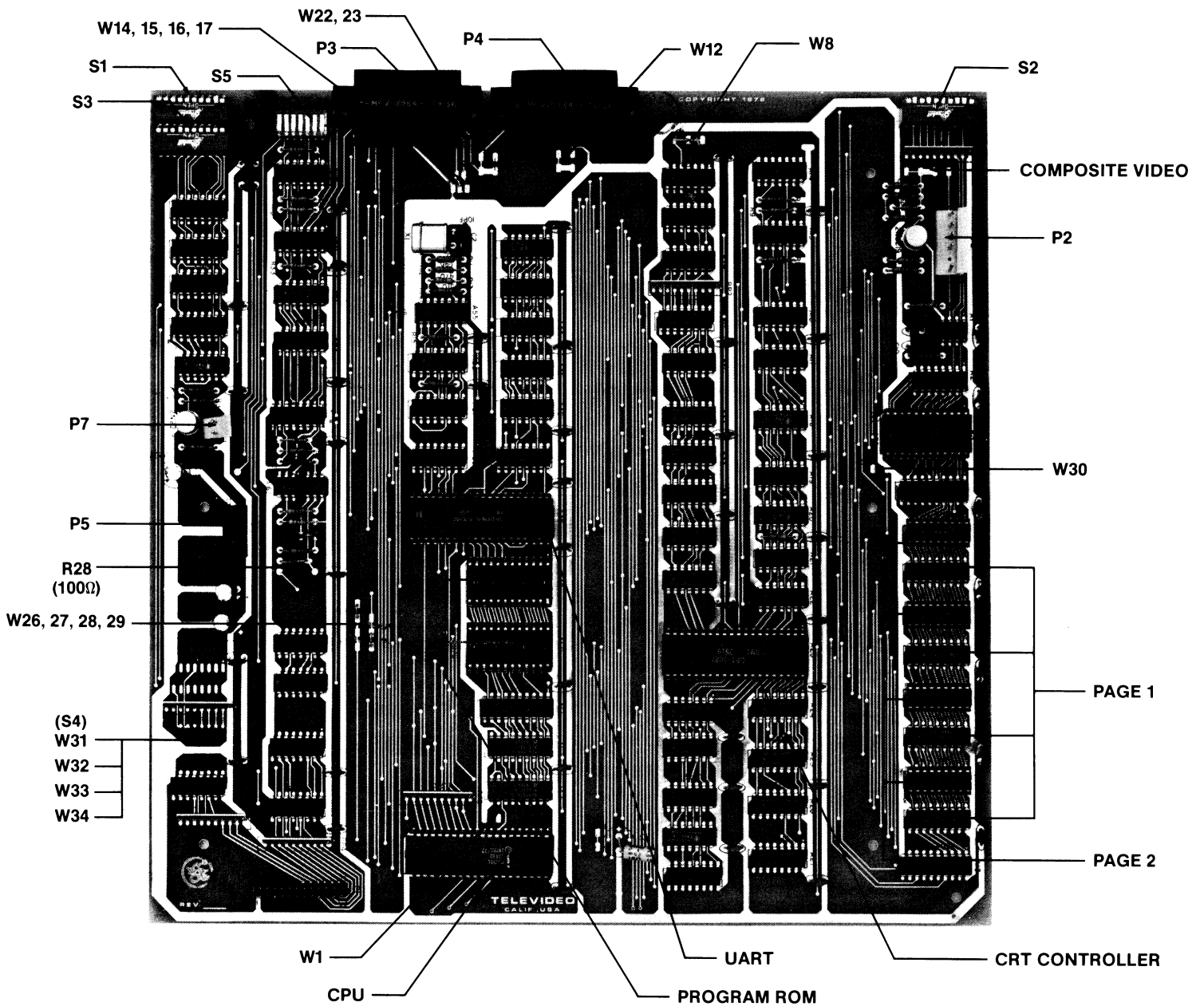
## 12.0 OPTION SWITCH SELECTION

S1 - Modem Port Baud Rate

S3 - Printer Port Baud Rate

**NOTE: ONLY ONE SWITCH DOWN**

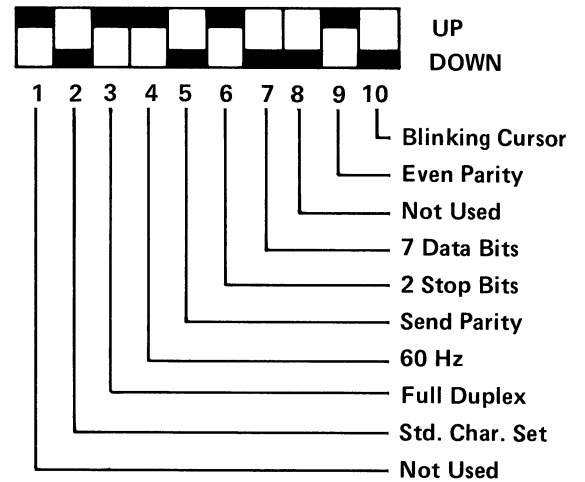
2	9,600
3	4,800
4	2,400
5	1,200
6	600
7	300
8	150
9	75
10	110 baud



## 12.1 S2 - UART/Terminal Options

1	Up Down	Not used Not allowed
2	Up Down	Alternate Character Set (option) Standard Character Set
3	Up Down	FULL DUPLEX HALF DUPLEX
4	Up Down	60 Hz – Refresh 50 Hz – Refresh
5	Up Down	No Parity Send Parity
6	Up Down	2 stop bits (may be used with No parity as space parity) 1 stop bit
7	Up Down	8 Data Bits (may be used with no parity as Mark parity) 7 Data Bits
8		Not used (Rev E and lower must be up)
9	Up Down	Parity Select (EVEN) (ODD)
10	Up Down	Steady Cursor (Rev E and lower W25 is used) Blinking Cursor

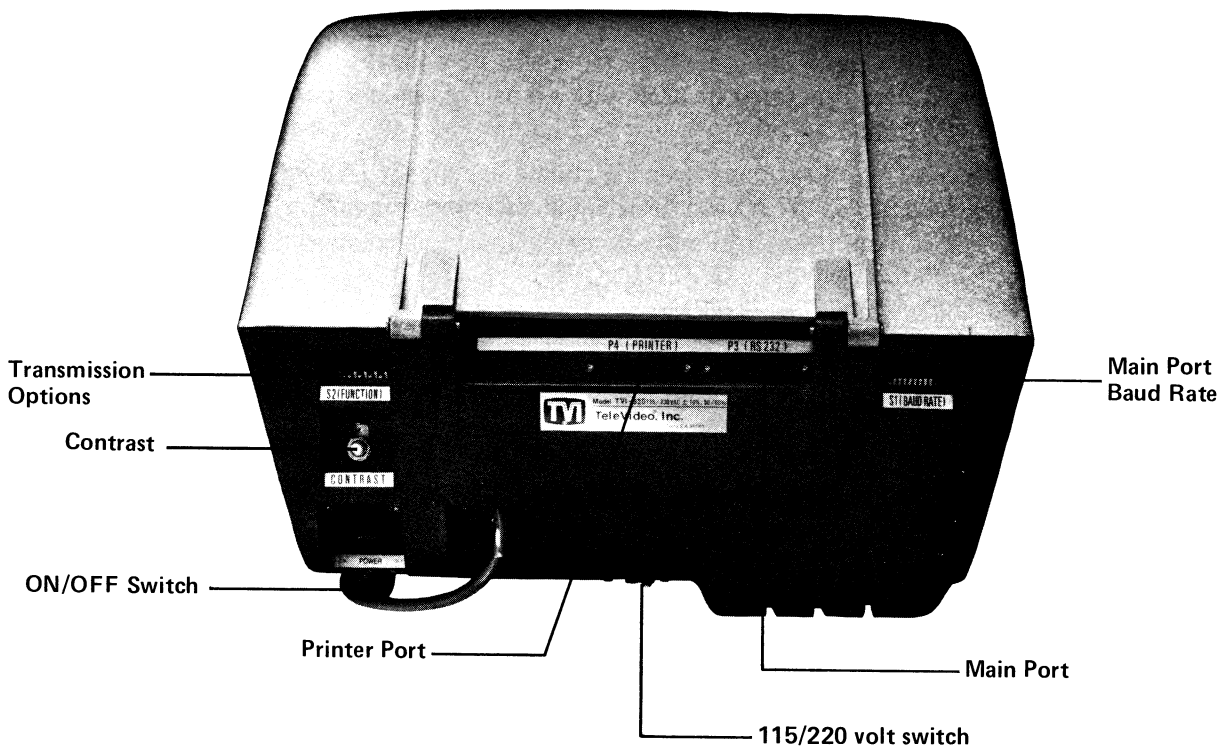
### SWITCH SETTING EXAMPLE



## 12.2 S5 - UART/Terminal Options (Reference EIA Standard RS-232C for signal definitions)

1	Open Closed	P3-6 Not connected Data set ready (DSR) received on P3-6
2	Open Closed	P3-8 Not connected Data Carrier Detect (DCD) received on P3-8
3, 4	S5 - 3 Open Open Closed Closed	S5 - 4 Open Closed Open Closed
5	Closed	P3-20 Not connected Data Terminal Ready is on when the terminal is ON. Data Terminal Ready (DTR) is connected to Request to Send (RTS). Not allowed
6, 7	S5 - 6 Open Open Closed Closed	S5 - 7 Open Closed Open Closed

# OPERATOR CONTROLS

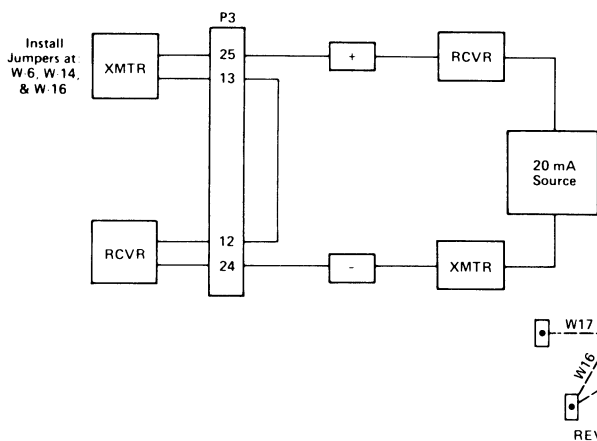


## JUMPER OPTIONS

*W12: Installation of this jumper connects terminal ready signal to printer connector	Output	P4-6
W13: Installation of this jumper connects terminal ready signal to printer connector	Output	P4-8
W22: Installation of this jumper connects printer ready signal to printer connector	Input	P4-4
*W23: Installation of this jumper connects printer ready signal to printer connector	Input	P4-20

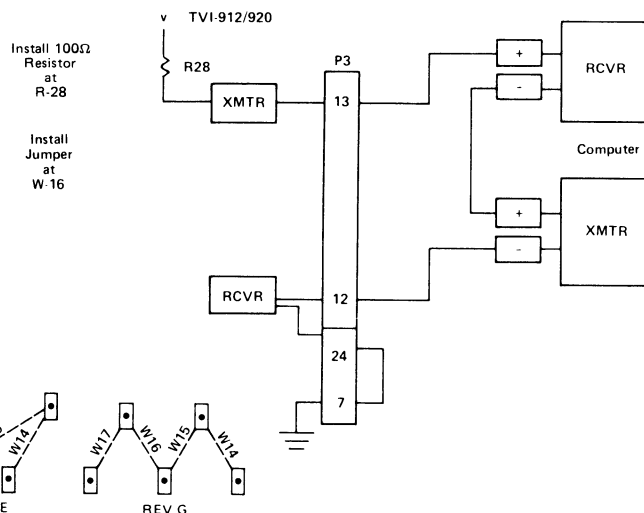
\*Traced on REV H PWA's.

### HALF-DUPLEX PASSIVE REV H WIRED

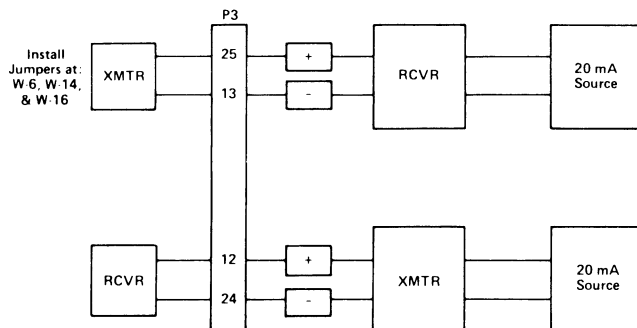


### HALF-DUPLEX ACTIVE

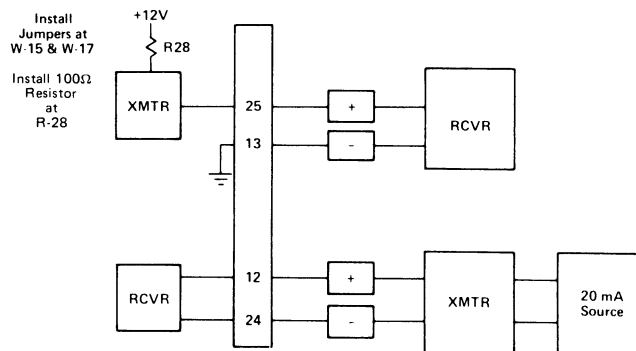
#### Current Loop



### FULL DUPLEX PASSIVE REV H WIRED



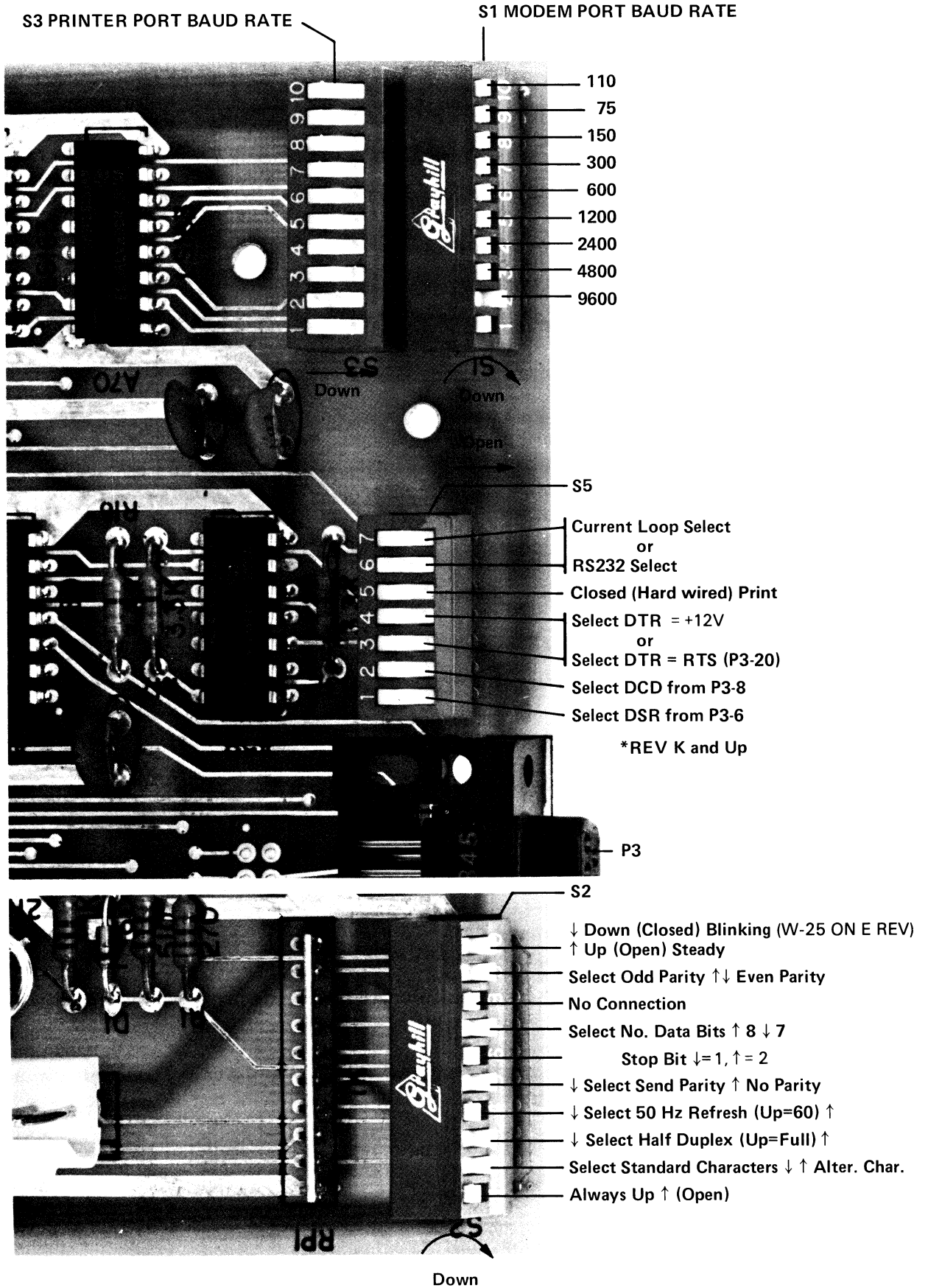
### FULL DUPLEX, ACTIVE XMTR



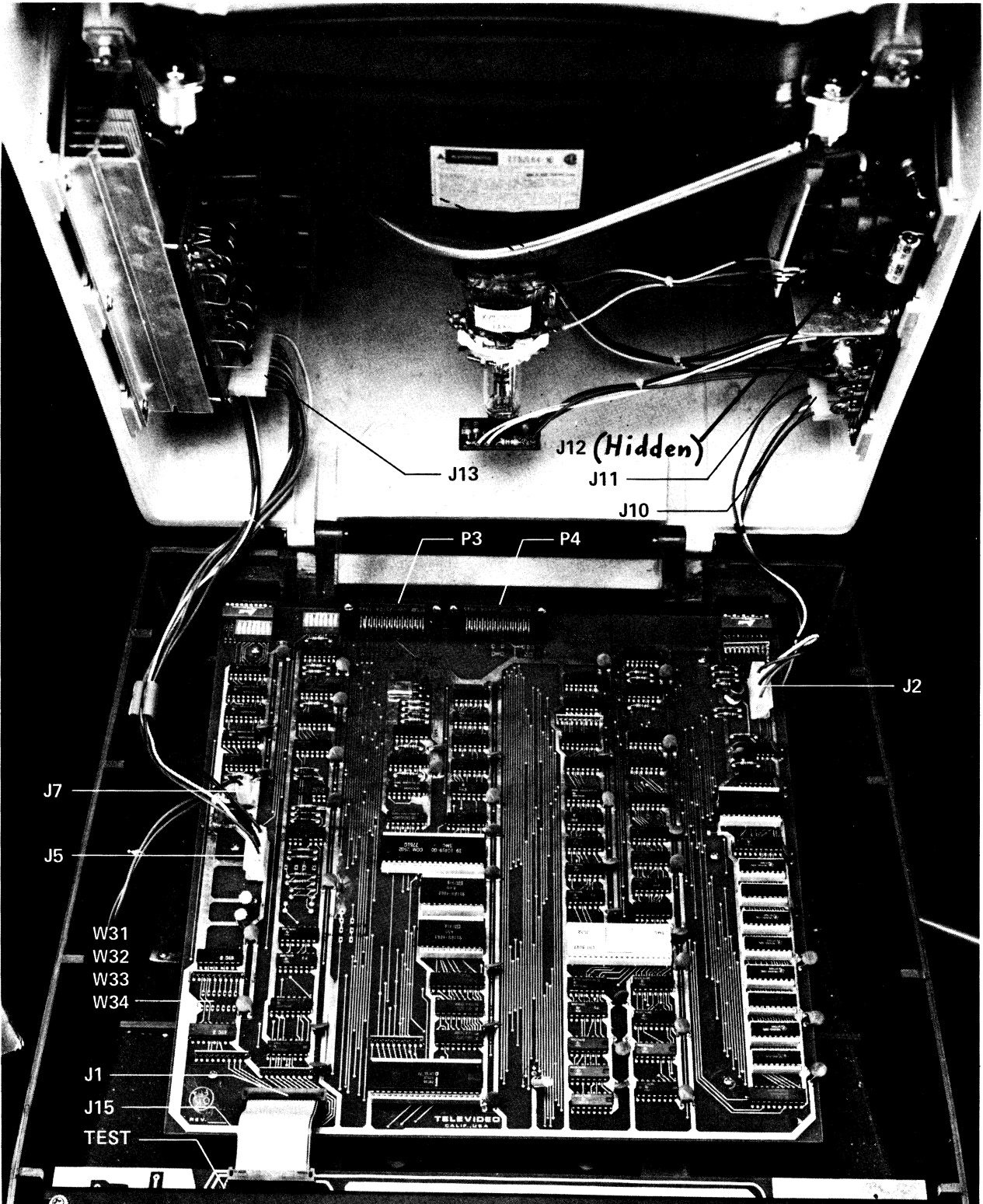
- S4/W31:** Installation of this jumper will enable an automatic line feed upon receipt of a carriage return from the remote or keyboard. See note.
- S4/W32:** Installation of this jumper will enable transmission of EOT at the end of Send, otherwise a CR (carriage return) is sent. See note.
- S4/W33:** Installation of this jumper will disable the automatic CR (carriage return) line feed in Column 80. See note.
- S4/W34:** Installation of this jumper will select Page Print Mode as the initial condition at power up. Extension Mode will be selected otherwise. See note.

Note: Terminal must be turned off, then on after making these changes.

# CONTROL BOARD SWITCHES



TERMINAL INTERIOR PHOTO



## ADDRESSABLE CURSOR

POSITION X or Y	ASCII CODE Transmitted	CURSOR POSITIONING		POSITION X or Y	ASCII CODE Transmitted
		POSITION X or Y	ASCII CODE Transmitted		
1	Space	28	;	55	V
2	!	29	<	56	W
3	"	30	=	57	X
4	#	31	>	58	Y
5	\$	32	?	59	Z
6	%	33	@	60	[
7	&	34	A	61	\
8	'	35	B	62	]
9	(	36	C	63	^
10	)	37	D	64	_
11	*	38	E	65	`
12	+	39	F	66	a
13	,	40	G	67	b
14	-	41	H	68	c
15	.	42	I	69	d
16	/	43	J	70	e
17	0	44	K	71	f
18	1	45	L	72	g
19	2	46	M	73	h
20	3	47	N	74	i
21	4	48	O	75	j
22	5	49	P	76	k
23	6	50	Q	77	l
24	7	51	R	78	m
25	8	52	S	79	n
26	9	53	T	80	o
27	:	54	U		

CURRENT PAGE: Transmit ESC = YX (Y = 1-24; X = 1-80)  
 \*DIRECT PAGE: Transmit ESC - PYX (P = 0 or 1)  
 i.e., ESC=%@ (Y = 6 X = 33) puts cursor at Line 6, Column 33



## ESCAPE SEQUENCES

BINARY		010		011		100		101		110		111	
HEX		2		3		4		5		6		7	
0000	0	SP		0		@	Extention Print Mode	P	Print Page	\		p	
0001	1	!		1	Set Tab	A	Page Print Mode	Q Q	Char Insert	a		q	End Blink/Blank
0010	2	"	Keyboard Unlock	2	Clear Tab	B	Set Block Mode	R	Line Delete	b		r	
0011	3	#	Keyboard Lock	3	Clear All Tabs	C	Set Conv. Mode	S	Send Whole Page * Unprotected	c		s	Send Whole Page All *
0100	4	\$		4	Send Line Unprotected	D		T	Line Erase to Spaces	d		t	Line Erase to Nulls
0101	5	%		5	Send Page Unprotected	E	Line Insert	U		e		u	
0110	6	&	Protect Mode On	6	Send Line All	F		V		f		v	Auto-Flip On
0111	7	'	Protect Mode Off	7	Send Page All	G		W	Char Delete	g		w	Auto-Flip Off
1000	8	(	Write Protect Off	8		H		X		h		x	
1001	9	)	Write Protect On	9		I	Back Tab	Y	Page Erase to Spaces	i	Tab	y	Page Erase to Nulls
1010	A	*	Clear All to Nulls	:	Clear FG to Nulls	J		Z		j	Start Reverse Video	z	
1011	B	+	Clear All to Spaces	;	Clear FG to Spaces	K	Toggle Page	[		k	End Reverse Video		
1100	C	,		<		L		\		l	Start Underline	l i	
1101	D	-	Load Cursor Page, Row, Column *	=	Load Cursor	M		]		m	End Underline		
1110	E	.		>		N		>	Start Blink	n		~	
1111	F	/	Read Cursor Page, Row, Column *	?	Read Cursor	O		-	Start Blank	o		DEL	

\* Later models only with A49B1 or A49C1 ROM.

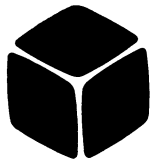
TVI-912/920 ASCII CHART

Bits					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1				
b7	b6	b5	b4	b3	b2	b1	Column	Row	0	1	2	3	4	5	6	7
0	0	0	0	0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	0	1	0	0	1	0	SOH	DC1	!	1	A	Q	a	q
0	0	0	1	0	0	0	2	0	STX	DC2	"	2	B	R	b	r
0	0	0	1	1	0	0	3	0	ETX	DC3	#	3	C	S	c	s
0	1	0	0	0	0	0	4	0	EOT	DC4	\$	4	D	T	d	t
0	1	0	0	1	0	0	5	0	ENQ	NAK	%	5	E	U	e	u
0	1	0	1	0	0	0	6	0	ACK	SYN	&	6	F	V	f	v
0	1	0	1	1	0	0	7	0	BEL	ETB	'	7	G	W	g	w
1	0	0	0	0	0	0	8	0	BS ←	CAN	(	8	H	X	h	x
1	0	0	0	1	0	0	9	0	SKIP HT	EM	)	9	I	Y	i	y
1	0	0	1	0	0	0	10	0	LF ↓	SUB	*	:	J	Z	j	z
1	0	0	1	1	0	0	11	0	VT ↑	ESC	+	;	K	[	k	{
1	1	0	0	0	0	0	12	0	FF →	FS	,	<	L	\	l	
1	1	0	0	1	0	0	13	0	CR	GS	-	=	M	]	m	}
1	1	0	1	0	0	0	14	0	SO	HOME RS	.	>	N	^	n	~
1	1	0	1	1	0	0	15	0	SI	NEW LINE US	/	?	O	_	o	DEL RUB

**OPERATOR'S QUICK REFERENCE**  
**TVI-912/TVI-920 CONTROL**

<b>Function</b>	<b>Sequence</b>
Beep _____	CTRL / G
Cursor ← . . . . .	CTRL / H
Cursor ↓ _____	CTRL / J
Cursor ↑ . . . . .	CTRL / K
Cursor → _____	CTRL / L
Home . . . . .	CTRL / ~, ^
Tab (skip) _____	CTRL / I
New Line . . . . .	CTRL / (underscore)
Protect Mode On _____	ESC &
Protect Mode Off . . . . .	ESC '
Start Half Intensity _____	ESC )
End Half Intensity . . . . .	ESC (
Set Column Tab _____	ESC 1
Clear Tab . . . . .	ESC 2
Clear All Tab _____	ESC 3
Send Line Unprotect to Cursor Position. . . . .	ESC 4
Send Page Unprotect to Cursor Position _____	ESC 5
*Send Whole Page Unprotect . . . . .	ESC S
Send Line All to Cursor Position _____	ESC 6
Send Page All to Cursor Position. . . . .	ESC 7
*Send Whole Page _____	ESC s
Clear All to Space . . . . .	ESC +
Clear All to Null _____	ESC *
Clear Unprotected to Null . . . . .	ESC :
Clear Unprotected to Space _____	CTRL/Z, ESC ;
Keyboard Enable . . . . .	ESC "
Keyboard Disable _____	ESC #
Load Cursor (Row, Column) . . . . .	ESC =
*Load Cursor (Page, Row, Column) _____	ESC -
Read Cursor (Row, Column) . . . . .	ESC ?
*Read Cursor (Page, Row, Column) _____	ESC /
Set Block Mode . . . . .	ESC B
Set Conversation Mode _____	ESC C
Print Page . . . . .	ESC P
Char Insert _____	ESC Q
Char Delete . . . . .	ESC W
Line Insert _____	ESC E
Line Delete . . . . .	ESC R
Line Erase to Space _____	ESC T
Page Erase to Space . . . . .	ESC Y
Back Tab _____	ESC I
Toggle Page . . . . .	ESC K
Start Blink Field _____	ESC ^
Start Blank Field . . . . .	ESC ___ (underscore)
End Blink/Blank _____	ESC q
Tab . . . . .	ESC i
Start Inverse _____	ESC j
End Inverse . . . . .	ESC k
Start Underline _____	ESC l
End Underline . . . . .	ESC m
Line Erase to Null _____	ESC t
Page Erase to Null . . . . .	ESC y
Auto Flip On _____	ESC v
Auto Flip Off . . . . .	ESC w
Extension Port On _____	ESC @
Extension Port Off/Page Print Mode On . . . . .	ESC A

\* Later models only with A49B1 or A49C1 ROM.



**TeleVideo®**

2149 Paragon Drive  
San Jose, California 95131  
(408) 946-8500/TWX: 910-338-7633 "TVI VIDEO"

Printed in U.S.A.