

TV Time/Channel Display Circuits

FEATURES

- Channel Display 1 to 16
- 4 Digit Clock Display option
- Color character on black background or color character on color background
- 14 or 24 DIL package

OPTIONS

Part Number	Channel	Time
AY-5-8301	1-16	No
AY-5-8320/21	1-16	

*The AY-5-8320/21 are capable of either simultaneous or separate time and channel display and have automatic display enable.

DESCRIPTION

The AY-5-8300 series is a family of MOS circuits designed to display channel and time information on the screen of a TV set. The information is displayed as colored characters on a black or color background. Channel information is displayed as a single character 1 to 16. Time is provided as a 4 digit hours and minutes display. The display is positioned at the top right hand corner or at the bottom center of the screen; the display may be permanent or momentary. Any of the AY-5-8300 series may be used for either 525 or 625 line systems.

PIN CONFIGURATION

14 LEAD DUAL IN LINE PACKAGE
AY-5

*7-39 thru
7-47
are combined*

AY-5-83

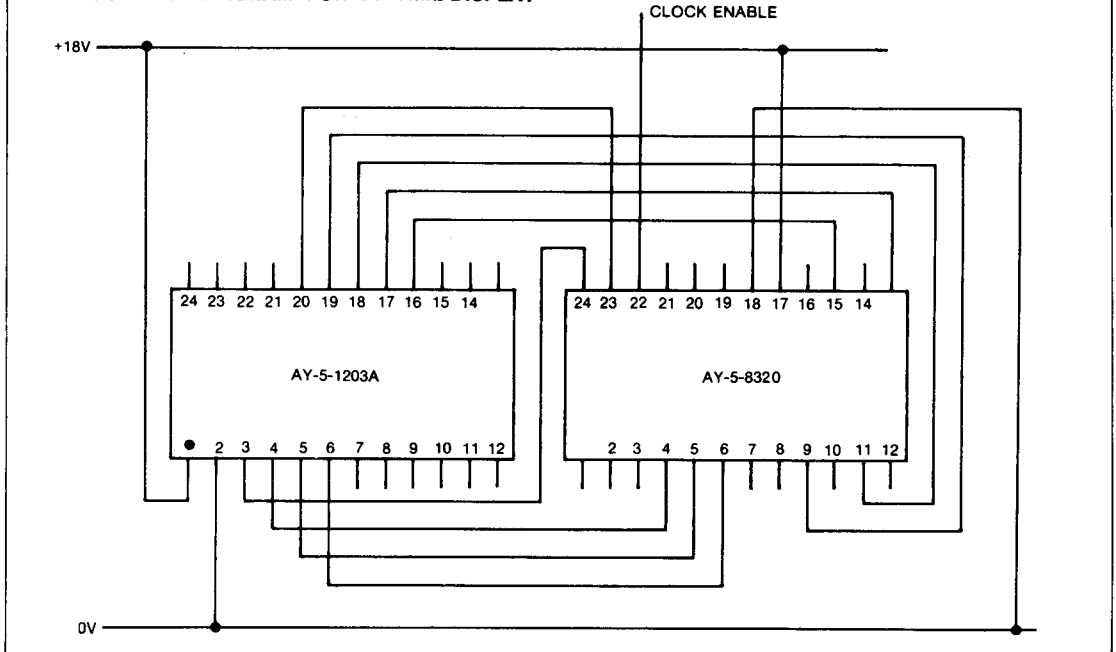
Chanr
Be
t

Ver
Horizc

2°

2'

INTERCONNECT DIAGRAM FOR TV TIME DISPLAY



ENTER-TAINMENT

PIN FUNCTIONS

Name	Function																																																																																										
ALL TYPES:																																																																																											
Vertical Sync Input	Resets the circuit at the end of each frame. At logic '0' during vertical flyback.																																																																																										
Horizontal Sync Input	Activates the line counter. At logic '0' during horizontal flyback.																																																																																										
1.1MHz Clock Input	Determines character position and width. Must be synchronized by horizontal sync pulse to prevent ragged edges on character.																																																																																										
Channel Inputs 2 ⁰ -2 ³	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="4" style="text-align: center;">Code</th> <th style="text-align: center;">Display</th> </tr> <tr> <th style="text-align: center;">2³</th> <th style="text-align: center;">2²</th> <th style="text-align: center;">2¹</th> <th style="text-align: center;">2⁰</th> <th style="text-align: center;">AY-5-8301/20/21</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">0</td><td style="text-align: center;">0</td><td style="text-align: center;">0</td><td style="text-align: center;">0</td><td style="text-align: center;">1</td></tr> <tr><td style="text-align: center;">0</td><td style="text-align: center;">0</td><td style="text-align: center;">0</td><td style="text-align: center;">1</td><td style="text-align: center;">2</td></tr> <tr><td style="text-align: center;">0</td><td style="text-align: center;">0</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td><td style="text-align: center;">3</td></tr> <tr><td style="text-align: center;">0</td><td style="text-align: center;">0</td><td style="text-align: center;">1</td><td style="text-align: center;">1</td><td style="text-align: center;">4</td></tr> <tr><td style="text-align: center;">0</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td><td style="text-align: center;">0</td><td style="text-align: center;">5</td></tr> <tr><td style="text-align: center;">0</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td><td style="text-align: center;">1</td><td style="text-align: center;">6</td></tr> <tr><td style="text-align: center;">0</td><td style="text-align: center;">1</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td><td style="text-align: center;">7</td></tr> <tr><td style="text-align: center;">0</td><td style="text-align: center;">1</td><td style="text-align: center;">1</td><td style="text-align: center;">1</td><td style="text-align: center;">8</td></tr> <tr><td style="text-align: center;">1</td><td style="text-align: center;">0</td><td style="text-align: center;">0</td><td style="text-align: center;">0</td><td style="text-align: center;">9</td></tr> <tr><td style="text-align: center;">1</td><td style="text-align: center;">0</td><td style="text-align: center;">0</td><td style="text-align: center;">1</td><td style="text-align: center;">10</td></tr> <tr><td style="text-align: center;">1</td><td style="text-align: center;">0</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td><td style="text-align: center;">11</td></tr> <tr><td style="text-align: center;">1</td><td style="text-align: center;">0</td><td style="text-align: center;">1</td><td style="text-align: center;">1</td><td style="text-align: center;">12</td></tr> <tr><td style="text-align: center;">1</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td><td style="text-align: center;">0</td><td style="text-align: center;">13</td></tr> <tr><td style="text-align: center;">1</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td><td style="text-align: center;">1</td><td style="text-align: center;">14</td></tr> <tr><td style="text-align: center;">1</td><td style="text-align: center;">1</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td><td style="text-align: center;">15</td></tr> <tr><td style="text-align: center;">1</td><td style="text-align: center;">1</td><td style="text-align: center;">1</td><td style="text-align: center;">1</td><td style="text-align: center;">16</td></tr> </tbody> </table>	Code				Display	2 ³	2 ²	2 ¹	2 ⁰	AY-5-8301/20/21	0	0	0	0	1	0	0	0	1	2	0	0	1	0	3	0	0	1	1	4	0	1	0	0	5	0	1	0	1	6	0	1	1	0	7	0	1	1	1	8	1	0	0	0	9	1	0	0	1	10	1	0	1	0	11	1	0	1	1	12	1	1	0	0	13	1	1	0	1	14	1	1	1	0	15	1	1	1	1	16
Code				Display																																																																																							
2 ³	2 ²	2 ¹	2 ⁰	AY-5-8301/20/21																																																																																							
0	0	0	0	1																																																																																							
0	0	0	1	2																																																																																							
0	0	1	0	3																																																																																							
0	0	1	1	4																																																																																							
0	1	0	0	5																																																																																							
0	1	0	1	6																																																																																							
0	1	1	0	7																																																																																							
0	1	1	1	8																																																																																							
1	0	0	0	9																																																																																							
1	0	0	1	10																																																																																							
1	0	1	0	11																																																																																							
1	0	1	1	12																																																																																							
1	1	0	0	13																																																																																							
1	1	0	1	14																																																																																							
1	1	1	0	15																																																																																							
1	1	1	1	16																																																																																							
AY-5-8301 Display Enable	When taken to logic '0', the display is enabled. If an RC network is connected to this pin, a momentary display can be obtained.																																																																																										
AY-5-8301 Character Output Color Output	Defines the background border and the character. Determines the character color. Goes to logic '1' during a character block.																																																																																										
AY-5-8320/21 Clock Inputs 2 ⁰ -2 ³ Mx1-Mx4 Strobe Input	Multiplexed 4 digit BCD clock data inputs such as available from the AY-5-1203A clock circuit. Multiplex inputs, at logic '1' during multiplex time slot. For the AY-5-8310/11, when operating in the 00-99 channel mode, Mx1 and Mx2 time slots are used. This input must go to a logic '1' during the middle of each Mx time slot to load the clock data into the chip.																																																																																										
AY-5-8320/21 Character Output Background Output Channel Display Enable Clock Display Enable Seconds Colon Input	Defines the character outlines. At logic '1' when displaying a character. Defines the background block. At logic '1' when outputting background. When taken to logic '1', the channel display is enabled. The display is automatically enabled when the channel is changed. When taken to logic '1', the clock display is enabled. This input controls the colon between the hours and minutes display. When at logic '0', the colon is blanked. If connected to the DP output of the AY-5-1203A clock circuit, the colon will flash once per second.																																																																																										

ENTERTAINMENT



OPERATION

The display is positioned digitally in both the vertical and horizontal directions. The vertical position is determined by counting horizontal sync pulses (the counting is initiated by the vertical sync pulse). The timing relationships are shown in Figs. 8a and 8b. Additionally, for the AY-5-8320/21, the time display is positioned 35 lines further down so that it appears immediately below the channel display.

In the horizontal direction the display is positioned by counting pulses from an external 1.1MHz oscillator which is synchronized with the horizontal sync pulse to prevent ragged edges on each character.

Each character is made up of 15 dots in a 3x5 matrix. With a one dot border around each character a total matrix of 35 dots in a 5x7 format is utilized. Each dot lasts 0.9µsec in the horizontal direction and is 5 lines high. This gives a rectangular dot and characters as shown in Fig. 1.

The various channel/time display formats are illustrated in Figs. 4, 6 and 7. The display positioning on the TV screen is shown in Figs. 6a and 6b.

In the AY-5-8301, the character display is controlled by two outputs. Character and Color. The video channels are controlled in the following manner:

(a) Black/white display

Character	Color	
0	0	Normal picture
1	0	Black (luminance channel full off)
1	1	Black
0	1	White

(b) Black/Yellow display

Character	Color	Normal picture
1	0	Black (luminance full off)
1	1	Black (luminance full off and blue suppressed)
0	1	Yellow (luminance full on and blue suppressed)

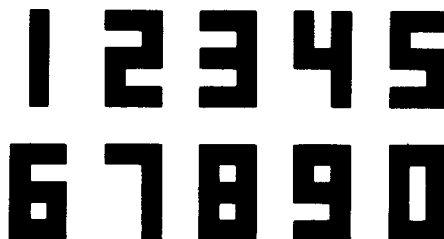
Other color displays are generated by suppressing one or two chrominance channels.

In the AY-5-8320/21, one video output defines the characters and the other a background block. Using these outputs, a display of any color character on a background of any color may be obtained. these outputs, a display of any color character on a background of any color may be obtained.

The channel data is input on four lines; in 1—16 channel mode, this information is applied in binary from a diode encoder attached to the varactor tuning drivers. Binary numbers greater than 9 are detected and displayed at a two digit character.

In the clock mode, data is entered on a 4 line BCD bus multiplexed into 4 time slots. A strobe signal occurring in the middle of each time slot is used to read the data into the chip.

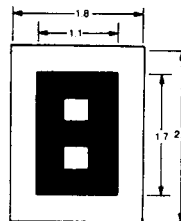
When the AY-5-1203A clock is used it can be directly connected to the AY-5-8320/21 with no external components. The AY-5-8320/21 displays the time with hours, minutes and a flashing colon for seconds (Fig. 5).



**Fig. 1 CHARACTER SET
(AY-5-8301/20/21)**



Fig. 2 CHANNEL DISPLAY



**Fig. 3 CHARACTER SIZE
(25/26 INCH SCREEN)**

ENTER TAINMENT

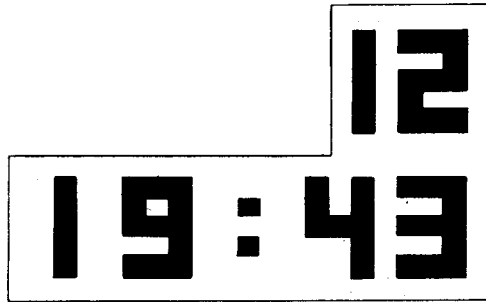


Fig.5 TIME AND CHANNEL DISPLAY (AY-5-8320/21)

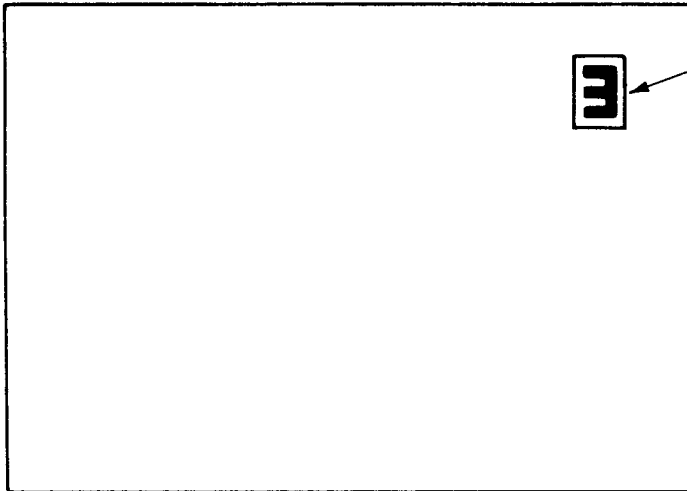


Fig.6a DISPLAY POSITION-CHANNEL

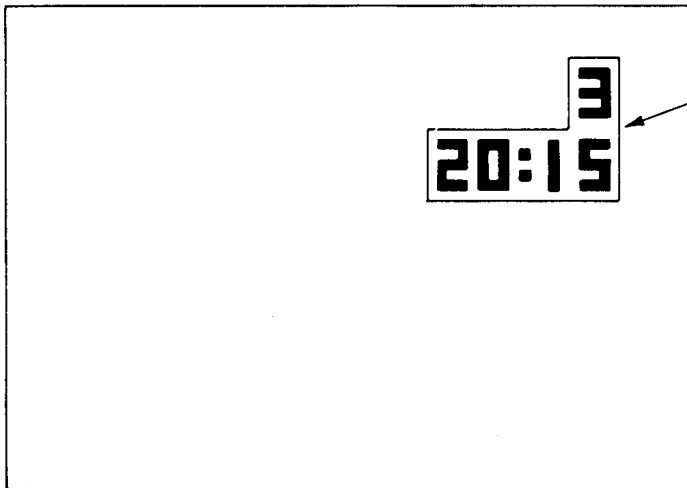


Fig.6b DISPLAY POSITION-CHANNEL

ELECTRICAL CHARACTERISTICS

Maximum Ratings*

Voltage on any pin with respect to V_{SS} pin +0.3 to -20V
 Ambient Operating temperature range 0°C to +85°C
 Storage temperature range -65°C to +150°C

*Exceeding these ratings could cause permanent damage. Functional operation of these devices at these conditions is not implied —operating ranges are specified below.

Standard Conditions (unless otherwise noted)

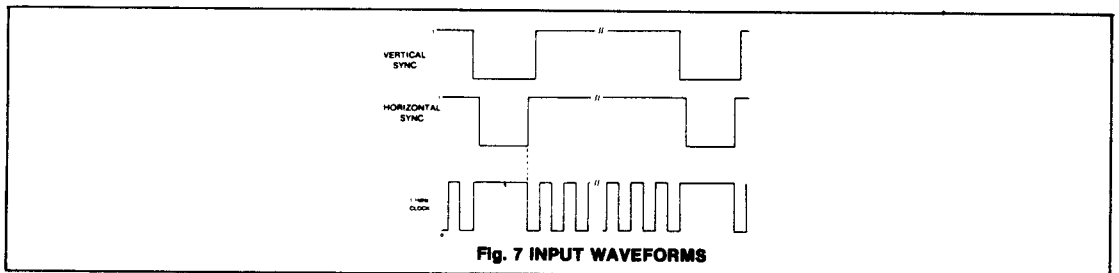
$V_{GG} = 0V$
 $V_{SS} = +17V$ to +19V
 Operating Temperature (T_A) = 0°C to +85°C

Characteristic	Min	Typ**	Max	Units	Conditions
Vertical Sync Input (Note 1)					
Logic '0'	0	—	7	V	
Logic '1'	$V_{SS} - 5$	—	$V_{SS} + 0.5$	V	
Rise & Fall Time	—	—	5	μs	10% to 90% Min slew rate 5V/ μsec
Horizontal Sync Input					
Logic '0'	0	—	7	V	
Logic '1'	$V_{SS} - 1.5$	—	$V_{SS} + 0.3$	V	
Rise & Fall Time	—	—	1	μs	10% to 90%
1.1MHz Clock Input					
Logic '0'	0	1.1	1.15	MHz	
Logic '1'	$V_{SS} - 5$	—	$V_{SS} + 0.3$	V	
Rise & Fall Time	—	—	300	ns	10% to 90%
Pulse width	250	—	—	ns	at logic 0 and logic 1 levels
Channel Inputs (Note 1)					
Logic '0'	0	—	7	V	
Logic '1'	$V_{SS} - 5$	—	$V_{SS} + 0.5$	V	
Leakage	—	—	10	μA	$V_{IN} = (V_{SS} - 19)$ Volts
Display Enable Inputs					
Switch point positive edge	$V_{SS} - 8$	—	$V_{SS} - 5$	V	
Outputs					
On resistance	—	—	1.5	k Ω	$V_{OUT} = V_{SS} - 2V$
Off leakage	—	—	1	μA	$V_{OUT} = 0V$
Turn ON time	—	—	200	ns	10-90% load 25K & 20pF to ground
Power: AY-5-8301	—	—	400	mW	$V_{SS} = +19V$
AY-5-8320	—	—	750	mW	$V_{SS} = +19V$

**Typical values are at +25°C and nominal voltages.

NOTE:

1. These inputs are diode clamped to V_{SS} . Maximum clamp current 50 μA .



ENTER TRAINMENT

ELECTRICAL CHARACTERISTICS

Maximum Ratings*

Voltage on any pin with respect to V_{SS} pin +0.3 to -20V
 Ambient Operating temperature range 0°C to +70°C
 Storage temperature range -65°C to +150°C

*Exceeding these ranges could cause permanent damage. Functional operation of this device at these conditions is not implied—operating ranges are specified below.

Standard Conditions (unless otherwise noted)

$V_{GG} = 0V$
 $V_{SS} = +11.4V$ to $+12.6V$
 Operating Temperature (T_A) = 0°C to +70°C

Characteristic	Min	Typ**	Max	Units	Conditions
Vertical Sync Input (Note 1)					
Logic '0'	0	—	3	V	
Logic '1'	$V_{SS} - 3.5$	—	$V_{SS} + 0.3$	V	
Rise & Fall Time	—	—	5	μS	10% to 90% Min slew rate 5V/ μsec
Horizontal Sync Input					
Logic '0'	0	—	3	V	
Logic '1'	$V_{SS} - 3.5$	—	$V_{SS} + 0.3$	V	
Rise & Fall Time	—	—	1	μS	10% to 90%
1.1MHz Clock Input	1.0	1.1	1.15	MHz	
Logic '0'	0	—	3	V	
Logic '1'	$V_{SS} - 3.5$	—	$V_{SS} + 0.3$	V	
Rise & Fall Time	—	—	100	ns	10% to 90%
Pulse width	300	—	—	ns	at logic 0 and logic 1 levels
Channel Inputs (Note 1)					
Logic '0'	0	—	3	V	
Logic '1'	$V_{SS} - 3.5$	—	$V_{SS} + 0.3$	V	
Clock Inputs, Multiplex, Strobe Inputs					
Logic '0'	0	—	3	V	
Logic '1'	$V_{SS} - 0.5$	—	$V_{SS} + 0.3$	V	
Input Resistance	—	20	—	k Ω	To V_{GG}
Display Enable Inputs					
Switch point negative edge	$V_{SS} - 5.5$	—	$V_{SS} - 3.5$	Volts	
Outputs					
On resistance	—	—	1	k Ω	$V_{OUT} = V_{SS} - 2V$
Off leakage	—	—	1	μA	$V_{OUT} = 0V$
Turn ON time	—	—	200	ns	10-90% load 25K & 20pF to ground
Power	—	150	—	mW	$V_{SS} = +12V$

**Typical values are at +25°C and nominal voltages.

NOTE:

1. These inputs are diode clamped to V_{SS} . Maximum clamp current 0.5mA.

ENTER-TAINMENT

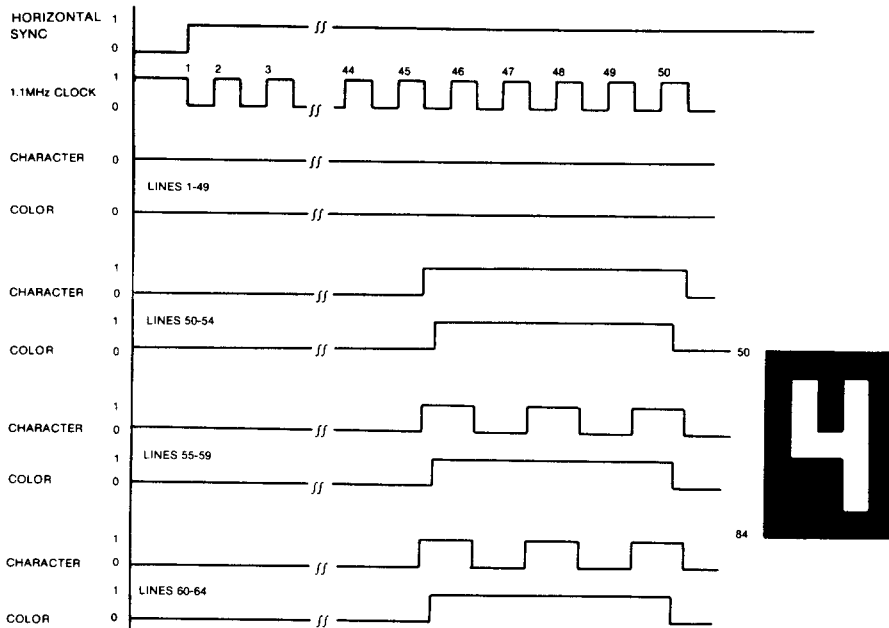


Fig. 8a OUTPUT WAVEFORMS (AY-5-8301)

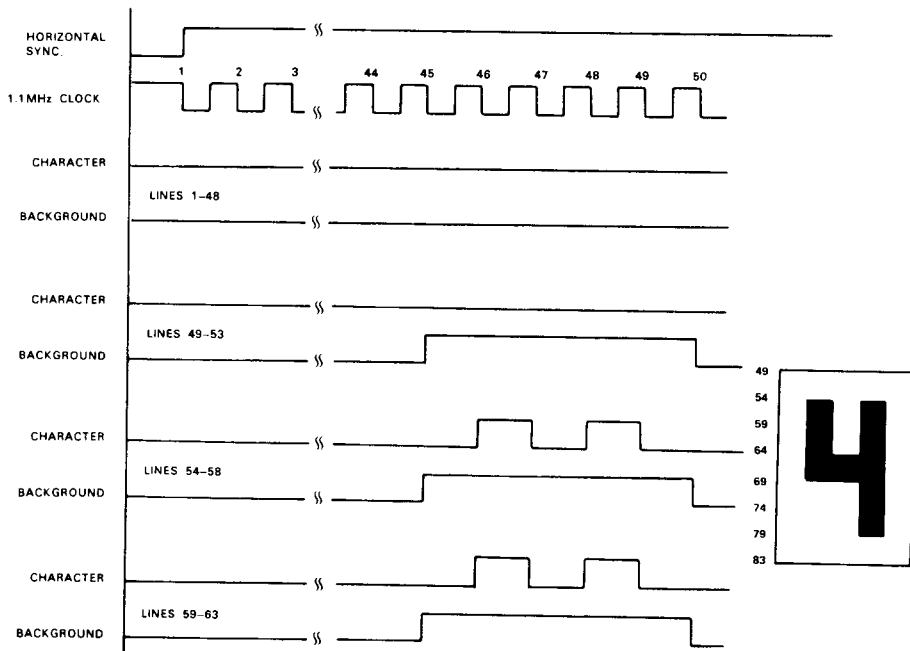


Fig. 8b OUTPUT WAVEFORMS (AY-5-8320/21)

ENTERTAINMENT

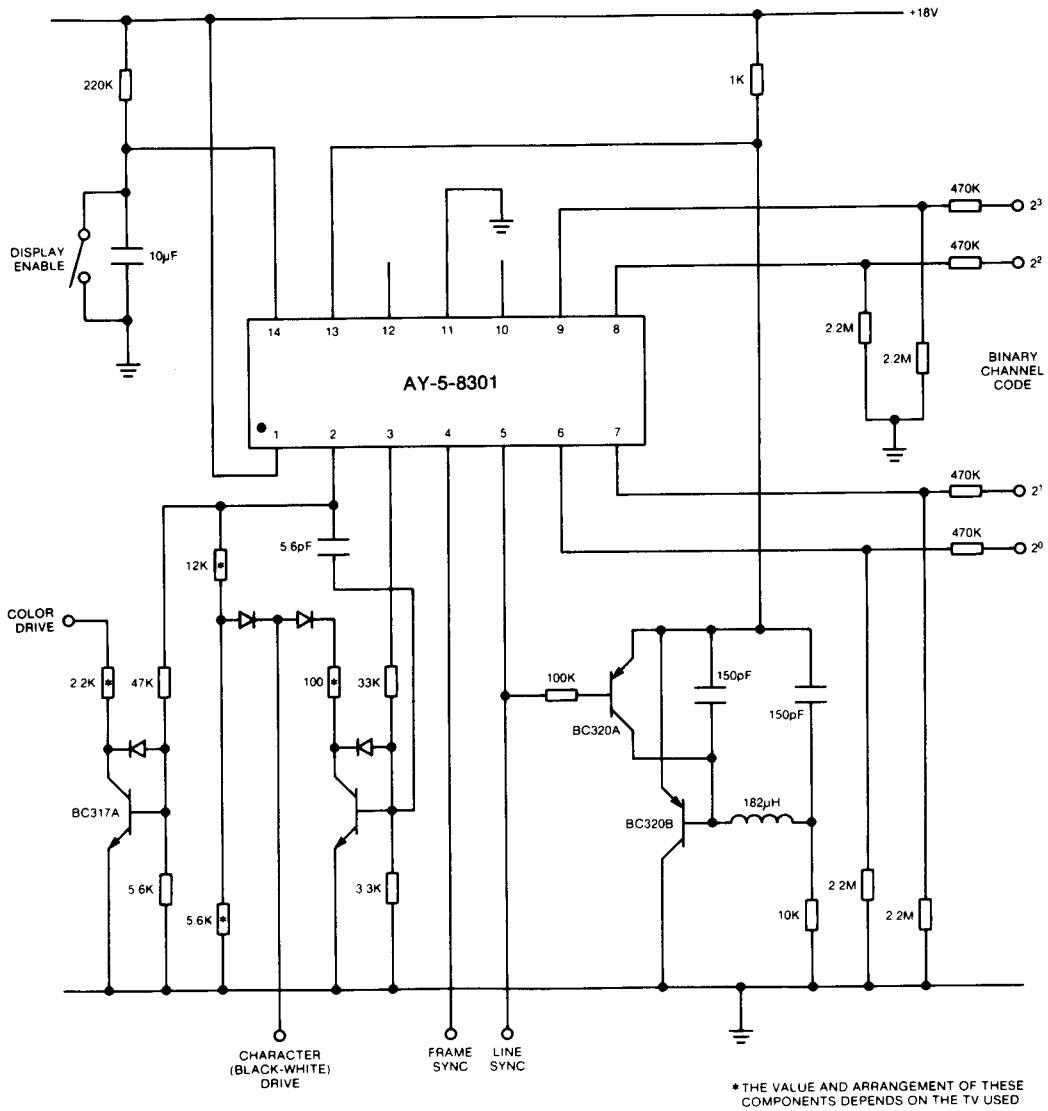


Fig.9

ENTERTAINMENT

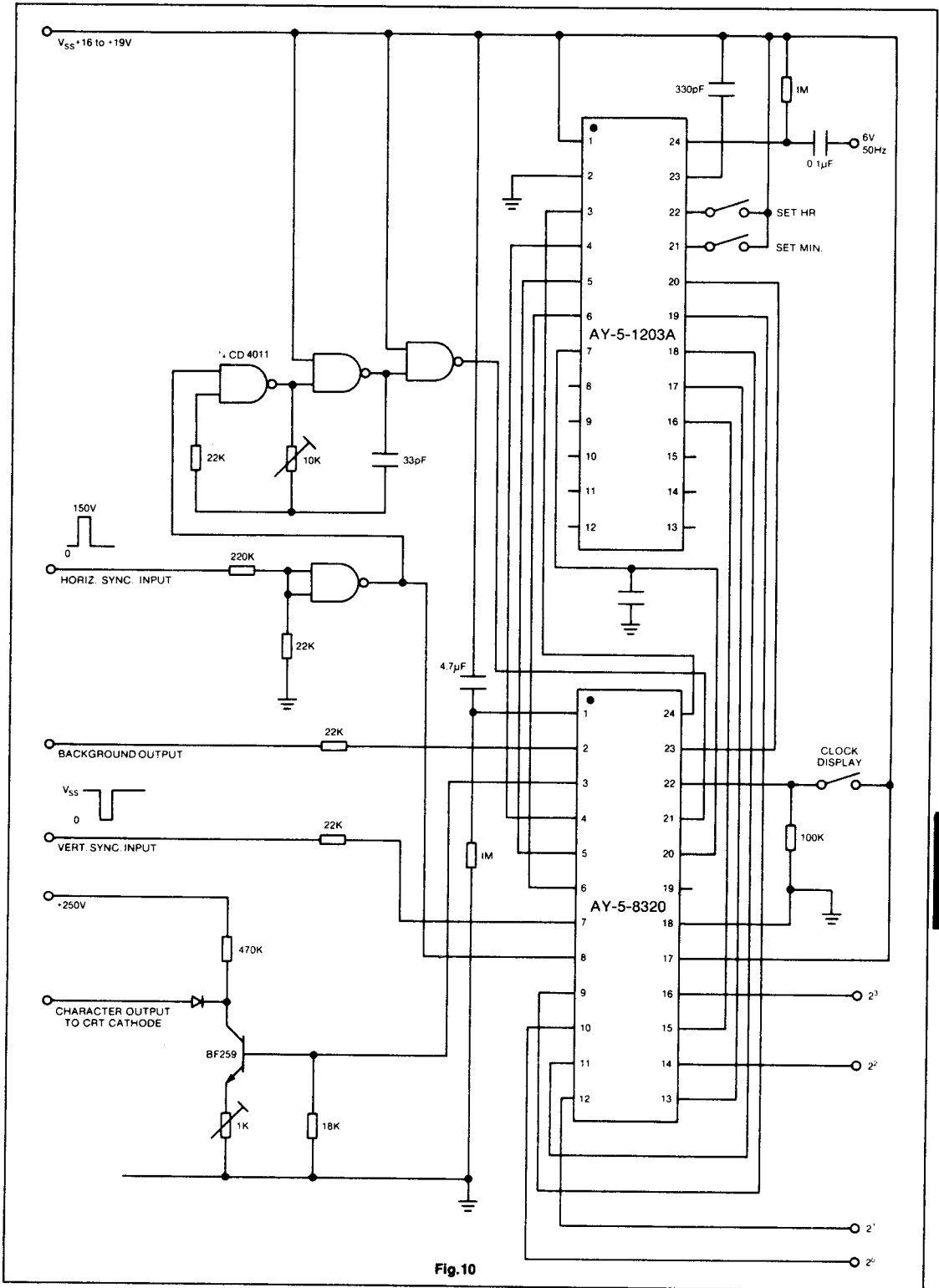


Fig. 10

ENTER-TAINMENT