

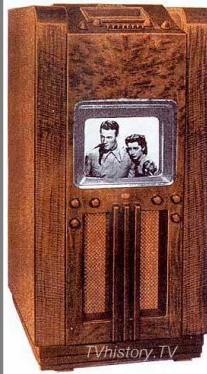
## Video

Prof. Stephen A. Edwards  
sedwards@cs.columbia.edu

NCTU, Summer 2005

Video - p. 11

## Television: 1939 Du Mont Model 181



The Model 181 is a high console model which provides television sight and sound entertainment with a selection of four (4) television channels. The black and white picture of pleasing contrast is reproduced on the screen of the 15 inch screen, and measures 8 inches by 10 inches. The beautifully grained walnut cabinet of pleasing modern design measures 35 1/2 inches high, 23 inches wide and 26 inches deep. It is completely A.C., operated from standard 110 volt 60 cycle power lines. Twenty-two (22) tubes including the Du Mont Television are employed in the superheterodyne circuit. A dynamic speaker is used for perfect sound reproduction. In addition, a three-hand superheterodyne all wave radio is provided for standard radio reception. This receiver employs 8 tubes, is completely A.C. operated from 110 volt 60 cycle power lines. Push button and manual tuning are provided. An individual dynamic speaker is used for broadcast sound reproduction.

Model  
181

TVhistory.TV

Video - p. 21

## Vector Displays



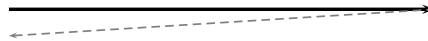
Video - p. 31

## Raster Scanning



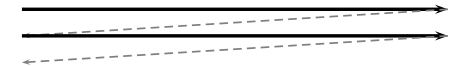
Video - p. 41

## Raster Scanning



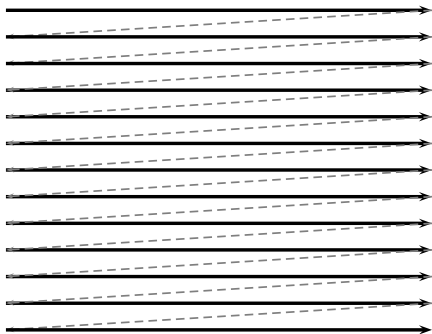
Video - p. 41

## Raster Scanning

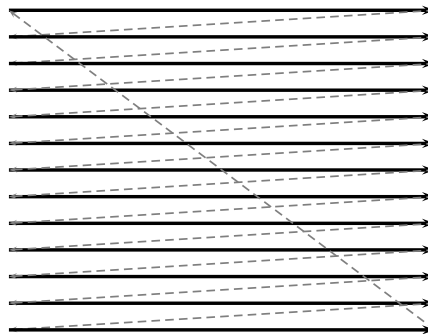


Video - p. 41

## Raster Scanning



## Raster Scanning



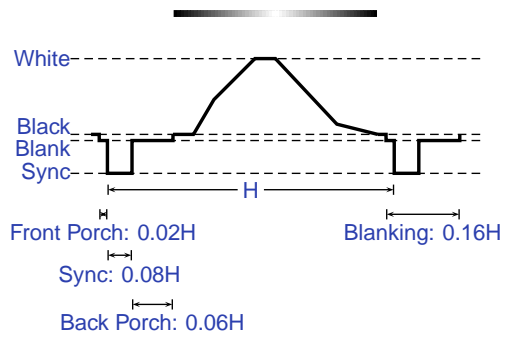
## NTSC or RS-170

Originally black-and-white  
60 Hz vertical scan frequency  
15.75 kHz horizontal frequency

$$\frac{15.75 \text{ kHz}}{60 \text{ Hz}} = 262.5 \text{ lines per field}$$

White 1 V  
Black 0.075 V  
Blank 0 V  
Sync -0.4 V

## A Line of B&W Video



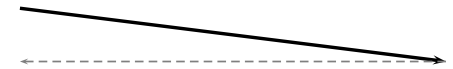
Video - p. 61

## Interlaced Scanning



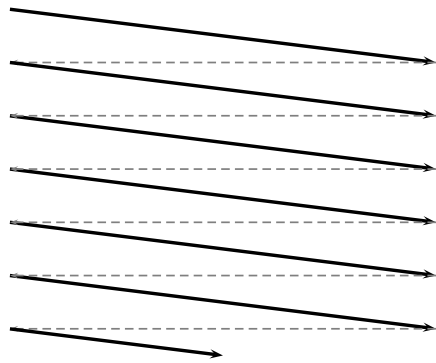
Video - p. 71

## Interlaced Scanning



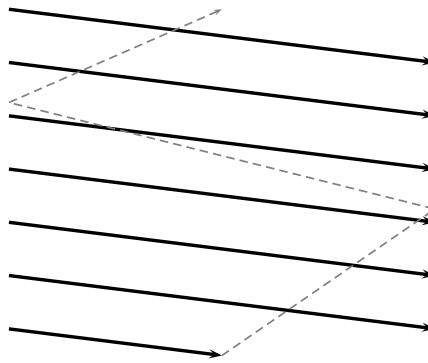
Video - p. 71

## Interlaced Scanning



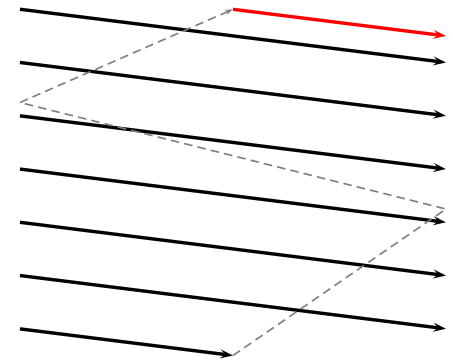
Video - p. 71

## Interlaced Scanning



Video - p. 71

## Interlaced Scanning

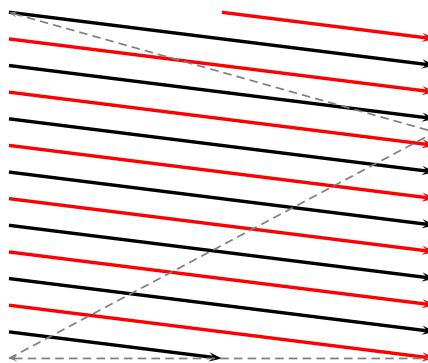


Video - p. 71

## Interlaced Scanning



## Interlaced Scanning



## Color Television

Color added later: had to be backwards compatible.

Solution: continue to transmit a "black-and-white" signal and modulate two color signals on top of it.

RGB vs. YIQ colorspaces

$$\begin{bmatrix} 0.30 & 0.59 & 0.11 \\ 0.60 & -0.28 & -0.32 \\ 0.21 & -0.52 & 0.31 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix} = \begin{bmatrix} Y \\ I \\ Q \end{bmatrix}$$

Y baseband 4 MHz "black-and-white" signal

I as 1.5 MHz, Q as 0.5 MHz at 90°:

modulated at 3.58 MHz

## International Standards

	lines	active lines	vertical res.	aspect ratio	horiz. res.	frame rate
NTSC	525	484	242	4:3	427	29.94 Hz
PAL	625	575	290	4:3	425	25 Hz
SECAM	625	575	290	4:3	465	25 Hz

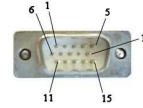
PAL: Uses YUV instead of YIQ, flips phase of V every other line

SECAM: Transmits the two chrominance signals on alternate lines; no quadrature modulation

Video - p. 91

## Computer Video: VGA

1	2	3	4	5
Red	Green	Blue	ID2	GND
6	7	8	9	10
RGND	GGND	BGND (+5V)	GND	GND
11	12	13	14	15
ID0	ID1	hsync	vsync	ID3



ID2	ID0	ID1	
-	-	GND	Monochrome, < 1024×768
-	GND	-	Color, < 1024×768
GND	GND	-	Color, ≥ 1024×768

DDC1 ID2 Data from display  
vsync also data clock

DDC2 ID1 I<sup>2</sup>C SDA  
ID3 I<sup>2</sup>C SLC

Video - p. 101

## VGA Timing

Mode	Resolution	Vertical	Horizontal	Pixel Clock
VGA	640×350	70 Hz	31.5 kHz	25.175 MHz
VGA	640×400	70 Hz	31.5 kHz	25.175 MHz
VGA	640×480	59.94 Hz	31.469 kHz	25.175 MHz
SVGA	800×600	56 Hz	35.2 kHz	36 MHz
SVGA	800×600	60 Hz	37.8 kHz	40 MHz
SVGA	800×600	72 Hz	48.0 kHz	50 MHz
XGA	1024×768	60 Hz	48.5 kHz	65 MHz
SXGA	1280×1024	61 Hz	64.2 kHz	110 MHz
HDTV	1920×1080i	60 Hz		
UXGA	1600×1200	60 Hz	75 kHz	162 MHz
UXGA	1600×1200	85 Hz	105.77 kHz	220 MHz
WUXGA	1920×1200	70 Hz	87.5 kHz	230 MHz

Video - p. 111

## Detailed VGA Timing

640 × 480, "60 Hz"

25.175 MHz Dot Clock  
31.469 kHz Line Frequency  
59.94 Hz Field Frequency

pixels	role	lines	role
8	Front Porch	2	Front Porch
96	Horizontal Sync	2	Vertical Sync
40	Back Porch	25	Back Porch
8	Left border	8	Top Border
640	Active	480	Active
8	Right border	8	Bottom Border
800	total per line	525	total per field

Active-low Horizontal and Vertical sync signals.

Video - p. 121