Early Television Museum

Saturday 10-6
Sunday 12-5
771-0510
CROSLEY

In All Television

No Finer Performance

No Greater Beauty
RCA R-100 Phonograph Attachment

RCA’s TRK-5, 9 and 12 had a connector to allow a phonograph attachment to be plugged in. This one was introduced at the 1939 World’s Fair.
Andrea 2.F-12

This 12 inch receiver was one of the Andrea models introduced in 1930. The set has a high quality Audion / Electret radio.

The video and deflection chassis are mating, as is the wooden top. The set was donated by Sara Siga.
This is the second generation of remote cameras made by RCA. It uses the 4 3/8 inch 1848 Iconoscope tube, and requires four support units, two of which are in our collection. There are only two pramer cameras in existence.

The first generation remote pickup system required two full size trucks to transport, while this unit could be carried in a car.
Television Tomorrow – Today!

This modern miracle is almost as amazing in its own way as the first draft of human language. It begins at the first flicker of a new story, but it’s not enough. It’s not just the rush of emotions, the beauty and motion of the world. It’s not just the story. It’s the story as it happens, right before your eyes. It’s a world that you can touch, see, feel, hear, and smell.

Fisher

[Image of a woman in front of a television set]
YOU CAN'T HELP INHALING - BUT
you can help your throat!

Call for
PHILIP MORRIS

THREEプロジェクト+100%
REAL PRODUCTION
AMERICA'S FIRST CIGARETTE
WW2 Iconoscope Camera

At the beginning of World War Two, RCA focused its TV engineering effort on developing military uses for television. A smaller version of the Iconoscope, the 1944, was developed to be put in a lightweight carrier. This camera was installed in the nose of a remote controlled glide bomber.

The glide bombers were carried aloft under B-17 bombers, and then released a few miles from their intended targets.

In the B-17, one person operated the television camera, while another person attempted to guide the glide bomber to its target.

The glide bombers turned out to be difficult to control, and few actually hit their targets. Later, these cameras were installed in B-17s that had reached the end of their useful lives. The bombers were filled with explosives, then crashed into targets.
Colordaptor

This kit converted a small-screen black and white TV set to color. It was assembled in the mid-50s by Edward Hauff, a Columbus resident who was an engineer for channel 6. It was kindly donated to the museum by his wife.
RCA C73293C

This tube was made in the early 50s for the RCA model 1 and 2 prototype color sets.

It is a C73293C developmental tube, and was one of the first tri-color picture tubes made.
CBS Colortron 265

This is the first rectangular color tube made in 1951. It was used in a set made by Westinghouse but only a few were sold.

Problems with component caused CBS to discontinue the tube. It was not until the F6 tube that rectangular tubes appeared again in color sets.
Television standards in Germany

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of lines</th>
<th>Number of frames [Hz]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1929</td>
<td>30</td>
<td>12.5</td>
</tr>
<tr>
<td>1931</td>
<td>48</td>
<td>25</td>
</tr>
<tr>
<td>1932</td>
<td>90</td>
<td>25</td>
</tr>
<tr>
<td>1934</td>
<td>180</td>
<td>25</td>
</tr>
<tr>
<td>1936</td>
<td>375</td>
<td>25</td>
</tr>
<tr>
<td>1937</td>
<td>441</td>
<td>25*</td>
</tr>
</tbody>
</table>

*Interlaced, 50 fields/sec
A screenshot of the 22 year old actress Ursula Patzschke, the first program announcer on German television. To be picked up well by early TV cameras she had to wear makeup and clothes rich in contrast.

She was hired in 1934 to bridge breaks in between programs. For lack of other program material, she frequently brought in her dogs and showed them to the early TV audience; sometimes she also presented the studio-housekeeper’s guinea pigs...
**Pre-war program examples:**

<table>
<thead>
<tr>
<th>German Text</th>
<th>English Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achtung! Rotes Licht! (1/5/1938)</td>
<td>Attention! Red traffic light!</td>
</tr>
<tr>
<td>&quot;Kleine Winke zur Berufsberatung&quot; (3/14/1938)</td>
<td>Little hints for choosing a profession</td>
</tr>
<tr>
<td>“Verliebt, verlobt, verheiratet” (5/30/1938)</td>
<td>In love, engaged, married – legal hints for engaged couple</td>
</tr>
<tr>
<td>Rechtstips für Verlobte</td>
<td>Police warnings</td>
</tr>
<tr>
<td>&quot;Die Kriminalpolizei warnt&quot; (7/4/1938)</td>
<td></td>
</tr>
</tbody>
</table>

Followed by the program announcer, news and short films
The most popular television play:

STATION D IM EISMEER (Station D in the Ice Sea)
Written by Hannes Braun

3 men are working in a metereological station in the arctic ice. After one year in solitude, the expected relieve does not arrive due to bad weather. The youngest member cannot hold out any more and commits suicide. The two remaining men hold out one more year.

Originally 30 minutes; the play was so popular that it was lengthened to 70 minutes. Performed at least 40 times in 1940.
In the studio from 1935-1944
“Fernsehstube” or “TV chamber” for public viewing of broadcast television – since hardly any ordinary person in Germany during the 1930s could afford his own TV set.

“Großbildstube” or “Large Screen Chamber” TV theater using a “Schmidt-mirror” TV projector
49 “Fernschstuben” in Berlin from 1935-1941

49 “Fernschstuben” in Berlin from 1935-1941

Zuständige Fernschubstellen während der Olympischen Spiele 1936

Zuständige Fernschubstellen während der Olympischen Spiele 1936

Zuständige Fernschubstellen während der Olympischen Spiele 1936

(Quelle: Eike, Klaus: Fernseh unter Bunkern, 1990)
The FE-1
"Fernsehempfänger 1" = "TV receiver 1"

This receiver was modeled and named after the successful "Volksempfänger" VE-1, the "Peoples (Radio) Receiver".

Starting manufacturing in 1939 for the new 441 line system and priced 650.00 Reichsmark, only 50 receivers were made until production was stopped at the start of the war.
Telefunken FE 1
How it looks today

Photo by
Eckhard Etzold
Telefunken FE VI
“mirror in the lid receiver
for the 441 line system
Paul Nipkow’s patent of an “electric telescope”, January 6, 1884

Paul Nipkow would have celebrated his 100th birthday on August 22, 1960
"Keystone effect" and associated interlacing problems when a disc scanned image is displayed on a cathode ray tube
“Line bending” problem when a disc scanned image is displayed on a cathode ray tube.
Correction of the "keystone effect" by tilting the film during scanning.
Optical correction of the “line bending” problem by use of a “special shape” lens
Optical correction of the “line bending” problem by use of a “special shape” lens
441 line 7 spiral disc for flying spot telecine and stationary objects
25 frames/sec, 50 fields interlaced – 175 revolutions/sec = 10,500 rpm

Field impulses slit with “after” impulses

Spiral for telecine

Spiral for slides / people
In dark cell

Line impulses slit
A 441 line 7 spiral disc needs a “slit disc” to expose the scanning hole of one line at a given time only.
How the disc was actually made....
Photograph of the actual scanning disc before closure of the capsule which had to be evacuated.

The disc had to be extremely well balanced by drilling holes on the heavier side and also at the center tension ring. Remember: 10,500 rpm!
FIG. 7—TELEVISION EXPOSURE TESTS FOR DIRECT TELEVISION (90 LINES) AT FIRST NATIONAL
Fig. 3.
FIG. 12—FIRST DIRECT TELEVISION TRANSMISSION TESTS BEING MADE IN CASTELLAN LABORATORIES WITH THE TELEPANTOSCOPE DESIGNED BY HIM
TELEVISIONE

Apparecchi MAGNETI MARELLI coperti alla XI Mostra Nazionale della Radio, che ha dato prova di essere un apparecchio non solo per raddoppiare la valenza la radiotelevisione, ma anche per renderla più vicina alla ragionevolezza.

Radiovisiva: delle trasmissioni alla base del C.I.R.C. tra le prime radiazioni e l'ultimo Stato di Bilancio per gli apparecchi e trasporti di matrice della FABBRICA ITALIANA MAGNETI MARELLI

RADIOMARELLI
Al alto a sinistra: televisione Magnetron modello TM 20 (1940) prodotta nella stabilimento di Sesto.
A destra: il primo televisore della ditta Geime (è il primo televisore progettato nel 1948, avvenuto nel mercato nel 1949.
In basso a destra: lo schermo della Telefunken (1935), uno a destra, e a sinistra di dritto, primo modello in modo di accesso.
Adding Sight to Sound in Stalin’s Russia: RCA and the Transfer of Electronics Technology to the Soviet Union

Alexander B. Magoun
April 30, 2005

The David Sarnoff Library
The Shiloh Tower, before the Transmitter intense
Agreement

CHIEF ADMINISTRATION OF THE ELECTRO-NUMERICAL
COMPUTING INSTITUTE OF THE PEOPLE'S COMMISSION
FOR AID TO SCIENTIFIC INDUSTRY OF THE U.S.S.R.

AND

 RADIO CORPORATION OF AMERICA

DATED AS OF
Philips Projection Set Optical Alignment Device

This device was used to adjust the optical focus of sets using the Philips Protegram projection assembly. The device is installed in place of the 3NP4 CRT. It has a test pattern on its face, with a light bulb behind it. Once the image was focused on the screen, the device is removed, the CRT re-installed. Then the electrical focus could be set.
Dot Sequential Color

Time Division Multiplex
for Color TV
Credits First

- “first RCA switching receivers could receive the final form of NTSC with no modifications”
  - George Brown
    - RCA Engineer
    - Autobiography
      - *And Part of Which I Was*
Credits First

• “...just about like multiplying R, G and B by raised sine waves out of phase by 120 degrees and adding them up.”
  – Jim Blinn - Personal Correspondence
  • Microsoft Scientist (Cal Tech at the time)
  • IEEE Computer Graphics & Applications
    – “NTSC: Nice Technology, Super Color”
    – March 1993, p.17-23
In-Band Multiplex

- Time Division Multiplex
- Inside the 4.2 MHz Video Band
  - Low Rate Sampling (CBS)
    - Field Sequential - 120 Hz
  - High Rate Sampling (RCA)
    - Close to upper limit of 4.2 MHz
Dot Sequential

- “Mixed Highs”
  - Color – Low Resolution
    - Below 2 MHz
      - Transmit Samples
        » Sequence RBG
        » Sample each color at 4 MHz
  - Details – High Resolution (B&W)
    - Above 2 MHz
      - Add B&W Values to Make the Composite Signal

4/30/2005  Dot Sequential Color  Early TV
Dot Sequential

- Does it work…
  - Issues
    - Sampled Signal Bandwidth
      - over 3.8 MHz
      - Overlap Monochrome Detail Signal
    - Filter Slope?
    - Probable Cancellations - Missing Frequencies
Color Demux

- NTSC De-multiplex
  - Crystal
  - 3.1 to 4.1 MHz Bandpass Filter
  - Phase Shifters
  - Inductors
  - Delay Line

- Dot Sequential De-multiplex
  - Crystal
  - Switcher
  - Reconstruction Filters
Dot Sequential Demux

- Demux Circuit Blocks
  - Recover Burst
  - Synchronize Local 3.58 MHz Oscillator to Burst
  - Generate Sampling Gates
    - Triple 3.58 to 10.74 MHz
    - Create Three Gate Signals
      - 120 Degrees of a cycle of 3.58 MHz is R, B, then G
  - Low Pass Filter Each Signal
Dot Sequential Demux

Diagram of a dot sequential demultiplexer circuit.
Dot Sequential Demux

- Demo
  - Patterns
  - Resolution
  - Bars
  - Decoder
  - Y/C Delay
- Picture
No-Signal.
Source: Computer
No-Signal.
Source: Computer
Test Patterns

Pioneers of Television
The Telectroscope Realized
Pete Fasciano, 06/24/2003
Television’s Pioneers

- John Peter Gassiot
- William Crookes
- Heinrich Geissler
- Ferdinand Braun
- Paul Nipkow
- Edouard Belin
- A. A. Campbell-Swinton
- Boris Rosing
- John Ambrose Fleming
- Lee DeForest
- John Logie Baird
- Charles F. Jenkins
- Hollis L. Baird
- Ulises Sanabria
- Ernst F. Alexanderson
- Kenjiro Takayanagi
- Vannevar Bush
- Philo Farnsworth
- Harry Lubecke
- Vladimir Zworykin
- Ray D. Kell
- Kalman Tihanyi
- Alan Blumlein
- Peter Goldmark
- John Wentworth
Gassiot's Cascade
John Peter Gassiot
1797-1877
Gas Discharge 1852
Thomas Edison
1847-1931

- Edison Effect, 1881 deemed of no value

Edison Tripolar Lamp
Karl Ferdinand Braun
1850-1918

- Cathode Ray Tube, 1897

Braun Tube
DuMont
Westinghouse
Paris Exposition, 1900

The word ‘Television’ is coined
Edouard Belin
A.C. Swinton & Boris Rosing
1863-1930

CRT 'camera', 1908
Lee DeForest
1873-1961

Triode Valve, 1906
Charles Francis Jenkins
1867-1934

SMPTE founder

13 June 1925
John L. Baird

Falkirk Scanner

Oliver Hutchinso
John L. Baird

“China Doll” Test

Stookie Bill
John L. Baird

“China Doll” Test

Stookie Bill
BIRDS HAVE ALWAYS HAD THE VISION TO SEE JEGELSKE DIGOCHAPE QUOTAMPLEXIMY ZHRILESQUELAMRICENT PROPHETICARELTYNSIAN
NBC & Felix the Cat

“China Doll” Tests

NBC

60 Lines
The First Teleplay
14 July 1930
The Man with a Flower in his Mouth
The First Teleplay
10 Sept 1928
The Queen’s messenger
Ernst F.W. Alexanderson

General Electric

Ray Kell
Flying Spot Scanner Studio

Light flow is reversed

W1XAV Boston

Raster Projector

Photocells
Ulises Sanabria
1906-1969
Interlace Scanning, 1931
3 way interlace disk
Vannevar Bush
1890-1974

Father of interactive TV

For some purposes, it may be desirable to concentrate:
the power of the light upon the place where it is needed.
In other to have a control transmittance of light about a
point, we may imagine a radially illuminated spot or
group. For the purpose of such a control, we may use a
focal zone the size of which is to be adjusted as
necessary. Such a focal spot may be made to move
over a surface, with a great variety of changes in
its intensity. The beam of the light may be
controlled by means of an electrostatic field.

F. Bats, Cambridge
Vannevar Bush
1890-1974

Father of interactive TV

"As We May Think" 1945
The Memex Concept
Phil Farnsworth

Image Dissector
Philo Farnsworth

Image Dissector

Justin Tolman's Notebook
Philo Farnsworth

- W3XE, W3XPF
- June 28, 1932
- 1st U.S. TV
Don Lee & L.A. Television

- W6XAO, Dec 23, 1931
- Channel 1, 44-50 Mc, 500 watts, 30 miles
- Farnsworth TV System by Harry Lubcke
Harry Lubcke

- W6XAO, Dec 23, 1931
- TV Scan patent 2,059,219
  - Sawtooth Sweep generator
  - Retrace Blanking
  - D.C. Restoration
  - Negative Sync Pulses

- Named the Emmy Award
  - Co-Founder, STE
  - Co-Founder, ATAS
Kalman Tihanyi
1897-1947

The Emitron in Hungary
Vladimir Zworykin

- Russian émigré RCA’s main man

Raymond D. Kell
1929-1934

Gen. David Sarnoff
Position the Outside White Area to Match Iconoscope Target Edges
1939, The World’s Fair

Television’s U.S. Debut
1936, BBC & Alexandra Palace

Alan Dower Blumlein

Jasmine Bligh

Crystal Palace

1851
The Monoscope Test Card

- Calibrated Camera

[Image of a test card with two images and a diagram of a device]
The Monoscope

NATIONAL UNION MONOTRON

MAUR E. EASTMAN. SATURDAY NIGHT SERENADE.
The Monoscope

Calibrated Picture

1699

2F21
The Charactron Monoscope

- Symbols Generator
- Crookes Masking

1698
The Charactron Radarscope

- 2 beam scanning systems in series
BBC & Baird Colour System
Goldmark CBS Color System

- The Scanning Disk Returns
Goldmark CBS Color System

- The Scanning Disk Returns
1953

January 1, 1954...
1953

January 1, 1954...

RCA color camera

TK41 prototype
China Doll  Test Subjects

- Faces of Television
  - Jasmine
  - Pem
  - Connie
  - Oliver
China Doll

Faces of Television

Jasmine

Lena

Connie

Carol

Pem

Trish Herron
Postscript – the Future?

- 30 fps/20K-lines

Diagram:
- Laser
- Microlens
- Array
- Rotation
- Lent
- Camera
- Pinhole
- Objective Lent
- Specimen
Postscript – the Future?

- 30 fps/20K-lines
- Was Baird right?
Introduction

- The basic steps in standards conversion are:
  1) Digitizing the source NTSC or PAL video
  2) Filtering the digital video data
  3) Spatial Correction (resizing)
  4) Temporal Correction - (frame rate conversion)
  5) Output Formatting and Signal Generation
**Typical Standards**

1) 525/60i interlaced electronic
2) 441/60i interlaced electronic
3) 243/30i interlaced electronic
4) 819/25i interlaced electronic
5) 625/25i interlaced electronic
6) 441/25i interlaced electronic
7) 405/25i interlaced electronic
8) 240/25p progressive electronic hybrid
9) 180/25p progressive electronic
10) 240/24p progressive electronic
11) 120/24p progressive electronic hybrid
12) 405/72i interlaced electronic-mechanical color hybrid
13) 120/25p progressive mechanical
14) 96/25p progressive mechanical
15) 90/25p progressive mechanical
16) 60/25p progressive mechanical
17) 50/25p progressive mechanical
18) 60/20p progressive mechanical
19) 48/20p progressive mechanical
20) 48/15p progressive mechanical
21) 45/15i triple interlaced mechanical
22) 24/15p progressive mechanical
23) 32/12.5p progressive mechanical hybrid
24) 30/12.5p progressive mechanical
25) 30/12.5p progressive mechanical
The video decoder is a single chip Philips SAA7113. It provides all the necessary logic to accept an NTSC, PAL or SECAM input and provide an 8 bit IBU601 digital output.
Field Programmable Gate Array

- The heart of the converter is a Xilinx Spartan IIe XC2S300E FPGA. It provides all system control and processing, and contains the equivalent of 300,000 logic gates, and 64Kb of memory.
Ancillary Functions

- Additional functions include:
  - Video D/A converter (TI THS56551A 10bit)
  - Video Memory (Cypress CY7C1049CV33 512KB X 8)
  - Image FLASH ROM (Atmel AT49BV322 4MB X 8)
  - Video PLL (MicroClock MK.1575-01)
  - Audio CODEC (Burr Brown PCM3008T 16bit)
  - FPGA FLASH ROM (Atmel AT17N002 2Mb)
  - Power supplies, video/audio filters and video/audio amplifiers

www.murenvidenys.com/converter
Spatial Correction

- Spatial Correction is the technical name for scaling and involves the following steps:

  1) Resampling the input to the required dimensions of the output using decimation to decrease size or interpolation to increase size.

  2) Filtering the input to reduce the high frequency components, thereby reducing artifacts in the output. This is usually done using a Finite Response Filter (FIR) which is simply a digital method for creating a signal processing filter.
Scaling through Interpolation

- When scaling the image size up, as in going from 625/25i to 819/25i, more samples need to be created than are in the original signal. This is done by interpolating the missing pieces of data in between samples.

<table>
<thead>
<tr>
<th>Line</th>
<th>Original Samples</th>
<th>Interpolated Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0 4 8</td>
<td>0 2 4 6 8</td>
</tr>
<tr>
<td>2</td>
<td>12 16 20</td>
<td>12 14 16 18 20</td>
</tr>
<tr>
<td>3</td>
<td>24 28 32</td>
<td>24 26 28 30 32</td>
</tr>
</tbody>
</table>

Example of 2:1 interpolation in both horizontal and vertical direction: Interpolated samples shown in BLUE.
Scaling through Interpolation

- When scaling the image size up, as in going from 625/25i to 819/25i, more samples need to be created than are in the original signal. This is done by interpolating the missing pieces of data in between samples.

<table>
<thead>
<tr>
<th>Original Samples</th>
<th>Interpolated Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line 1</td>
<td>0 2 4 6 8</td>
</tr>
<tr>
<td>Line 2</td>
<td>10 12 14 16 18 20</td>
</tr>
<tr>
<td>Line 3</td>
<td>24 26 28 30 32</td>
</tr>
</tbody>
</table>

Example of 2.1 interpolation in both horizontal and vertical directions. Interpolated samples shown in blue.
Scaling through Decimation

- When scaling the image size down, less samples need to be created than are in the original signal. This is done by dropping pieces of data.

<table>
<thead>
<tr>
<th>Line</th>
<th>Original Samples</th>
<th>Decimated Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line 1</td>
<td>0 2 4 6</td>
<td>line 1: 0 4</td>
</tr>
<tr>
<td>Line 2</td>
<td>6 8 10 12</td>
<td>line 2: 12 16</td>
</tr>
<tr>
<td>Line 3</td>
<td>12 14 16 18</td>
<td></td>
</tr>
<tr>
<td>Line 4</td>
<td>18 20 22 24</td>
<td></td>
</tr>
</tbody>
</table>

Example of 2:1 straight decimation in both horizontal and vertical directions. Decimated samples shown in blue.

www.auroravideos.com/converter
Filtering the video image

- In the previous slides it was shown that simple decimation is not a good choice since much of the original data is lost, meaning much of the original image detail is lost. It was shown that filtering the video samples before scaling is desirable as all original samples contribute to the scaled output yielding better image detail. This can also be shown graphically as follows...
Filtering the video data

- The example at right shows graphically what happens when the video signal is down sampled without first being filtered to reduce the high frequency components. The sampled data does not represent the input.
Filtering the video data

- The example at right shows what happens when the video signal is down sampled after first being filtered to reduce the high frequency components. The sampled data better represents the average input.
Filtering must be applied before scaling!

- The image to the upper right represents a full resolution NTSC image. The one to the lower right represents a scaled 120 line image that was not filtered before decimation.
Filtering reduces artifacts in the image

- The image to the upper right represents a full resolution NTSC image. The one to the lower right represents a scaled 120 line image that was filtered before decimation.
Temporal Correction

- Temporal Correction is the technical word for frame rate conversion. Many video standards do not share the same frame rate, i.e. 525/30i (NTSC) to 625/25i (PAL), so something needs to be done to correct the input video to match the rate of the selected output video. As will be shown, there is no perfect way to do this regardless of cost or effort, and all methods are a compromise. Here are some of the different methods...
Temporal Correction Methods

1. Time Multiplexing. Simplest and worst looking method used on cheap international standards converters.
2. Straight interpolation/decimation. Better than multiplexing but results in stuttering or jumping.
4. Motion Estimation. Best, costliest, and most complicated method used on >$100K broadcast equipment.

The present Standards Converter uses method 3.
Time Multiplexing

- In this method, the output video is taken at a fixed rate independent of the input video. This means that frames of video in the output can be temporally split between input frames, resulting in a torn image as shown.

www.somevideo.com/someconverter
Straight Interpolation/Decimation

- In this method, frames are dropped or added from the input video to create the desired output frame rate. This can result in a large jump in motion as shown, or as a stutter if a frame is duplicated.
Interpolation/Decimation with Filtering

- In this method, the output video is a blend of two adjacent frames of the input video. This can result in a softening or blurring of the image as shown. This is usually not visible along with the normal motion.
Motion Estimation

- In this method, a computer evaluates the image for moving objects and tries to determine where they would be in time for the interpolated-decimated frames. This is why this method is so costly and complex and doesn’t always work as well as shown here.
Telecined Film

- One exception to the rule is when Film is broadcast on NTSC with a process known as 3:2 pulldown or telecine. When this occurs, it is possible to detect this process and reconstruct the original image with no compromise in quality.
Interlaced Video

- All of the previous slides assumed that the input and output video were progressive formats. In fact, all input video is interlaced (NTSC and PAL), and many output video standards are also interlaced. In these cases the video is usually processed a field at a time to retain as much of the field based information as possible. If the output video standard is progressive, the two fields in the input video are blended to create a pseudo progressive image.
Output Formatting and Signal Generation

- While all video signals share common attributes, each specific format differs in how the video data is constructed. Consider the following:
  - Standards like the Western Mechanical scan from right to left, top to bottom with a triple line interlace, while the Baird Mechanical format scans from bottom to top, right to left.
  - NTSC and PAL video share a common aspect ratio of 4:3 (width to height). Aspect ratios of the output standards vary from 4:3 for most electronic formats to 3:7 for the Baird Mechanical format.

www.auronvideoxy.com/converter
Output Formatting and Signal Generation

• Most Mechanical formats do not include sync pulses in the video as they used the AC power frequency, or the fundamental line frequency in the video for synchronization.

• The gamma of electronic television has been set at 0.45/2.2 while the Neon Lamps of Mechanical sets have a gamma of nearly 1.0.

• All of these differences need to be taken into account when generating the video signal for a particular standard. A few examples of the actual video signals are shown next...
Basic Operation

- The converter accepts on its input any NTSC or PAL/SECAM source, either composite (RCA/BNC) or S-Video (mini-DIN). Initially the front panel LED will blink RED to indicate no signal is present. When a valid video signal is attached, the LED will go solid RED to signify this. At this point the converter will be outputting the selected video signal on its output RCA/BNC connector.
Default Image

- The converter includes a feature so that when no video signal is attached to the input, a default image will be output. The image is selectable from either a stepped gray scale or up to 2 user programmable images such as those shown at the right. These images can be saved at any time through the front panel push button.
Center Zoom Function

- Since much of today's video is shown in 16:9 Letterbox format, a Zoom function allows the center 4:3 portion of the image to fill the screen. Amazingly, since the input video format is usually much higher than the converted output, no loss of resolution results.
Audio I/O

- Although audio I/O is not required on a video standards converter, it was added for several reasons.
  - The processing of the video takes time, so the audio is delayed a similar amount to make sure it stays in sync with the video.
  - Some mechanical standards use a synchronous motor called a phonic coil for synchronization, so an appropriate sine wave is output on one of the channels for this use.
Example Outputs:
441/30i on GE HM-225
Example Outputs:
343/30i on RCA RR-359
Example Outputs:
45/15_3i on Western Visionette
Example Outputs:
30/12.5p on Baird Televisor
Inside view of Converter
The Birth of BBC Television 1936-1939

1936
1937
1938
The Birth of BBC Television
1936 to 1939
Motorola 19CT1

This was Motorola’s first color set, introduced in late 1954. It still has the original 19 inch picture tube. Almost all of these sets were modified with a 21 inch tube by Motorola. This set was not for sale, and is marked “experimental” on the top of the cabinet.

<table>
<thead>
<tr>
<th>Screen Size</th>
<th>19 inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year Made</td>
<td>1954</td>
</tr>
<tr>
<td>Quantity Made</td>
<td>2</td>
</tr>
<tr>
<td>Cabinet</td>
<td>Original Finish</td>
</tr>
<tr>
<td>Electronic Restoration</td>
<td>Restored</td>
</tr>
</tbody>
</table>
This was Motorola's first color set, introduced in late 1954. It used a 19 inch picture tube, but this set, like most of the 19 inch sets, was modified with a 21 inch tube by Motorola. This may be the only surviving example of this set.

**Motorola 19CK2**

- **Screen Size**: 21 inch
- **Year Made**: 1954
- **Cabinet**: Original Finish
- **Electronic Restoration**: Not Restored

---

**Motorola 19CK2**

- **Screen Size**: 21 inch
- **Year Made**: 1954
- **Cabinet**: Original Finish
- **Electronic Restoration**: Not Restored
King Color
is a Salesman!

You can talk about Color TV for hours, but what really
appeals are the demonstration shows in a fraction of the
sales plan that makes the network your
salesman. This is easy.
**ColorTime, U.S.A.**

will work in any community... in any size store... makes small floor space... and small investment.

All you do is set up a side-by-side comparison of color and black-and-white reception. Motorola sets the stage with... a complete (and completely practical) COLOR SHOW-AND-SELL KIT

Here's a big, big audience-watching device of tomorrow, today! Motorola's ColorTime 111 is not only a sales aid that makes your store a real show place... makes a corner of your store into a comfortable Color Theater... makes every television a great persuader for Color TV sales.

Look over this program now. Start your ColorTime promotion with next week's color schedule!
**Colortime U.S.A.**

A partial schedule of the shows you now can see on Motorola Color TV.

---

**October**

<table>
<thead>
<tr>
<th>Sun</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thur</th>
<th>Fri</th>
<th>Sat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
<td>26</td>
<td>27</td>
<td>28</td>
</tr>
<tr>
<td>29</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**November**

<table>
<thead>
<tr>
<th>Sun</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thur</th>
<th>Fri</th>
<th>Sat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
<td>26</td>
<td>27</td>
<td>28</td>
</tr>
<tr>
<td>29</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Daytime... Nighttime... All the time...

This Wonderful World of Color TV—at a New Level.
Daytime... Nighttime... All the time... Almost 15 Hours in Color... Every... 

30 MINUTES 

60 MINUTES 

90 MINUTES 

INSERTS 

OMNIBUS 

HOME 

Color TV—at a New Low Price from MOTORC
New Price from **MOTOROLA**
Color... Every Week This Year

SPECIALS

JANUARY

THE MOTOROLA WAY TO COLOR TV VOLUME
NOW, for the first time anywhere
Motorola Color TV
THE GREATEST DEVELOPMENT OF THE ELECTRONIC AGE

Now, you can take your choice of Motorola color TV's. Their superb craftsmanship and lovely
standing design and lovely woods will earn them a place among the finest furnishings.
Without a doubt, for Motorola, the finest of color TV's for the home.
Motorola
model 160-1

Here’s a new in the modern mood—revived with traditional refinement.

It’s the all-in-one solution: entertainment, information, and communication—just like the old days, but with modern technology. The new Motorola model 160-1 is designed with the elegance and simplicity of the past, now enhanced with the latest in technology. It’s perfect for living rooms, bedrooms, and even outdoors. Enjoy your favorite shows, music, or movies, and stay connected with friends and family. The Motorola model 160-1 is a timeless piece that adds a touch of sophistication to any home.
COLOR TV - THE BIGGEST THING AHEAD.
OUTSTANDING WINDOW SIGNS ESTABLISH
YOU AS A MOTOROLA COLOR TV DEALER

YOU CAN DOMINATE MAIN STREET
WITH A MOTOROLA COLOR TV
ILLUMINATED OUTDOOR SIGN

MOTOROLA TV
COLOR TELEVISION

MOTOROLA TV
COLOR TELEVISION

MOTOROLA TV
COLOR TELEVISION

You can dominate the color television market in your area if you sign up with Motorola. This sign can be used in your window, on the counter or on the wall.

MOTOROLA
COLOR TELEVISION

You immediately establish yourself as a Motorola Color Television Dealer when you sign up with this tag 8 x 12 double-faced projection sign. Motorola was the very first in the industry to offer this feature a color television illuminated outdoor sign. This is a sign that you can use when the prospects in your area are ready to purchase color television. Your Motorola Sign will serve as a constant reminder that your store is the place to buy. 
WELL PAY UP TO $200 FOR YOUR TV SET FOR $0.00 A WEEK
OWN COLOR TV

MOTOROLA COLOR TV

COLOR TV PROGRAMS
(Dealer Name)

COLOR TV

MOTOROLA COLOR TV

Only $19.95 down delivers this
BIG SCREEN Color TV

[Ad for Motorola Color TV]
MOTOROLA
Color TV

SPOT RADIO
SCRIPTS
Have you seen a Color TV Show?
YOU ARE INVITED TO SEE NEW AND EXCITING BIG SCREEN

MOTOROLA Color TV

See a popular TV program in Full Color. Feel free to bring a guest. No obligation, of course.

We'll look forward to seeing you.

TIME
PROGRAM
PLACE

PRINTED IN U.S.A. FORM NO. 3457
for the family of a man

who has made his mark in the world...
and, for color television at its best,
you are invited to see

Motorola Color TV

Elusive in the hands

only $595 ... lowest price by far!

$695

be the first in your area to own the miracle

of Big Screen Motorola Color TV

With Motorola you enjoy all the wonderful new color programs of their kind.
Because only Motorola Color TV has all these outstanding features . . .

NEW 23-IN. Picture
Clarity, brightness, depth, color on display!

NEW LOUD "SUPERCHARGER"
For extra brightness, your eyes only the Motorola picture

NEW "COLOR Synchronizer"
Look, you won't get lost—now how do you like it?

NEW "COLOR Synchronizer"
Looks, your picture is sharp—sick, but you did it!

NEW "COLOR Synchronizer"
Wide, picture shows, details sharp . . . color, but not this!

...and every Motorola Color Picture Tube carries a full-year's warranty!
be the first in your area to own the miracle
of Big Screen Motorola Color TV

With Motorola you enjoy all the wonderful new color programs at once!23
Besides, only Motorola Color TV has all these pace-setting features...

BIG BET in picture - Clear, bright, stable - each and every
in the world!

NEW COAST "SUPER-QUALITY" Perfect color reproduction even during
into the Motorola standards!

NEW "COLOR CONTROL" Fixed lens color is continuously
N your sight!

NEW "COLOR GLASS" Kwan! Kwan! - glass color stability

... and every Motorola Color Picture Tube carries a full year's warranty!

for the family of a man

who has made his mark in the world...
COLOR TV...NOW HERE COAST TO COAST

the home entertainment experience
of a lifetime...

Finally, the wonder of color television is for all. Even for those who have always favored black and white TV, the beauty and excitement of color is now within reach.

Look! Here are just a few of the big-time, big-star color TV shows on the air coast to coast:

JOHNNY CARSON
JACKIE GLEASON
THE MIDDAY SHOW
DONALD O'CONNER
NANCY ROSE
PERRY MASON
HARRISON HART
KAY KENNEY
FRANK LAINE
KIM NOVAK
RICHARD WING

And more to come!

It's estimated that before the end of the year, there will be more than 250 hours of network color television per week over some 100 stations, coast-to-coast.
DEEPLY STYLED TO GRACE

THE FINEST SETTINGS

205 sq. in. PICTURE

205 square inches of smart viewing area guarantees a big, easy-on-the-eyes picture with true-to-life color and clarity.

2 SETS IN 1...
GETS BOTH COLOR AND BLACK & WHITE PROGRAMS

No need to switch in and flip switches. You get your favorite programs, saving in trouble... automatically... in color or black and white.

NEW, SIMPLIFIED COLOR TUNING

Just turn color control, select color intensity and matching your taste. No complex math to learn.

...better see Motorola Color TV at your Motorola Dealer NOW!
COLOR TV...NOW HERE COAST TO COAST

the home entertainment experience
of a lifetime...

Looking to add color television to your home? Motorola's new Color TV is the perfect addition to your living room. With its vibrant colors and lifelike images, you'll enjoy a whole new world of entertainment.

Look! Here are just a few of the big-time, big-star color TV shows on the air coast to coast:

- Studio One
- Jack's Orson
- The Morning Show
- Andy Griffith
- Garry Moore
- Remember Mama
- Andy World
- Red Skelton
- Dangers of Sullivan
- I Love Lucy
- Jack Benny

And more to come! It's estimated that by the end of the year, there will be more than 30 hours of network color television per week from over 100 stations, coast to coast!

only $395...lowest price by far!

$695

and, for color television at its best, you are invited to see

Motorola Color-TV

Finest in the land