A/V Tech Basics for Archivists

AMIA 2013

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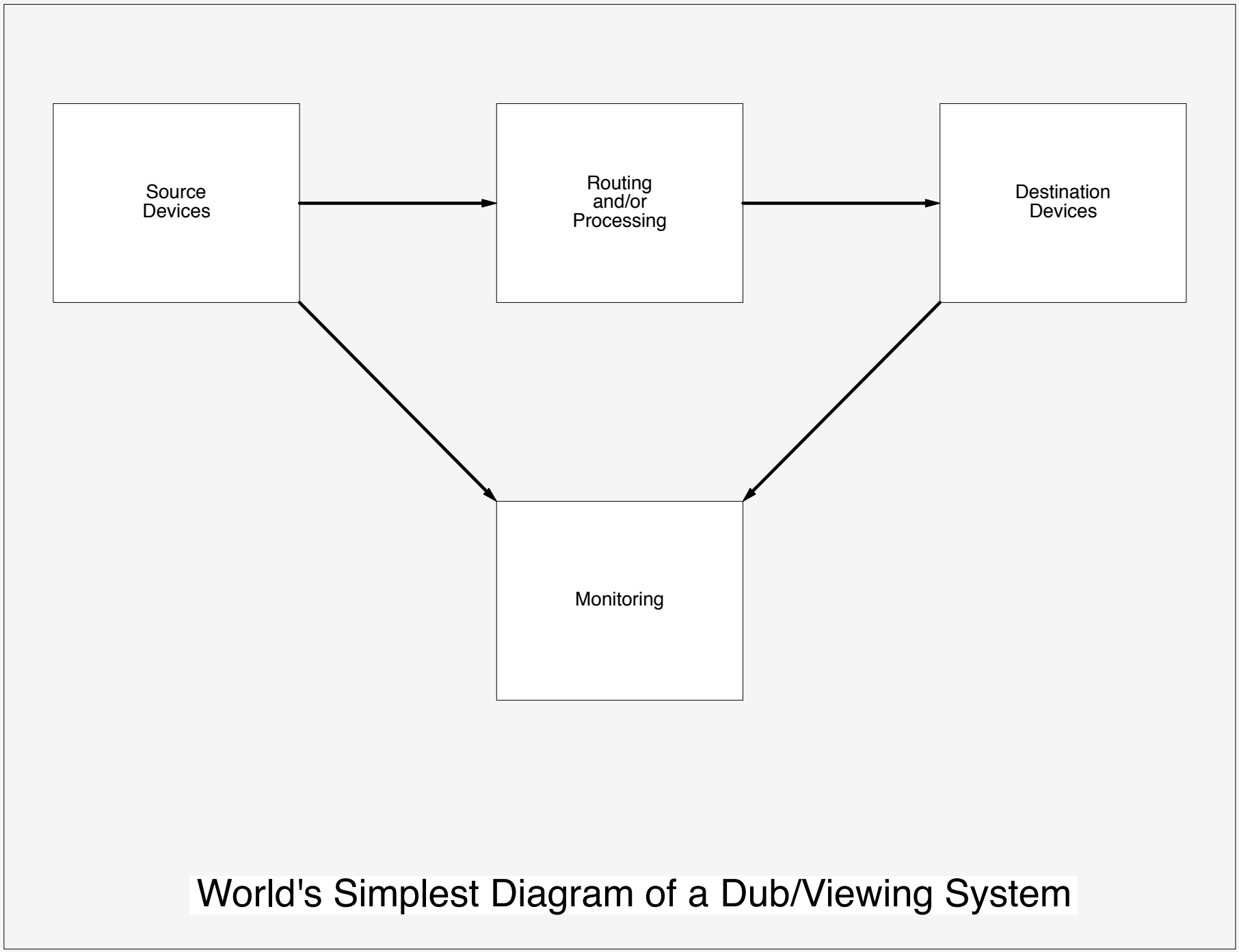
Workshop Overview

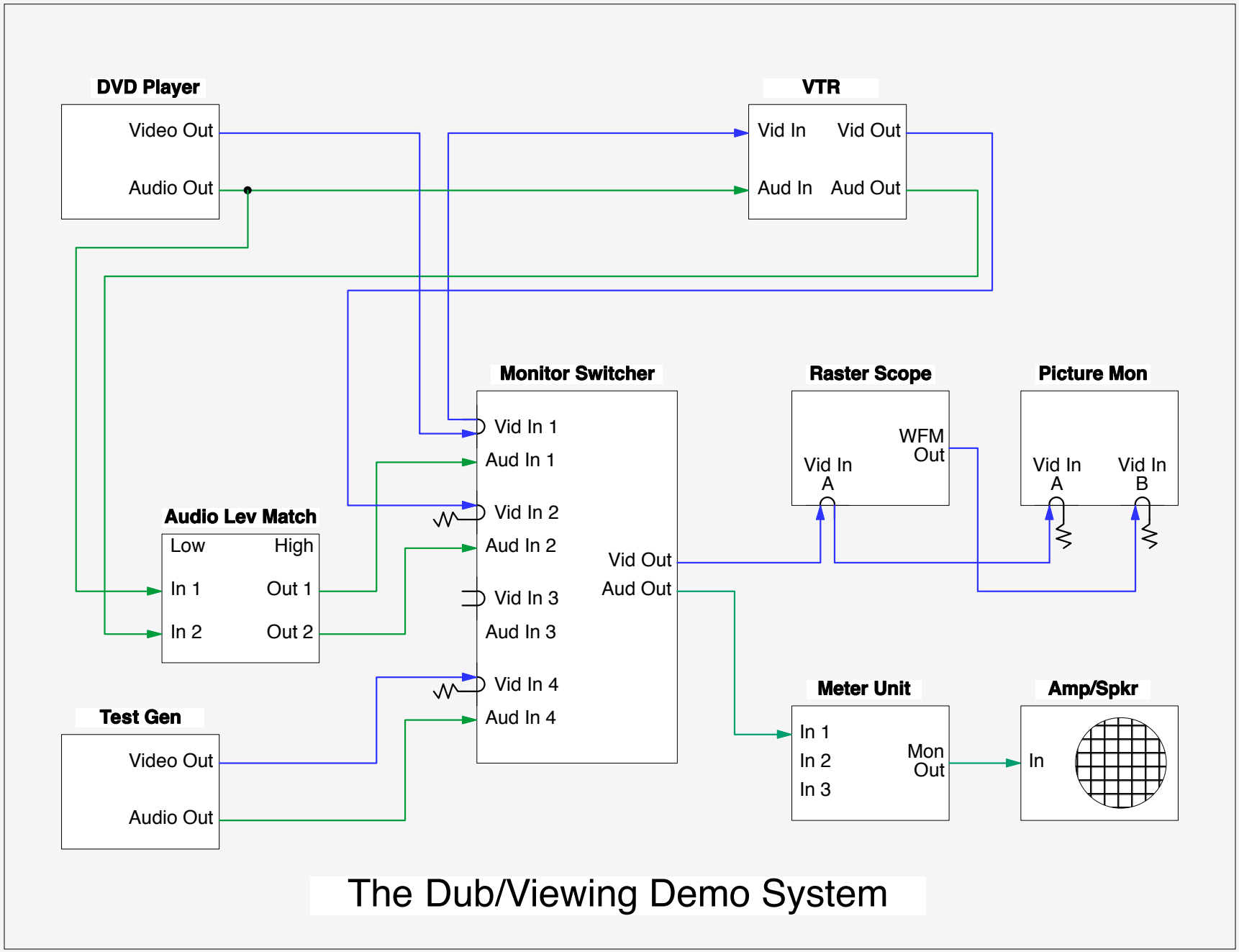
- Elements of a dub/viewing system
- Video signals, connections, monitoring
- Audio signals, connections, monitoring
- Videotape machines
- Simple troubleshooting



World's Simplest Diagram of a Dub/Viewing System


SONY
VIDEO CLEANING
SAMMA Solo
VIDEOTEK
00056406
Panasonic
SONY
SONY


VIDEOTEK
00056406
Panasonic
Betamax
SONY
DIGITAL VIDEOCASSETTE PLAYER DVW-A510
SONY


DVD Player
Video Out
Audio Out
VTR
Vid In
Vid Out
Aud In
Aud Out
Monitor Switcher
Vid In 1
Aud In 1
Vid In 2
Aud In 2
Vid In 3
Aud In 3
Vid In 4
Aud In 4
Vid Out
Aud Out
Raster Scope
Vid In A
WFM Out
Picture Mon
Vid In A
Vid In B
Audio Lev Match
Low
High
In 1
Out 1
In 2
Out 2
Test Gen
Video Out
Audio Out
Meter Unit
In 1
In 2
In 3
Mon Out
Amp/Spkr
In
The Dub/Viewing Demo System

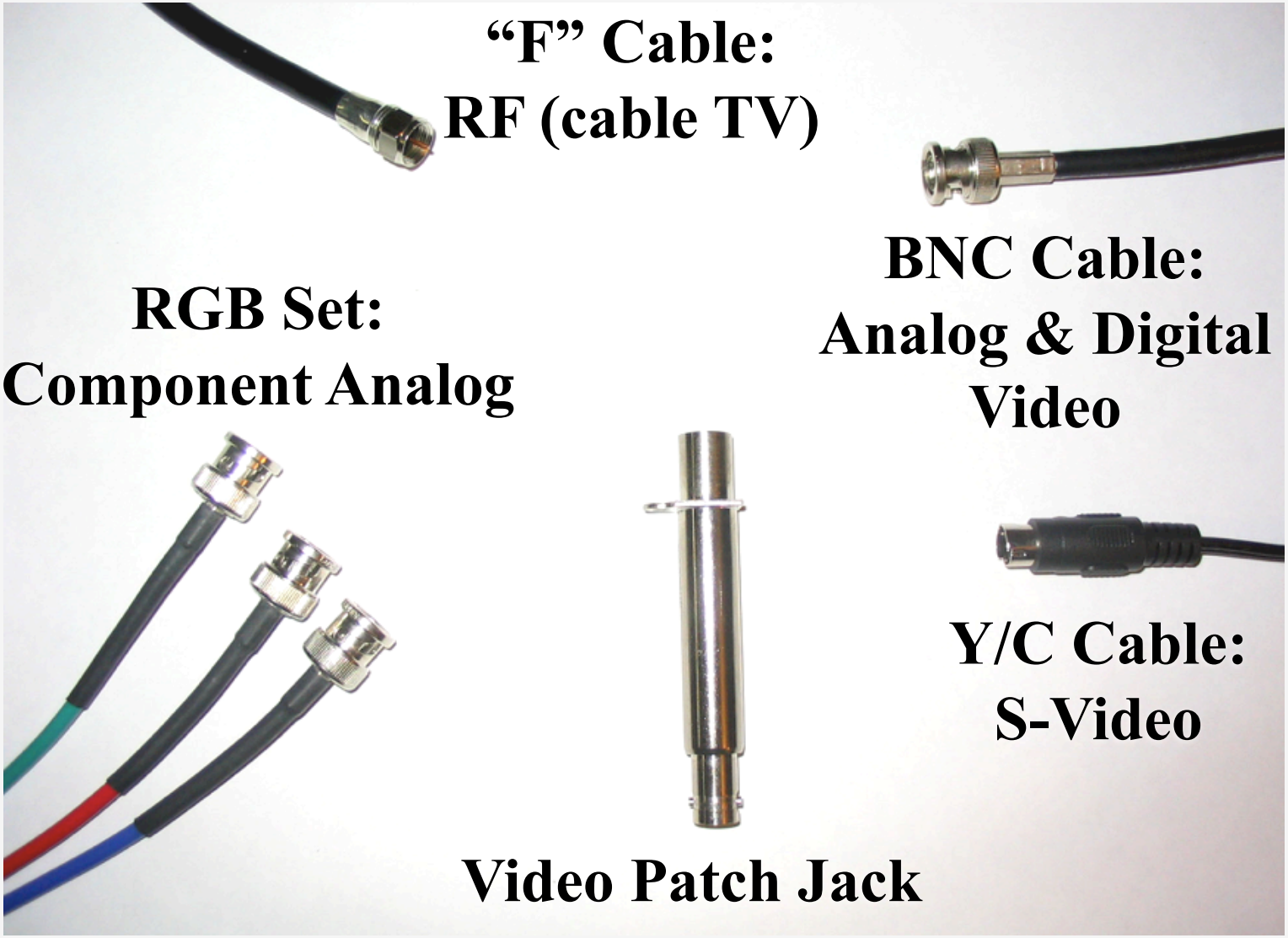
Composite Video

- Luminance and chrominance are carried together on one wire, along with sync signals.
- Once most pervasive format, but poorest quality due to need for separating luma and chroma at displays and other devices.

Component Video

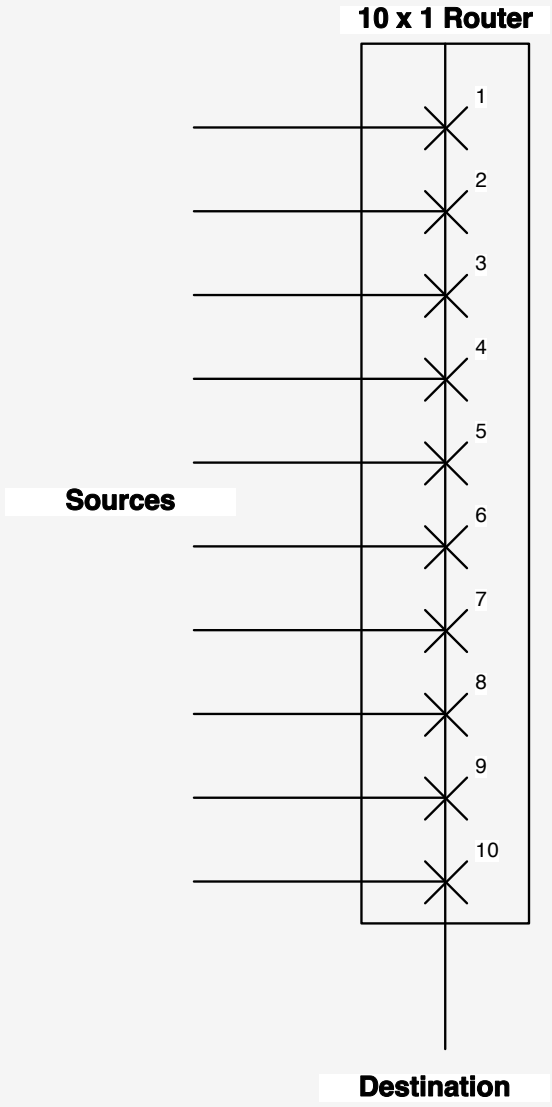
- Video is carried on three wires, either as RGB or color-difference (Y, R-Y, B-Y).
- Became prominent in professional video with Betacam. Maintains better image quality.
- Several variants to contend with…

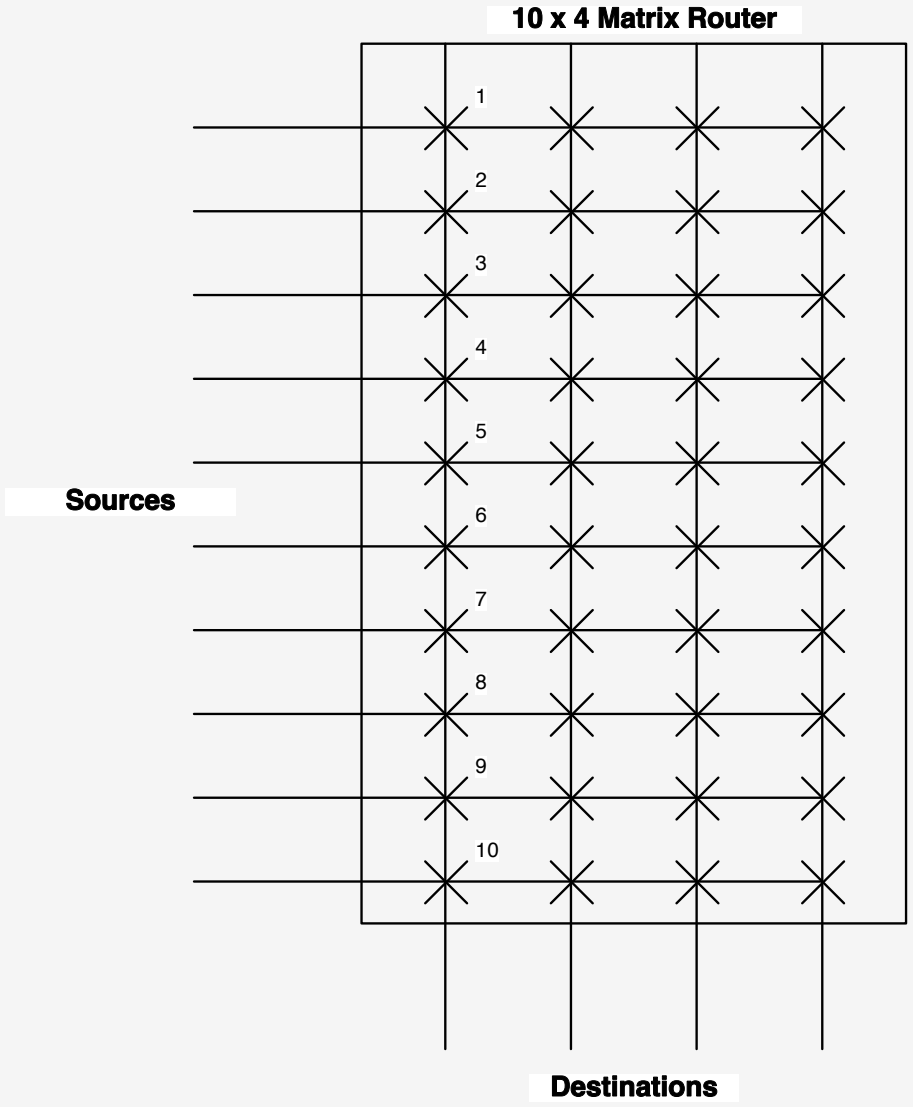
Video Signal Formats & Connectors



Critical Video Connection Rules

- Video signal lines must terminate in 75-ohms at the final connection point!
- You cannot passively “split” or “combine” video signals!
- You can passively “loop” signals between devices, but must terminate at the end!

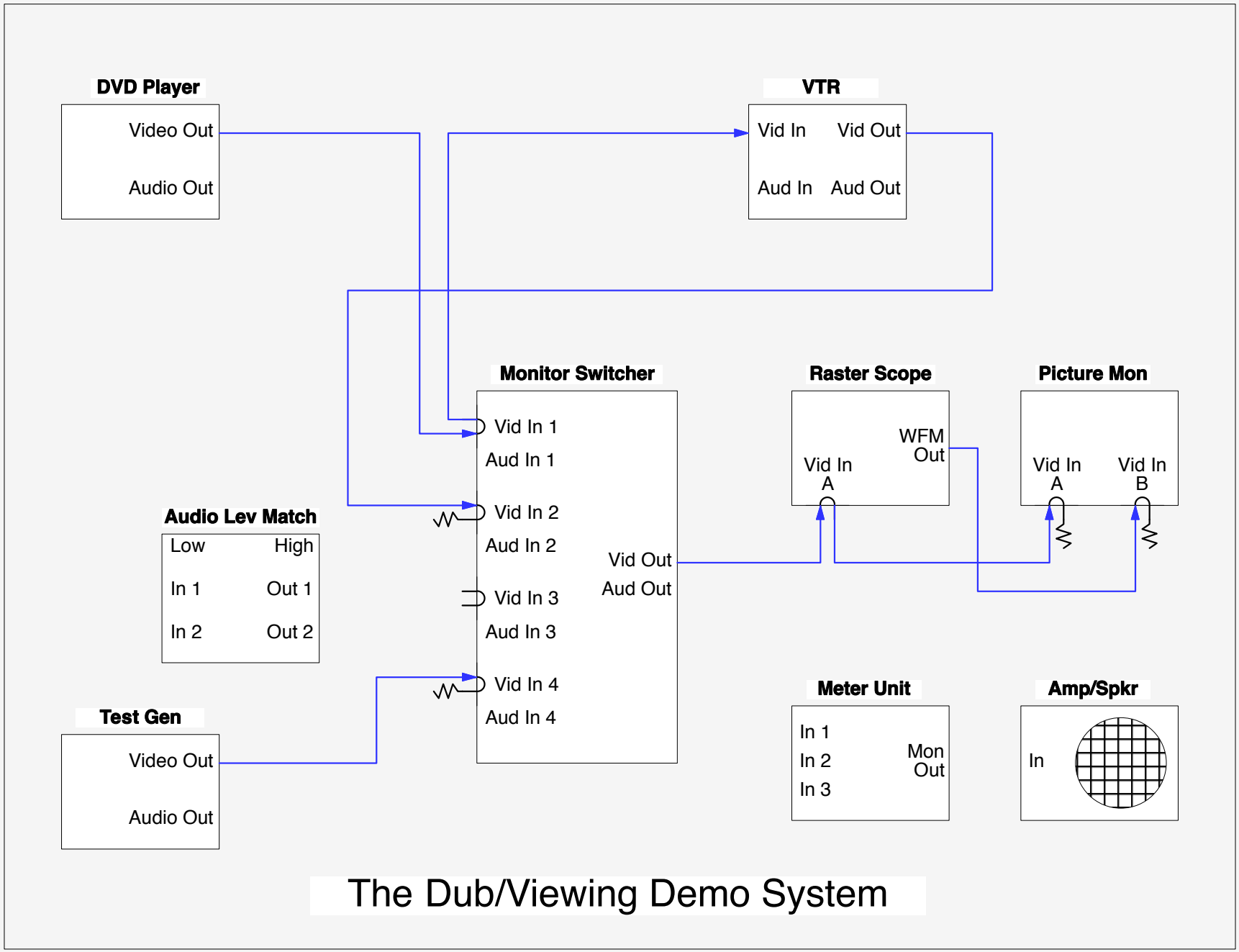




Video (Audio) Routing Switchers

Signal Flow Strategies

- Maintain Signal Quality
- Accurate Monitoring
  - What is the signal really like?
  - How will it look/sound elsewhere?
- Flexibility


DVD Player
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Aud In 4
Vid Out
Aud Out
Raster Scope
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Amp/Spkr
In
The Dub/Viewing Demo System

The Monitor as a Reference

- Apply a known good signal
- Adjust the monitor
- Leave it alone!

Today's Display Situation

- CRTs no longer being made
- Standards were based on CRT performance
- Fixed-pixel displays often worse for viewing standard-def due to scaling artifacts
- Unpredictable color-rendering, pixel depth between various displays

Typical Monitor Controls

Typical Monitor Rear View

Why Bars & Tone Matter!

How does anyone know what
the Content is supposed to look like?

And furthermore…

How does anyone know what
ANYTHING is supposed to look like?

Why Bars & Tone Matter!

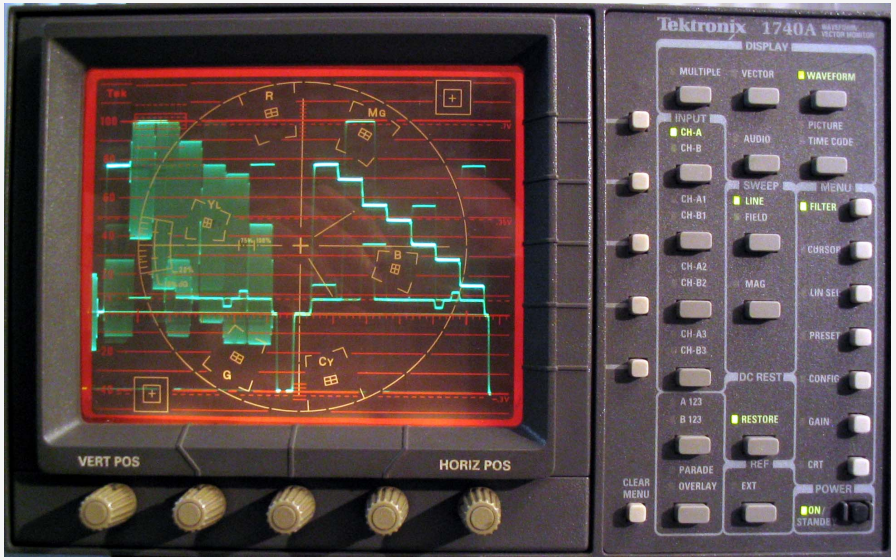
- We know what colorbars are supposed to look like (they have been defined by Standards).
- Establish a known reference for Content (which includes the conditions at the time)
- Use for setting up tape playback to produce the desired result
- Useful for verifying proper operation of equipment and systems

Where to get test signals?

- Facility test generator
- Non-linear editor
- Many newer VTRs
- Professional cameras

How do we know if the TEST SIGNAL is good?

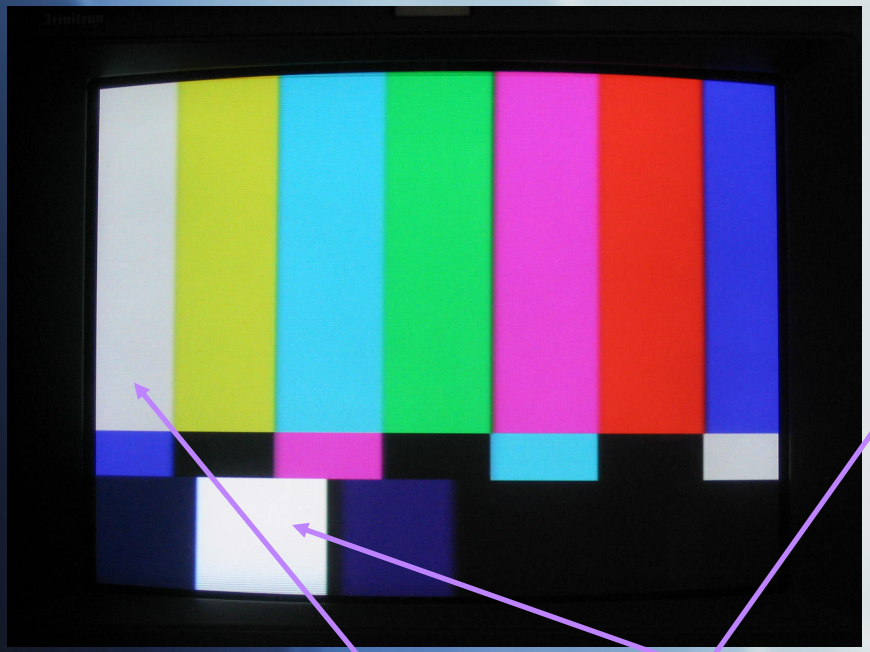
Waveform Monitor/Vectorscope
Conventional & Rasterizing

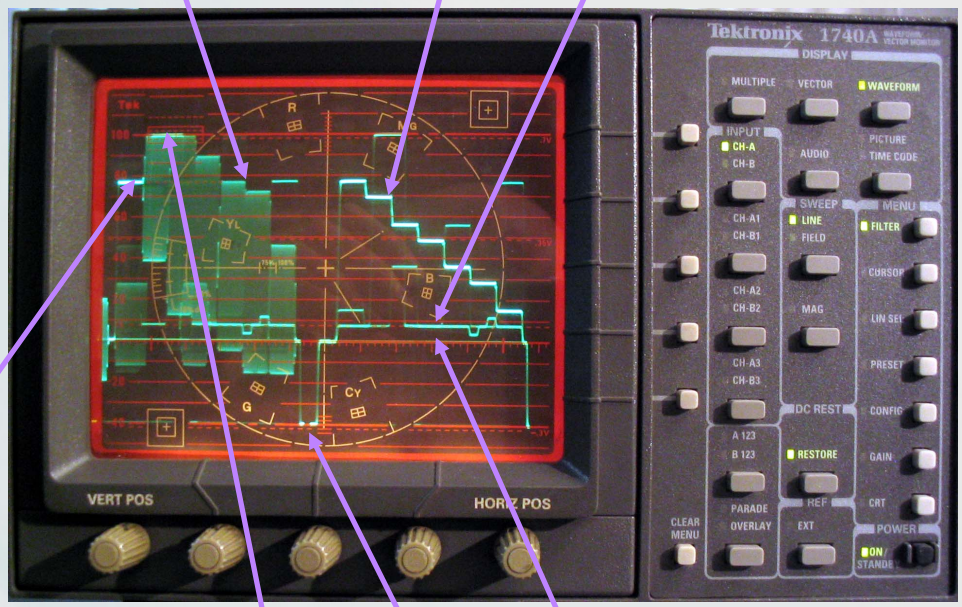


Waveform Monitor & Vectorscope

- Measure luminance and chrominance levels
- Find appropriate black or white levels, appropriate saturation, hue (composite)
- Display color-balance information (for color-correction)
- Find flaws in video, track down system problems

Waveform Monitor





Bar luminance steps

Chroma packets

Black level (7.5)

Baseline (0 ire)

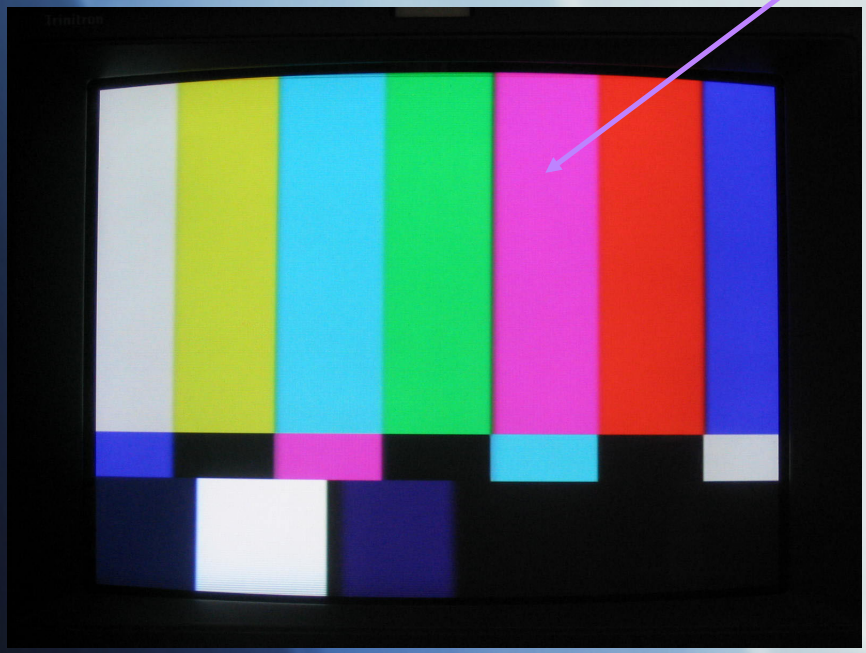
H-sync pulse

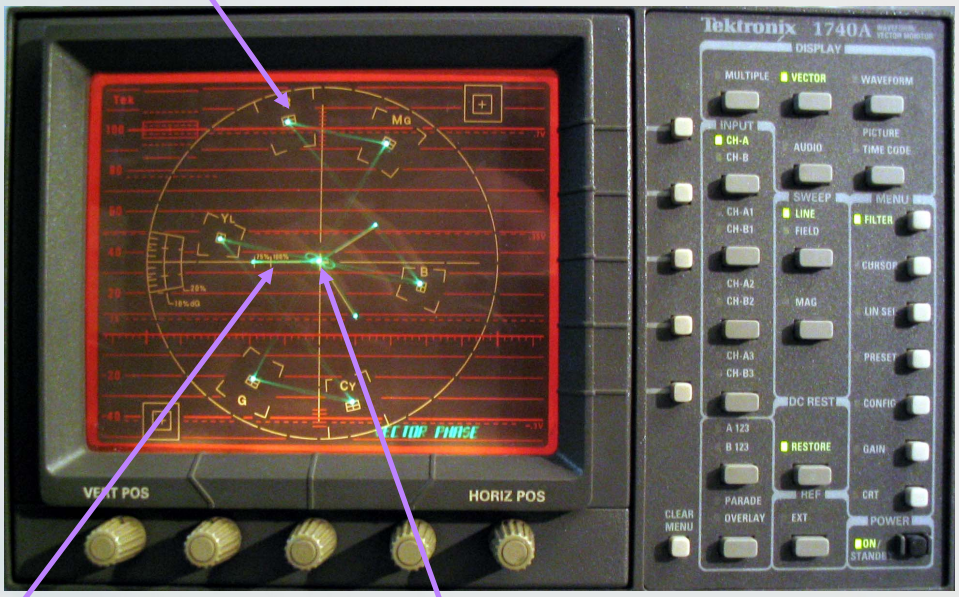
Gray Bar

Peak white patch

Vectorscope

Colorbar Vectors





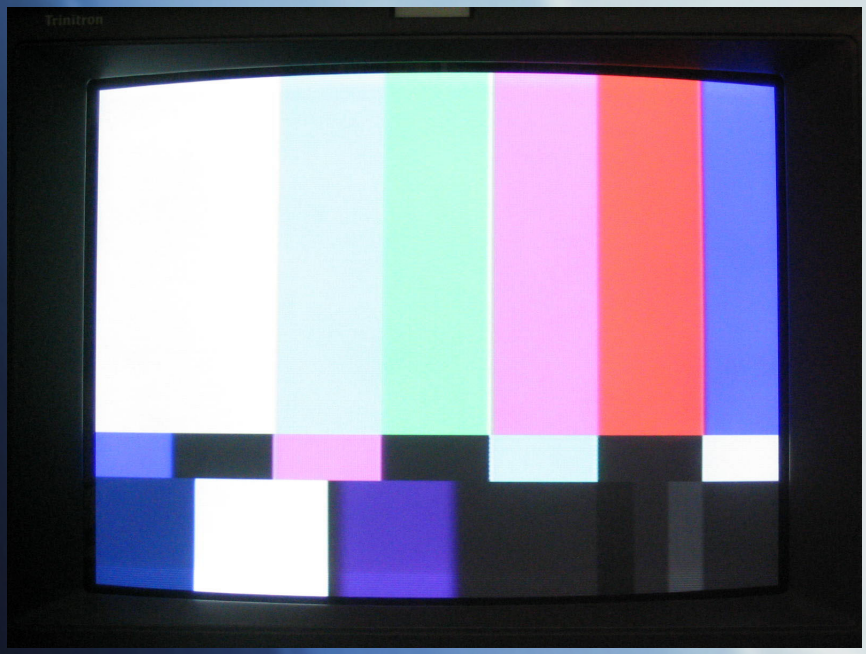
Colorburst Vector

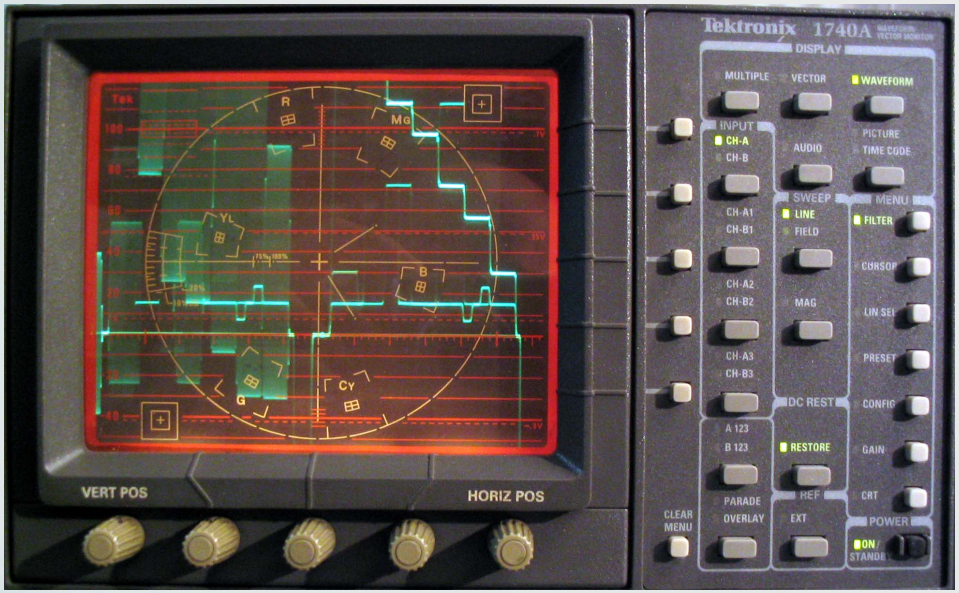
No chroma
at center

Some Common Video System Problems

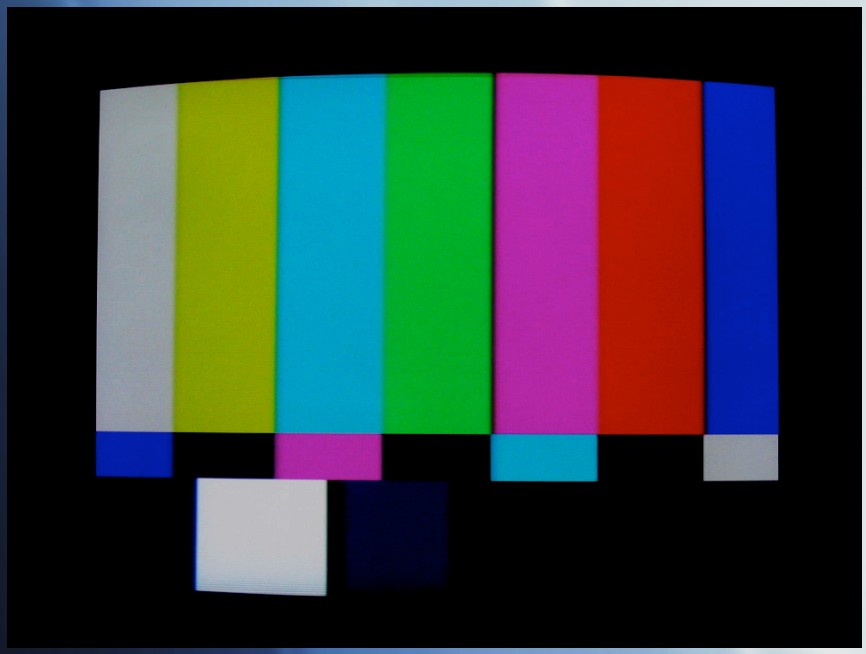
- No termination or double-termination (watch those switches and terminators)
- Two signals feeding same input (improperly using passive loop-thrus)
- Component cable mixup (Y, R-Y, B-Y)
- Component mode error (YRB vs. RGB)

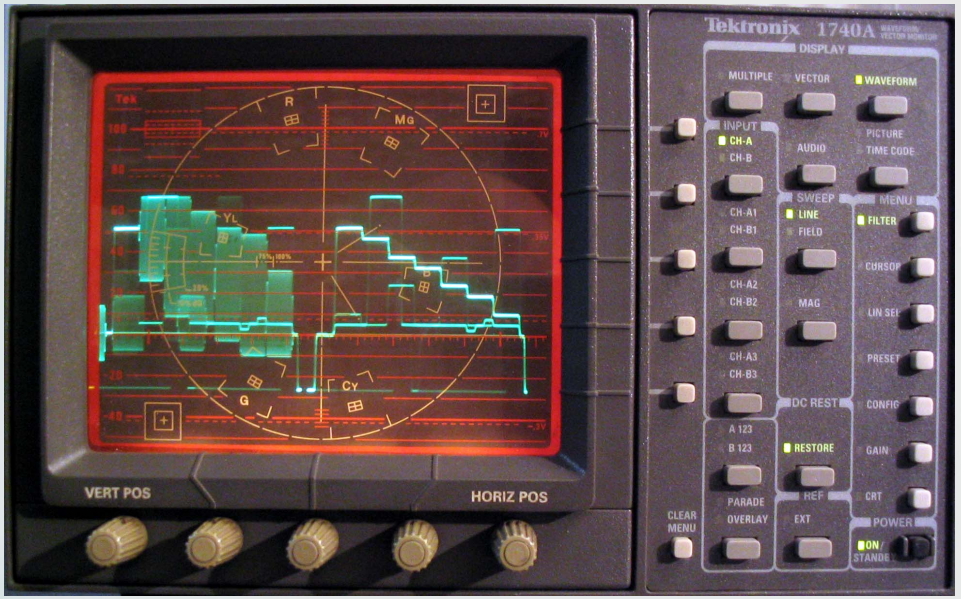
Video Unterminated



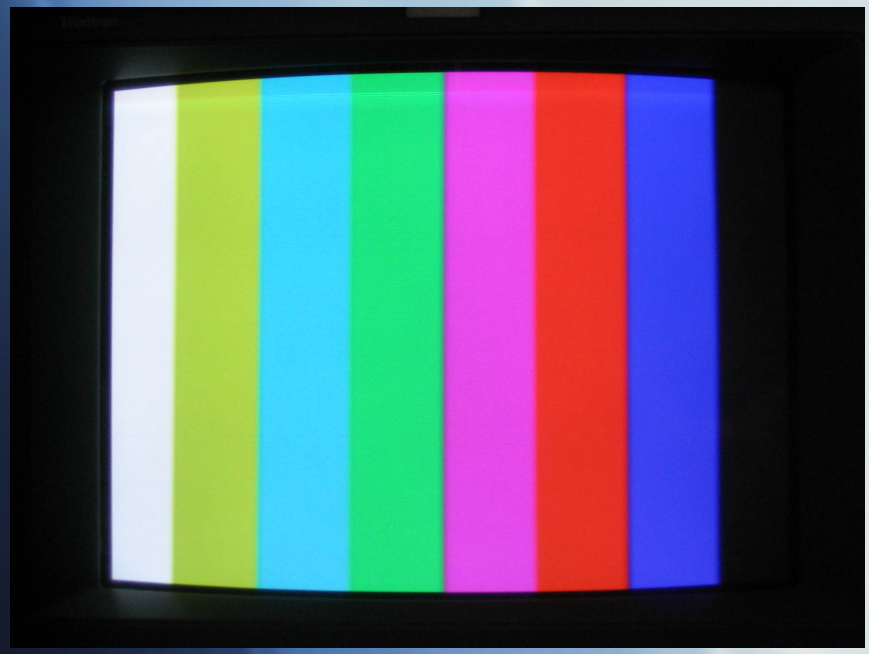


Video Double-terminated

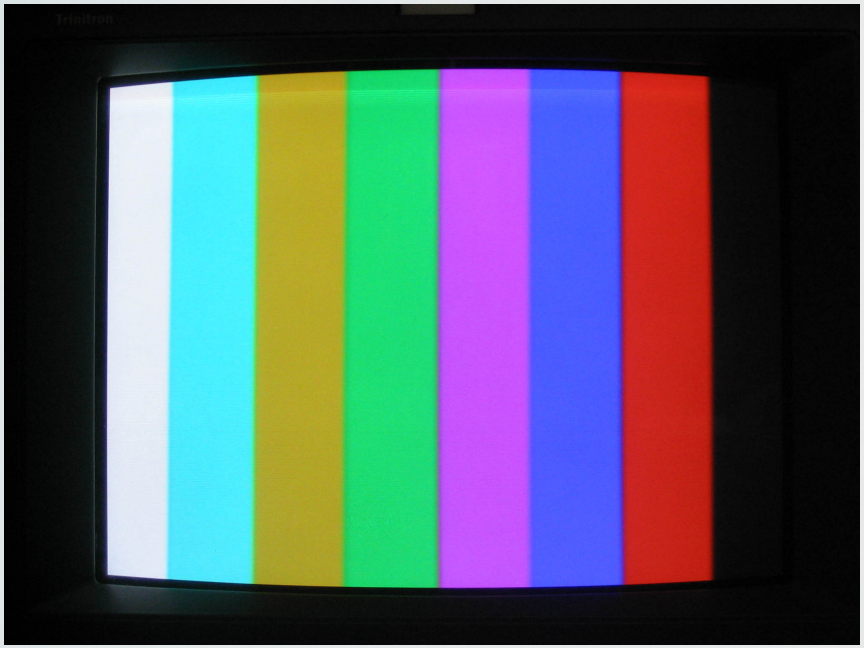




Component Cable Mixup



Correct



R-Y & B-Y Swapped

A/V Tech Basics for Archivists

BREAK 1

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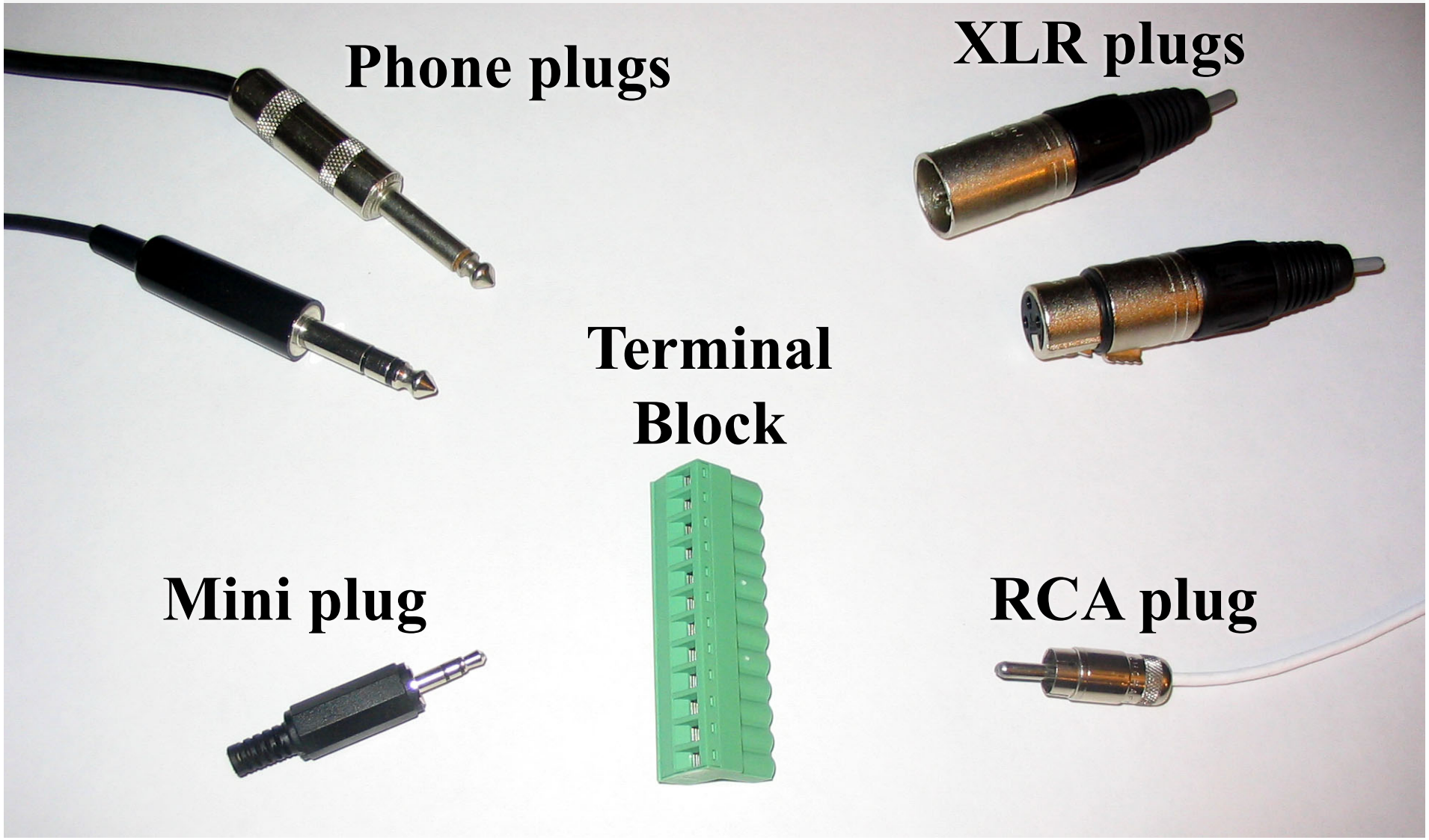
Audio Operating Level

- There are roughly three categories of audio operating level: Mic, Line and Speaker.
- “Line” has a wide range of levels in use between equipment.
- Professional equipment line levels are typically 10-20 dB higher than consumer or “prosumer”.
- Pro level is often referred to as “+4”
  Consumer level is often known as “-10”
- It is not wise to connect these devices together without proper interfacing to compensate!

Balanced and Unbalanced Connections

- This has nothing to do with “tonal balance.”
- Balanced audio connections cancel out noise picked up on the cable.
- Balanced typically uses two signal wires and a shield, connectors have three terminals.
- Balanced is usually also “pro” (+4) level.
- You can connect balanced and unbalanced together but it requires knowledge!

Common Audio Connectors



Issues with Audio Connectors

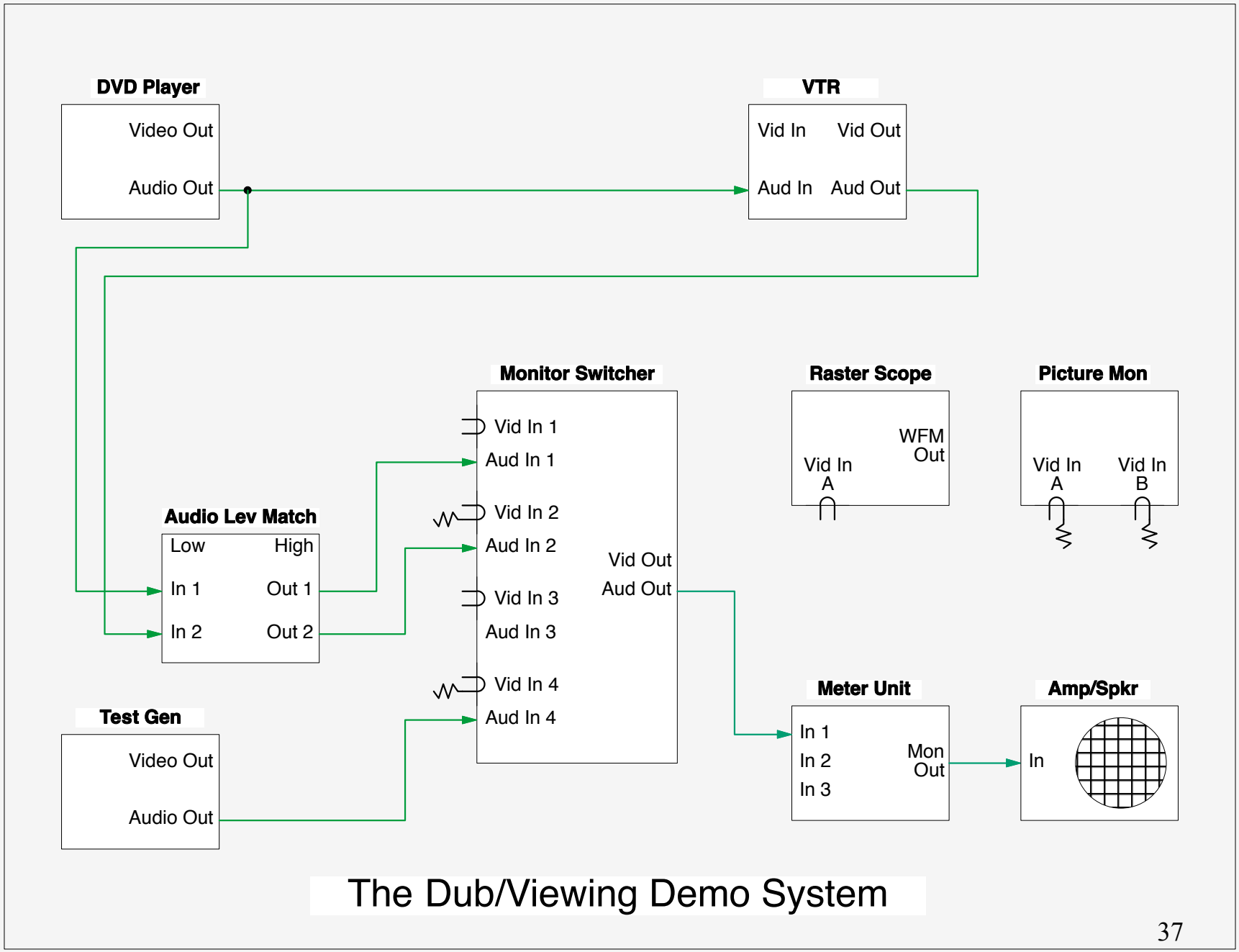
- The same types of connectors are often used for different types of signals
  (eg: XLRs for both mic and line level).
- Some connectors look similar but aren't
  (eg: 2- and 3-conductor phone plugs).
- Preponderance of unbalanced "consumer" connectors (RCA phono plug) on gear.

Simple Chart of Audio Connectors and Signal Levels

Connector Type	Description	Typical Uses	Operating Levels	Typically Found
XLR (aka Canon) 	3 pins plus shell	Balanced Audio	Mic level	Mics, mixers, preamps
			Line Level (+4)	Pro audio gear Interfaces Pro video gear
Note: Usually signal flow follows direction of pins. *Note: In most audio applications Pin 1 is ground/shield. Generally do not connect Pin 1 to shell!*				
TRS Phone Plug (aka 1/4" Stereo Plug) 	Tip/Ring/Sleeve	Balanced Audio	Line Level (+4)	Mixers Pro audio gear
		Headphone	Line / speaker Level	Headphones
TS Phone Plug (aka 1/4" Mono Plug) 	Tip/Sleeve	Unbalanced Audio	Line Level (+4 / -10)	Semi-pro audio gear
		Musical Instruments	Varies	Musical instruments
		Speakers	Speaker Level	PA speakers
Mini Plug (aka mini phone, 1/8" Plug) 	Tip/Ring/Sleeve (or T/S)	Bal or Unbal Audio	Line Level (-10)	Computer audio Audio players Misc. device ins/outs
		Headphone / earpiece	Line / speaker Level	Audio players, earbuds
RCA (aka Phono) 	Center Pin w/ metal surround	Unbalanced Audio	Line Level (-10)	Semi-pro audio gear Computer interfaces Consumer gear
TRS Patch Plug (aka 1/4" or Longframe telephone patch)	Tip/Ring/Sleeve	Balanced Audio	Line Level (+4)	Pro (broadcast) patchbays
Note: Although similar, Patch plugs and jacks do not mate well with Phone plugs and jacks.				
Bantam Patch Plug (aka Tiny Telephone or TT)	Tip/Ring/Sleeve	Balanced Audio	Line Level (+4)	Pro (broadcast) patchbays
Terminal Block  (aka terminal strip, screw terminals, screw contacts, Phoenix block…)	Screws or screw-down slots	Any	Any	Distribution amps Converters Device ins/outs Misc.

NOTE: Some connectors above, particularly XLR, mini plug and terminal blocks, may be used for non-audio applications (such as control or power).

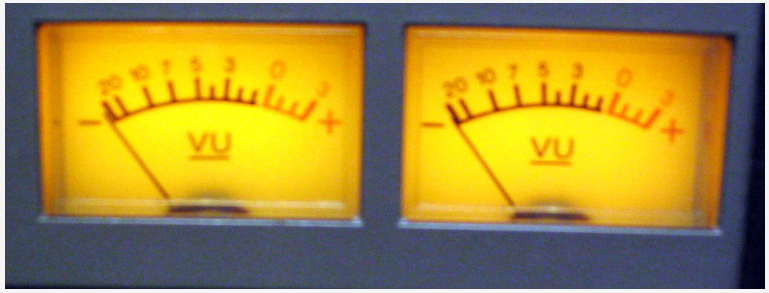
Broadcast-style Audio Patch Panel



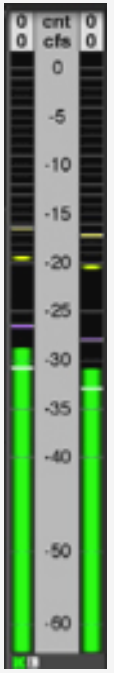
The Dub/Viewing Demo System

Uh oh…

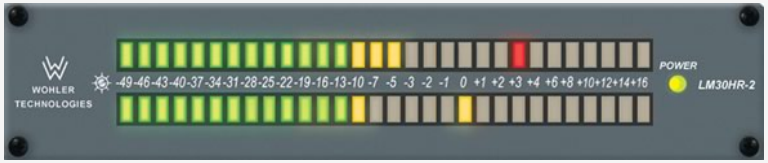

VU
VU


VU
VU


VU
VU


cnt
cfs
0
-5
-10
-15
-20
-25
-30
-35
-40
-50
-60


VIDEO
AUDIO
CTL
0:00:00:00
CH 1
CH 2
CH 3
CH 4
REC PB
UNITY
INPUT SELECT
VIDEO
AUDIO
COUNTER


WOHLER
TECHNOLOGIES
-49-46-43-40-37-34-31-28-25-22-19-16-13-10 -7 -5 -3 -2 -1 0 +1 +2 +3 +4 +6 +8 +10+12+14+16
POWER
LM30HR-2

Audio Metering

Why does the same audio

look different

on

different meters?

Audio Metering

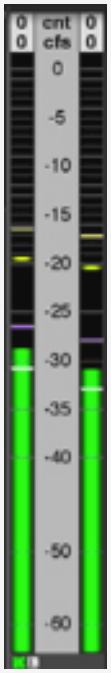
- Mechanical analog or electronic bargraph?
- Where is “0”? Different for analog and digital applications.
- How large is the scale range? Meters vary from 23dB to 60 or 80dB scales.
- How quickly does the meter respond to changes in audio? Ballistics can be average, peak, PPM, etc.

Audio Metering Analog

- Analog audio will distort when level is too high, but the effect is usually gradual.
- Analog meters were designed to show average levels around 0VU.
- There is usually 10-20 dB headroom left above 0VU before distortion.
- Tone should be at 0VU.

Audio Metering Digital

- Digital audio has an absolute upper limit which is called Full Scale.
- Meters for digital equipment read in terms of dBFS (decibels relative to Full Scale)
- Maximum possible level is at 0 dBFS.
- Tone is usually at about -20 dBFS so there is 20dB of headroom before overload.



Typical Audio Flaws

- Clipping and other distortion
- Excessive noise beneath audio
- Tonal imbalance
- Channel phase reversal
- Audio/video lip-sync errors

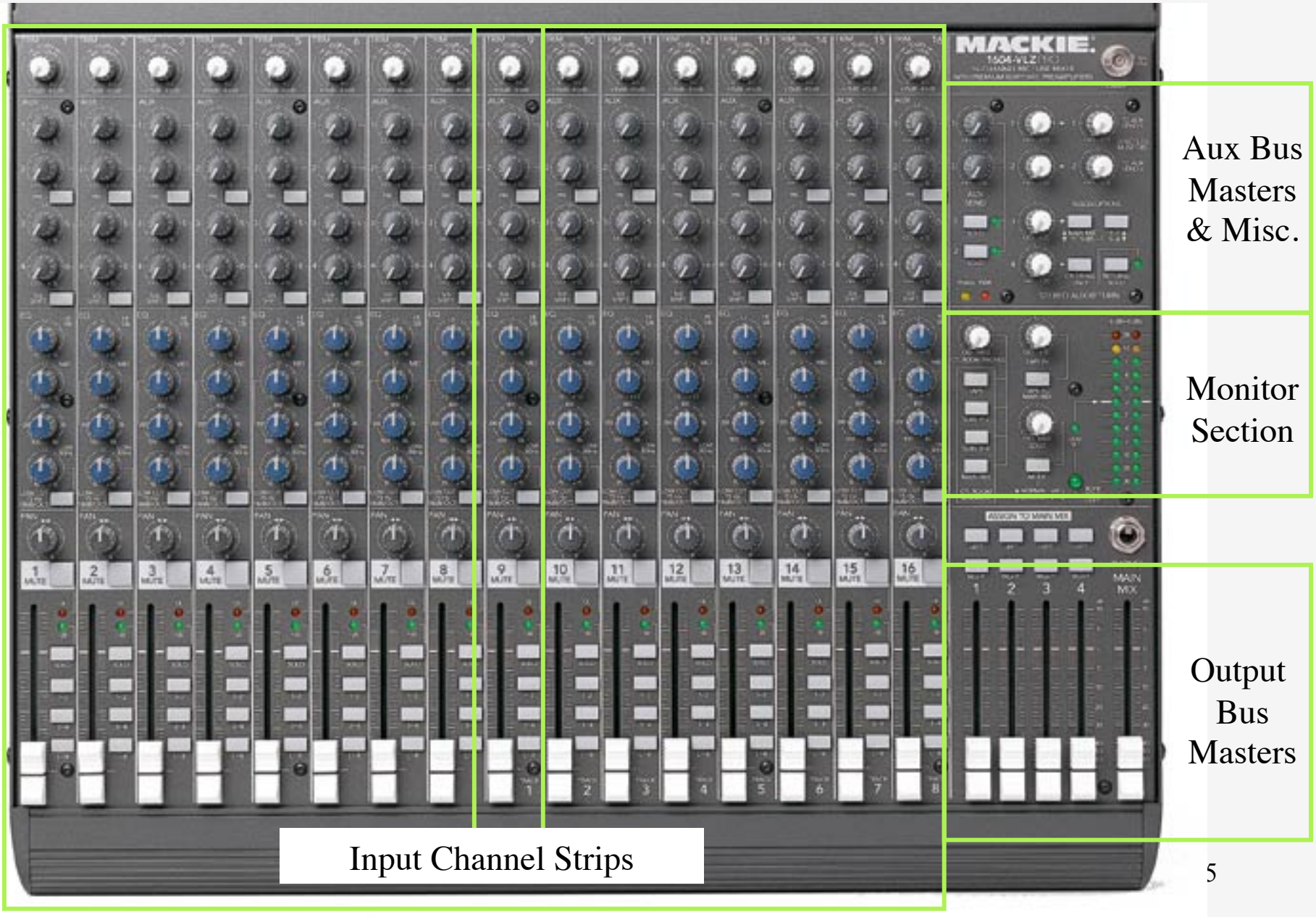
Basic Mixer Sections

- Input Channels
  Process signals entering mixer
  (input jacks, mic preamp, equalizer, channel fader)

- Buses & Outputs
  Combine signals together and send out
  (bus assign, bus master level, output jacks)

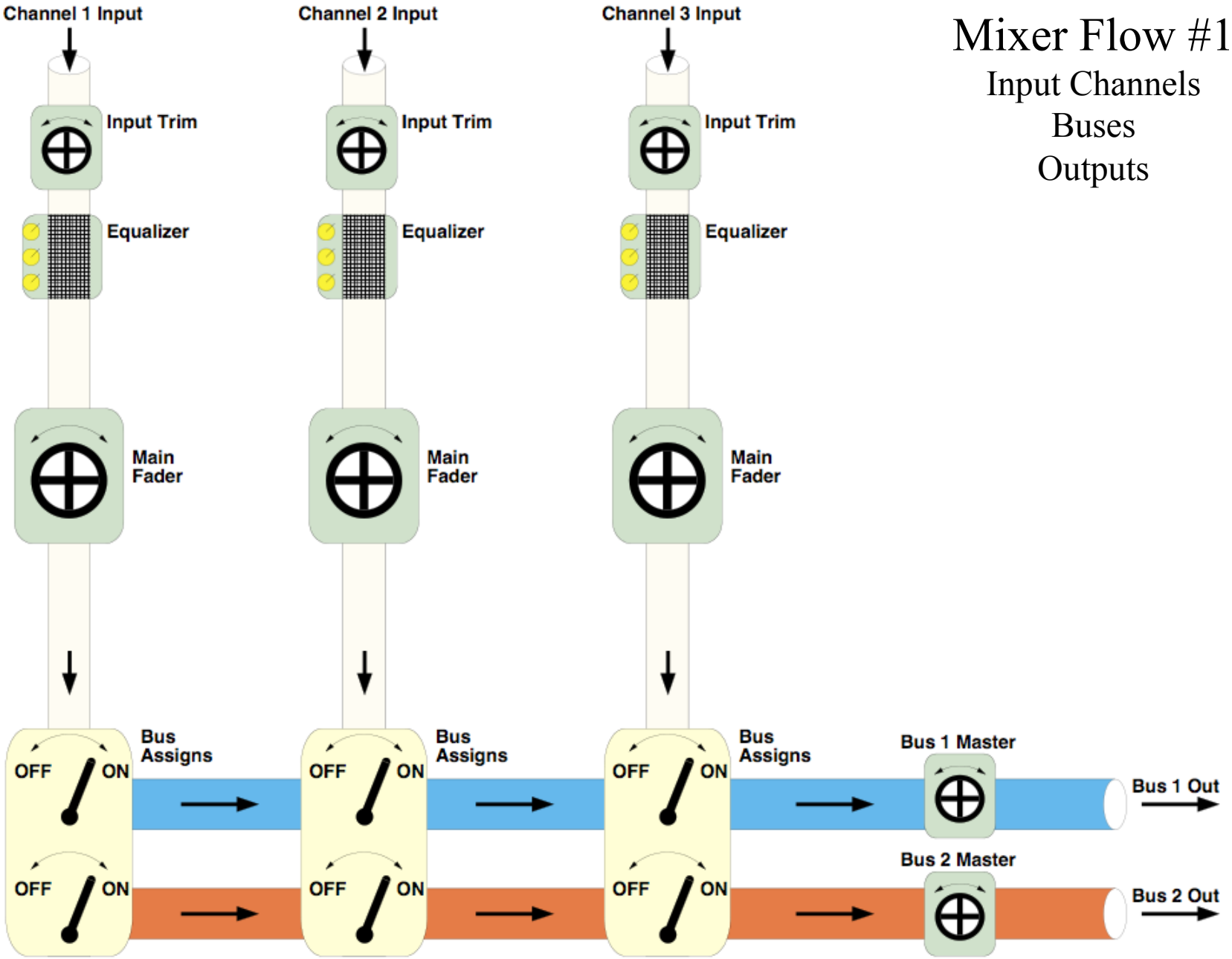
- Monitoring
  Controls speaker volume and what is heard
  (mon source select, speaker select, speaker volume)

Basic Mixer Sections



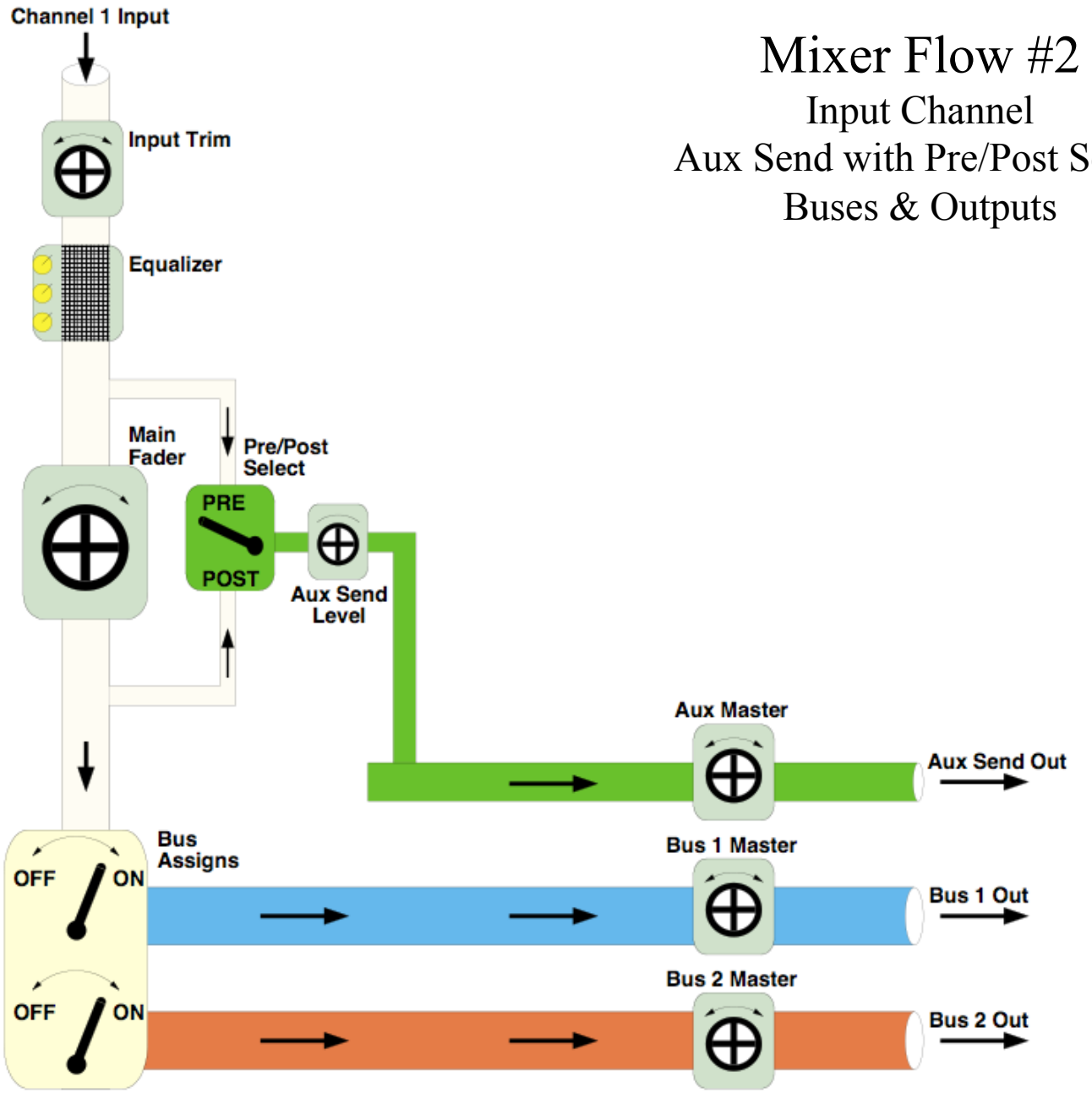
Mixer Flow #1

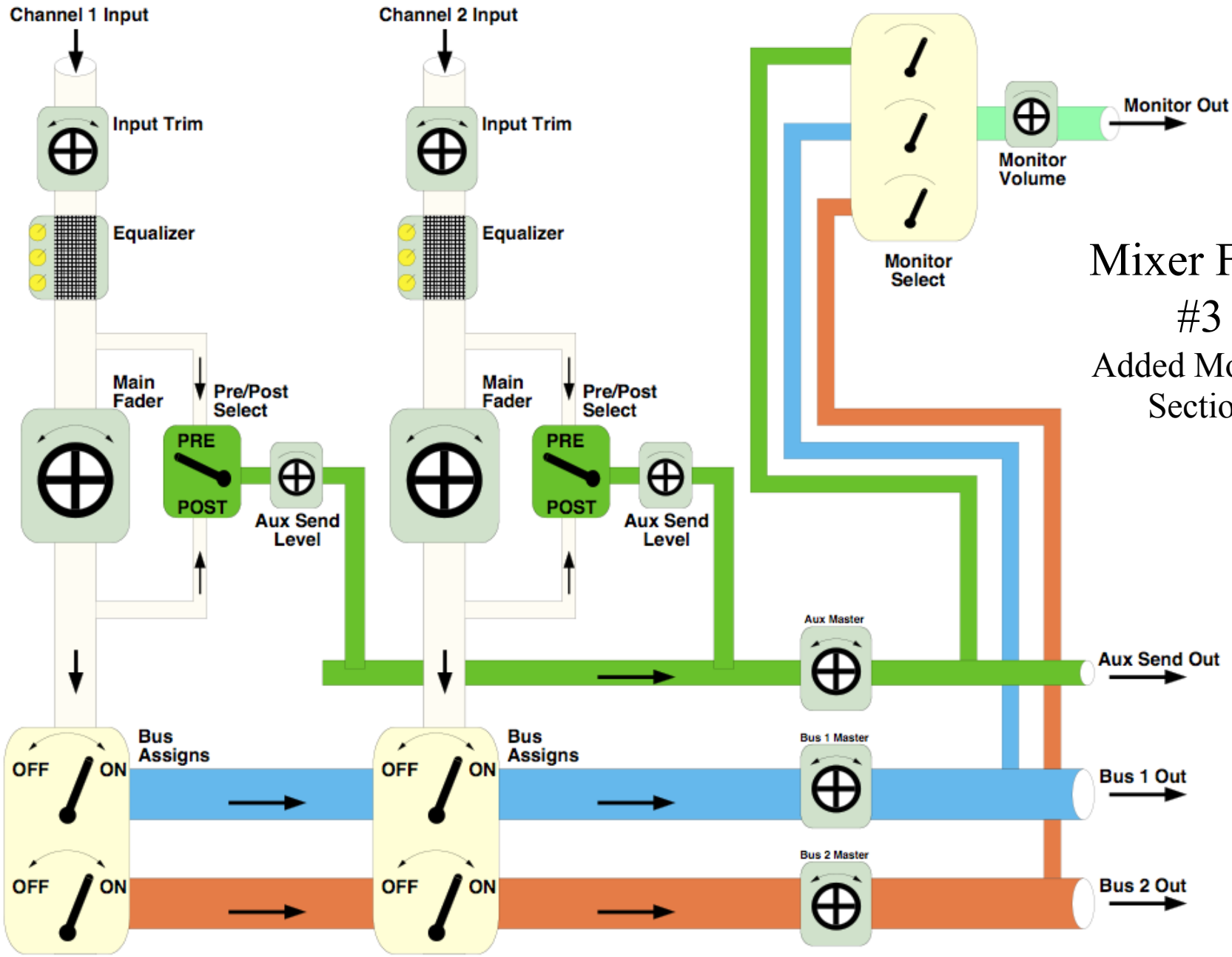
Input Channels
Buses
Outputs



Mixer Flow #2

Input Channel
Aux Send with Pre/Post Select
Buses & Outputs

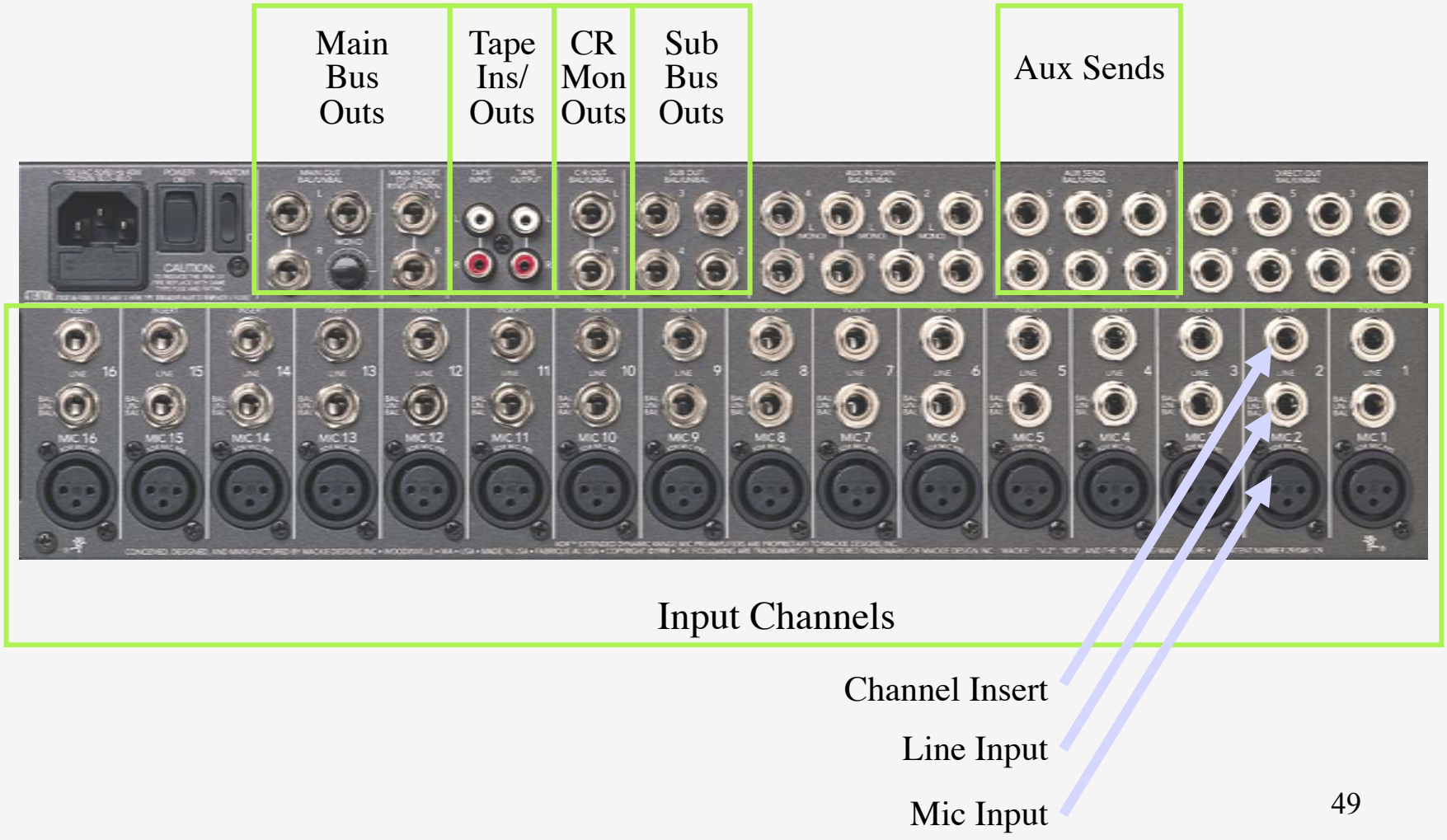




Mixer Flow #3

Added Monitor Section

Typical Mixer Connections



A Word about Phantom Power

- 48 volts DC used to power condenser microphones
- This voltage can damage other equipment.
- Unless you are using a condensor mic LEAVE IT OFF!

A/V Tech Basics for Archivists

BREAK 2

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Videotape Formats

Legacy Analog:

- VHS, S-VHS, Hi-8
- 3/4” (U-matic), 1”
- Betacam, Beta SP

Videotape Formats

Legacy Digital:

- D-1 (component)
- D-2, D-3 (composite)

Videotape Formats

Digital Betacam Family:

- Digi Beta
- Betacam SX
- Betacam IMX

Videotape Formats

Other Digital:

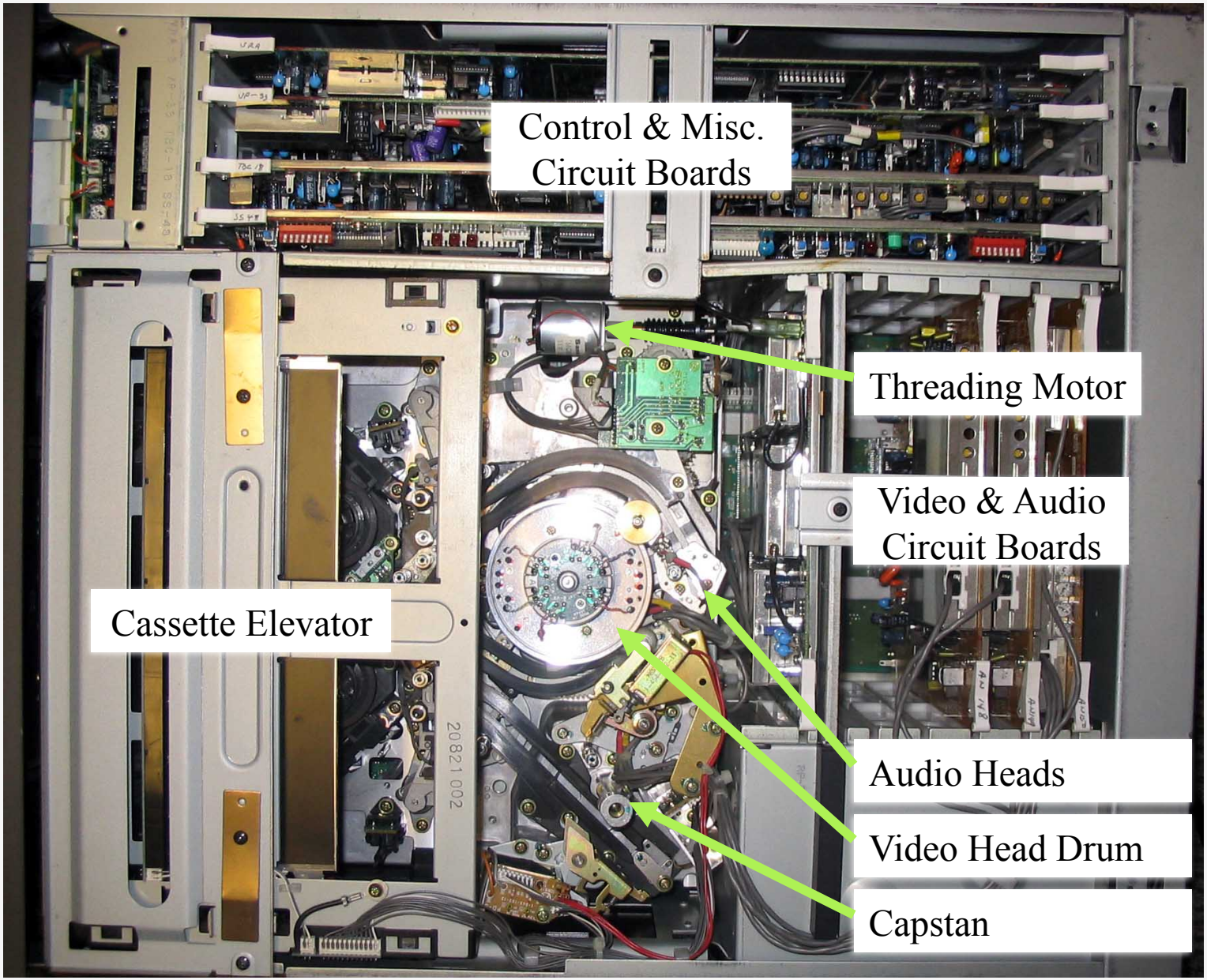
- D-5 (Panasonic)
- HDCam (Sony)
- D-9 (Digital-S)

Videotape Formats

DV-based:

- DV, mini-DV
- DVCam
- DVCPro 25/50/100
- HDV

PVW-2800 Internal View



VTR Systems

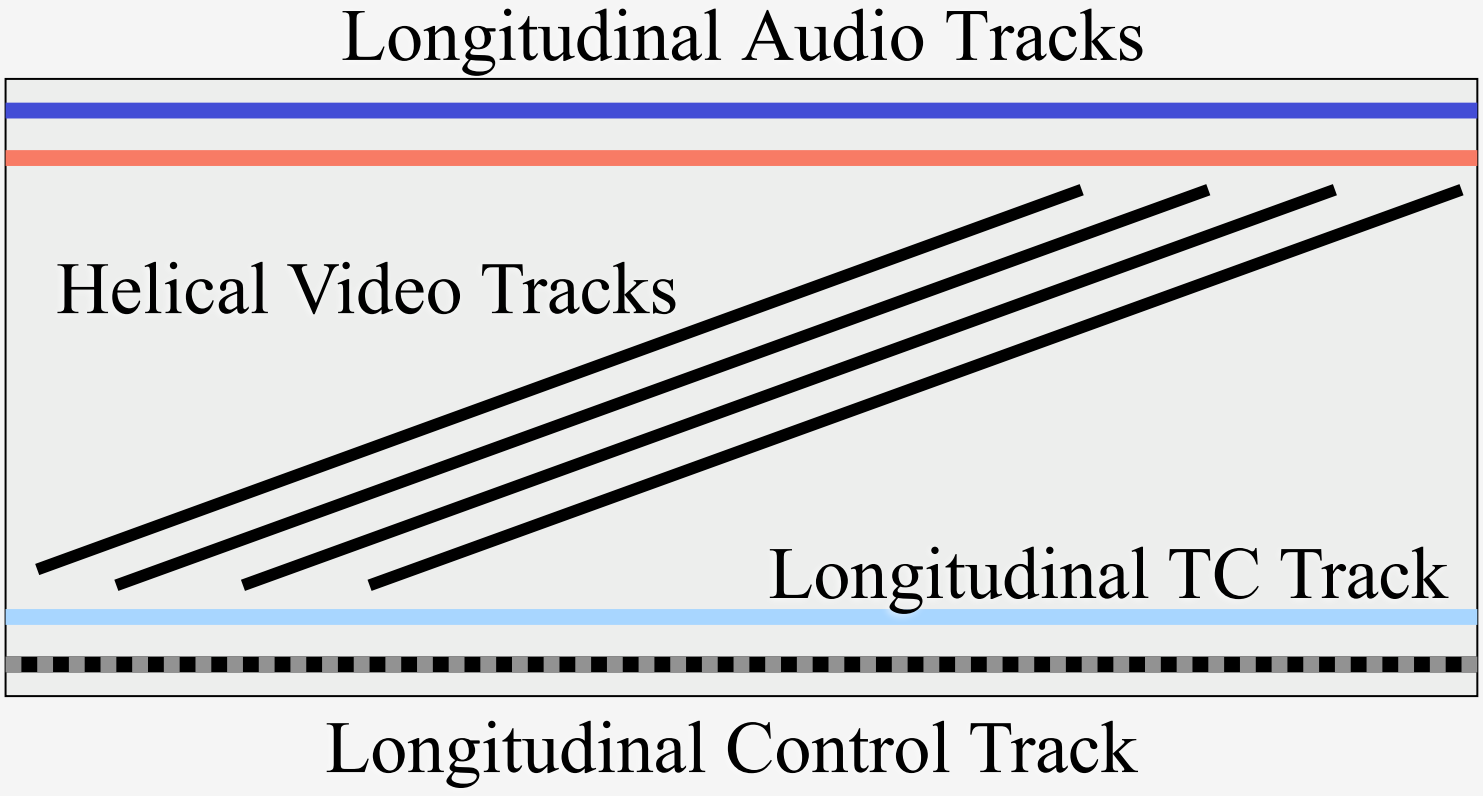
- Video processing
- Audio processing
- Capstan servo -- controls tape movement
- Drum servo -- controls head drum

VTR Servos

- Lock to Reference input during playback
- Lock to Record input during recording
- Internal TBC (timebase corrector) may lock differently than servo system

VTR Tape Tracks

Similar for analog or digital formats



VTR Recording Modes

- E/E (electronics-to-electronics) -- passes input signals through to output
- Hard (crash) Record -- erases and records all tracks at once, no sync with previous recording
- Assemble Record -- erases and records all tracks, but picks up in sync with previous recording
- Insert Record -- only erases and records selected tracks (control track must be present!)

VTR Front Panel

Timecode Controls may be various places!

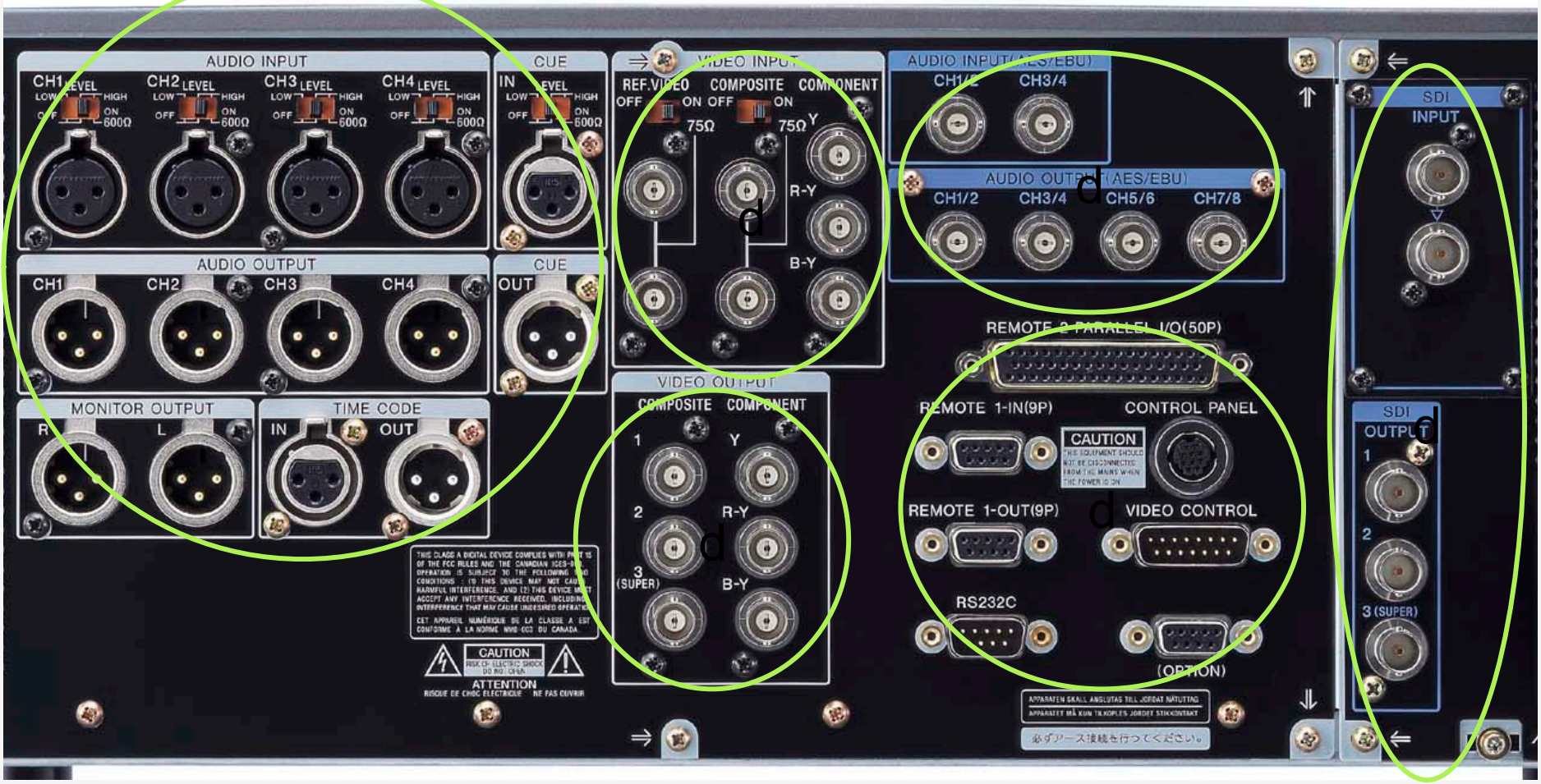
VTR Rear Panel Connectors

Analog Audio I/O

Analog Video Inputs

Digital Audio I/O

Digital Video I/O



Analog Video Ouputs

Remote Control And Misc.

Menus & Special Switches

If your VTR has any of the following switches on the back…

- Ref Auto/Manual: Set to AUTO
- Audio input 600-ohm terminations: Set to OFF
- Audio input level: Set to HIGH

Menus & Special Switches

When in doubt
use the Factory Default settings!

A few words about Reference, Genlock and Timing

- Reference signals are used to make equipment produce output signals in sync with each other.
- Reference is about playback, not recording; the recording device always locks to its input signal.
- To “genlock” means locking a device to a reference signal.
- “Timing” is about the relationship between two devices that both feed a third device (such as cameras feeding a switcher).
- There is NO “timing” in a dub/viewing or NLE system!
- Having devices locked to a common reference when possible is recommended, but not critical in most cases.

Simple Troubleshooting

Use good observation techniques:

- Note all conditions during problem
- Note conditions leading up to problem
- When was the last good operation? Has anything changed?
- Be clear about meaning of words!

Troubleshooting Strategies

- It pays to know how things are SUPPOSED to work.
- Start with known good signals (bars and tone), good path and monitoring.
- Change one thing and observe…
- Swap things: cables, equipment, software
- Cut problem in half

Troubleshooting Strategies

Manuals are like GOLD!

(especially for legacy gear)

Please send me feedback on this workshop!

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