AV
Like
Paint by Numbers

Presented By: Eric J. Marshall
AV Like Paint by Numbers

1 = Blue  2 = Red  3 = Green  4 = Orange

Presented By: Eric J. Marshall
When I started in the industry, my boss drew me a picture of what WE DID.
I Upgraded the Drawing
1. Address Cable
2. Address Pathway
3. Address the Stations
4. Address the Head End
What Do We Do TODAY?
Audio Video

1. Input Sources
2. Output for Sharing
3. Distribution
4. Process
Can we do AV?
I was hired to start doing AV at a structured cabling company.

Do you know how to install cable?

Do you know how to mount things on walls and ceilings?
Let me pull your cable!
We are both going to the same place!

TDMM:
Save 30-40%

Sold 2.4 million
In 2 months!
4 Steps of AV

Input Sources → Process → Distribute → Share

SEE IT
HEAR IT
RECORD IT
STREAM IT
5th Step of AV

Control

Input Sources

Process

Distribute

Share

SEE IT

HEAR IT

RECORD IT

STREAM IT
Step 1 – Input Sources
What are input sources?

Anything that generates Audio or Video
Audio Source Examples

- CD Player / Recorder
- SACD and DVD-A
- MP3 Player
- Streaming Internet / Audio Server
- AM/FM Tuner
- Satellite Radio

- Cassette Tape Player / Recorder
- Phonograph / Record Player / Turntable
- Microphone
- Instrument
- Background Music
Video Source Examples

- BluRay Player / Recorder
- TV Tuner or TV antenna
- Cable TV / Satellite TV
- VCR
- PVR / Video Server
- I-Pod Video
- Camcorder
- Computer / Internet

- Video CDs
- Document Camera
- Game Console
You don’t have to worry about all the sources
Devices have connectors

CONNECTORS

CONNECT

THE REAL CONNECTION IS THE SIGNAL

CONNECTORS

CONNECT

BUT

HDMI

DVI

VGA
Devices have connectors

THE REAL CONNECTION IS THE SIGNAL
Devices have connectors

CONNECTORS
CONNECT

THE REAL CONNECTION IS THE SIGNAL

CONNECTORS
CONNECT

BUT

HDMI
DVI
VGA
High Resolution
• RGBHV = 5 Wire
• RGBS = 4 Wire
• RGsB/RsGsBs = 3 Wire

Can be either
• Component = 3 Wire

Low Resolution
• S-video (Y/C) = 2 Wire
• Composite = 1 Wire
• Radio Frequency (RF)
BNC Connector

• Used with coaxial cable.
• It is a round metal connector that is pressed and twisted to lock into place.
• BNC stands for “Bayonet Neill Concelman” (the names of the two developers – Paul Neill and Carl Concelman).
• Used for professional AV applications.
DB / HD Connectors

- Common connector for computers.
- If it has 2 rows of pins it is called a “D-sub” or “DB” connector.
- If it has 3 rows of pins it is called an “HD” connector.
- The connector type is usually followed by a number telling the number of pins it can hold.
  - (ex. DB9, DB25)

HD15 is what is used by most computers!
Audio plug

- Plugs are used for many audio applications
- Typical sizes are 3.5mm, 2.5mm, ¼”, and 3/16”
- **3.5mm** is what is used on most computers and portable audio devices!
Audio Connectors

Female XLR Connector

Male XLR Connector

RCA Plug

1/4” Plug TRS (Tip Ring Sleeve)

1/8” 3.5mm mini-plug TRS

Speakon for Speakers

Euroblock, Captive Screw or Phoenix Connector

Toslink

Banana Plugs

Spade Lugs

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E.R.I.C.
Low Voltage Services
What Does Digital Add to Signal?
What Does Digital Add to Signal?

**EDID**
(Extended Display Identification Data)
- Hot Sync
- AV properties
- HDCP
What Does Digital Add to Signal?

HDCP™
HIGH-BANDWIDTH DIGITAL CONTENT PROTECTION

Prevent Non-licensed devices from receiving content
Block eavesdropping – “Man in the Middle” attacks
What Does Digital Add to Signal?
Different HDMI Examples
Different Display Port Examples

Display Port

Display Port Mini
Display Port / HDMI Comparison

<table>
<thead>
<tr>
<th></th>
<th>DVI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display Port vs. HDMI</td>
<td>Display Port vs. HDMI</td>
</tr>
<tr>
<td>Display Port</td>
<td>HDMI</td>
</tr>
</tbody>
</table>

Jan 09
DVI Connector

- LFH (low force helix) connector
- DVI-D = 24 pins and a single larger, offset ground bar; carry a digital signal ONLY.
- DVI-I = have 4 extra pins that surround the offset ground bar; carry both digital and analog signals.

- Used for Digital and High Definition Video
Different USB Examples

<table>
<thead>
<tr>
<th>Connector Type</th>
<th>USB 2.0 Image</th>
<th>USB 3.0 Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>B</td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
<tr>
<td>Micro-B</td>
<td><img src="image5.png" alt="Image" /></td>
<td><img src="image6.png" alt="Image" /></td>
</tr>
<tr>
<td>Mini-B 5 Pin</td>
<td><img src="image7.png" alt="Image" /></td>
<td>-</td>
</tr>
<tr>
<td>Mini-B 4 Pin</td>
<td><img src="image8.png" alt="Image" /></td>
<td>-</td>
</tr>
<tr>
<td>C</td>
<td><img src="image9.png" alt="Image" /></td>
<td></td>
</tr>
</tbody>
</table>
Don’t get confused by the connectors!
<table>
<thead>
<tr>
<th>COMPUTERS</th>
<th>VIDEO</th>
<th>AUDIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-sub (DB)</td>
<td>F-type</td>
<td>RCA</td>
</tr>
<tr>
<td>HD</td>
<td>HD</td>
<td>Plugs</td>
</tr>
<tr>
<td>DIN</td>
<td>RCA</td>
<td>DIN</td>
</tr>
<tr>
<td>BNC</td>
<td>BNC</td>
<td>Captive Screw</td>
</tr>
<tr>
<td>DVI</td>
<td>DIN</td>
<td>Binding Post</td>
</tr>
<tr>
<td>HDMI</td>
<td>DVI</td>
<td>XLR</td>
</tr>
<tr>
<td></td>
<td>HDMI</td>
<td>THE REAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CONNECTION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IS THE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SIGNAL</td>
</tr>
</tbody>
</table>

CONNECTORS CONNECT BUT
The Physical Connection

• Consists of two major components:
  • Conductors= pieces of wire that carry signals between devices. $$$$$$
  • Connectors= mechanical junctions between the conductors and pieces of equipment.

• To properly understand how to connect devices to the AV system you need to understand CONNECTORS and SIGNALS.
What’s the difference on the connector?

- The Pin Out – the way the conductors are placed in the connectors on each end. The pin out is the “Road Map” for the signal!
What’s the difference on the connector?
What are the Pin-outs?

- Computer = HD 15
- S-video = 4 pin din
- Consumer Audio plug = 3.5mm
- Instrument/Professional Audio plug = ¼”
- RCA Color codes
  - Yellow, Green & Blue & Red = video
  - White, Red, Black, Orange = audio
- What version digital cable?
Male vs Female Connectors
What else makes the difference?

- Cables are a channel for the signal – WHAT GOES IN COMES OUT!!!!!!
- Cables/Adapters can not change the signal – electronics or special circuitry within a cable can.
- Examples:
  - DVI signal from a computer is different from DVI signal from a TV.
  - VGA (computer) and component video are different signals.
Gender Changers & Adapters

Make sure signal is same!
Make sure pin out is same!

Use one at other end?
Useful for coupling
Gender Changers & Adapters

Make sure signal is same!
AES/EBU vs. S/PDIF

CONNECTORS CONNECT

BUT

THE REAL CONNECTION IS THE SIGNAL
What is in the signal?

VIDEO

• Resolution
• Signal Type – RGB, Component…
• Digital Add Ons
What is Resolution?

- Resolution = a measure of a video device’s capability to make small dots and lines on a screen.
- **Horizontal resolution** = number of dots that can fill one line
- **Vertical resolution** = Number of lines.
- NTSC standard = 480 lines
- HDTV = 720 and 1080 lines
- UHD = 2K, 4K, 8K

Example Resolutions
- 640 x 480 VGA
- 800 x 600 SVGA
- 1024 x 768 XGA
- 1600 x 1200 UXGA
- 1920x1080 Full HD

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What is High Definition?

- High Definition is wider and fills more of the eyes viewing area.
- High Definition has more pixels.
- High Definition can be both digital and analog.
What is Resolution?
What is Resolution?
What is with the “i” and “p”?

1/60th of a second field + 1/60th of a second field = 1/30th of a second frame
What is with the "i" and "p"?

1080i 720p
What is Signal Type?

<table>
<thead>
<tr>
<th>Output</th>
<th>Format</th>
<th>Color Bit Depth</th>
<th>HDCC Mode</th>
<th>HDCC Compliance</th>
<th>Video Mute</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Auto</td>
<td>Auto</td>
<td>Auto</td>
<td>No Display</td>
<td>Mute</td>
</tr>
<tr>
<td>2</td>
<td>DVI RGB 444</td>
<td>Auto</td>
<td>Auto</td>
<td>No Display</td>
<td>Mute</td>
</tr>
<tr>
<td>3</td>
<td>HDMI YUV 444 Full</td>
<td>Auto</td>
<td>Auto</td>
<td>No Display</td>
<td>Mute</td>
</tr>
<tr>
<td>4</td>
<td>HDMI YUV 444 Limited</td>
<td>Auto</td>
<td>Auto</td>
<td>No Display</td>
<td>Mute</td>
</tr>
<tr>
<td>5A</td>
<td>HDMI YUV 422 Full</td>
<td>Auto</td>
<td>Auto</td>
<td>No Display</td>
<td>Mute</td>
</tr>
<tr>
<td>5B</td>
<td>HDMI YUV 422 Limited</td>
<td>Auto</td>
<td>Auto</td>
<td>No Display</td>
<td>Mute</td>
</tr>
<tr>
<td>6A</td>
<td>HDMI YUV 422 Full</td>
<td>Auto</td>
<td>Auto</td>
<td>No Display</td>
<td>Mute</td>
</tr>
<tr>
<td>6B</td>
<td>HDMI YUV 422 Limited</td>
<td>Auto</td>
<td>Auto</td>
<td>No Display</td>
<td>Mute</td>
</tr>
<tr>
<td>7</td>
<td>HDMI YUV 444 Limited</td>
<td>Auto</td>
<td>Auto</td>
<td>No Display</td>
<td>Mute</td>
</tr>
<tr>
<td>8</td>
<td>HDMI YUV 444 Limited</td>
<td>Auto</td>
<td>Auto</td>
<td>No Display</td>
<td>Mute</td>
</tr>
</tbody>
</table>
Digital Add Ons?

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E.R.I.C.
Low Voltage Services
What About Audio?

Pro Audio cables and connectors - an overview:  https://youtu.be/AnU27N3CIsw
Measuring 100V line audio systems:  https://youtu.be/2RG2i4FtA2M
How to Choose the Best Speaker Cables: Gauge, Resistance and More:  https://youtu.be/r7DdcZCbaBo
How To Wire Subwoofers - Parallel vs Series - Single Voice Coil and Dual Voice Coil:  https://youtu.be/jryFmlCR4qA
How To Test Your Speaker System:  https://youtu.be/TCdUL5ZvMHc
Audio Impedance Meter- Testing 70/ 100 volt Speakers:  https://youtu.be/NKCN_aK9wgQ
Amplifier to Speaker Matching Tutorial | UniqueSquared.com:  https://youtu.be/pUou_noD1Gc
Understanding Sound Reinforcement - Power Amplifiers (Part 1):  https://youtu.be/xFRH_1WQw4Y
Understanding Sound Reinforcement - Power Amplifiers (Part 2):  https://youtu.be/QS2JXG6QWmQ
Troubleshoot and Eliminate AC Hum on Sound System:  https://youtu.be/l4famaQmWnA
Biamp Audio 101 - Wiring & Interconnects: Balanced vs. Unbalanced:  https://youtu.be/2uHaQ50Y9ew
Biamp Audio 101 - Gain Structure: Steps for Proper Gain Structure:  https://youtu.be/rNbbz9swKto
Biamp Audio 101 - Measurements & the dB: Audio Meters:  https://youtu.be/S6cUqod7JiY
SynAudCon: Gain Structure:  https://youtu.be/lel8FZ4wLfi
What does bridge on an amplifier mean:  https://youtu.be/cwXGd4bl-f0
What About Audio?

Pre-Process
– Mic = -60 dBV (0.001 volt) to -40 dBV (0.010 volt)
– Instrument = -20 dBu
– Pro Line = +4 dBu (1.25V)
– Consumer Line “Aux” = -10 dBV (0.300 volt)

After Process
– Speaker = 25v or 70v or 4/8ohm
Electrical dB reference chart:

<table>
<thead>
<tr>
<th>Reference Symbol</th>
<th>Reference type</th>
<th>Reference level:</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>power</td>
<td>0 dBm = 1.0 mW</td>
<td>Original electrical dB reference</td>
</tr>
<tr>
<td>dBV</td>
<td>pressure</td>
<td>0 dBV = 1.0 V RMS = +2.2 dBu</td>
<td>Rarely used in pro audio</td>
</tr>
<tr>
<td>dBv</td>
<td>pressure</td>
<td>0 dBv = 0.7746 V RMS</td>
<td>Older version of dBu, rarely used</td>
</tr>
<tr>
<td>dBu</td>
<td>pressure</td>
<td>0 dBu = 0.775 V RMS</td>
<td>Frequently used in pro audio</td>
</tr>
<tr>
<td>dB VU</td>
<td>pressure</td>
<td>0 dB VU ~ +4 dBu</td>
<td>Pseudo-reference for VU meters &amp; LED bar graphs</td>
</tr>
</tbody>
</table>
## Meters

### Scales compared

<table>
<thead>
<tr>
<th>Volts</th>
<th>dBu</th>
<th>VU</th>
<th>dBfs (SMPTE RP155)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.283 V</td>
<td>24 dBu</td>
<td>+2</td>
<td>20 dBfs</td>
</tr>
<tr>
<td>9.757 V</td>
<td>22 dBu</td>
<td>+1</td>
<td>18 dBfs</td>
</tr>
<tr>
<td>7.750 V</td>
<td>20 dBu</td>
<td>+0</td>
<td>16 dBfs</td>
</tr>
<tr>
<td>6.156 V</td>
<td>18 dBu</td>
<td>-2</td>
<td>14 dBfs</td>
</tr>
<tr>
<td>4.890 V</td>
<td>16 dBu</td>
<td>-4</td>
<td>12 dBfs</td>
</tr>
<tr>
<td>3.884 V</td>
<td>14 dBu</td>
<td>-6</td>
<td>10 dBfs</td>
</tr>
<tr>
<td>3.085 V</td>
<td>12 dBu</td>
<td>-8</td>
<td>8 dBfs</td>
</tr>
<tr>
<td>2.451 V</td>
<td>10 dBu</td>
<td>-10</td>
<td>6 dBfs</td>
</tr>
<tr>
<td>1.947 V</td>
<td>8 dBu</td>
<td>-12</td>
<td>4 dBfs</td>
</tr>
<tr>
<td>1.546 V</td>
<td>6 dBu</td>
<td>-14</td>
<td>2 dBfs</td>
</tr>
<tr>
<td>1.228 V</td>
<td>4 dBu</td>
<td>-16</td>
<td>0 dBfs</td>
</tr>
<tr>
<td>0.976 V</td>
<td>2 dBu</td>
<td>-18</td>
<td>-2 dBfs</td>
</tr>
<tr>
<td>0.775 V</td>
<td>0 dBu</td>
<td>-20</td>
<td>-4 dBfs</td>
</tr>
<tr>
<td>0.616 V</td>
<td>-2 dBu</td>
<td>-22</td>
<td>-6 dBfs</td>
</tr>
<tr>
<td>0.499 V</td>
<td>-4 dBu</td>
<td>-24</td>
<td>-8 dBfs</td>
</tr>
<tr>
<td>0.388 V</td>
<td>-6 dBu</td>
<td>-26</td>
<td>-10 dBfs</td>
</tr>
<tr>
<td>0.309 V</td>
<td>-8 dBu</td>
<td>-28</td>
<td>-12 dBfs</td>
</tr>
<tr>
<td>0.245 V</td>
<td>-10 dBu</td>
<td>-30</td>
<td>-14 dBfs</td>
</tr>
<tr>
<td>0.195 V</td>
<td>-12 dBu</td>
<td>-32</td>
<td>-16 dBfs</td>
</tr>
<tr>
<td>0.155 V</td>
<td>-14 dBu</td>
<td>-34</td>
<td>-18 dBfs</td>
</tr>
<tr>
<td>0.123 V</td>
<td>-16 dBu</td>
<td>-36</td>
<td>-20 dBfs</td>
</tr>
<tr>
<td>97.6 mV</td>
<td>-18 dBu</td>
<td>-38</td>
<td>-22 dBfs</td>
</tr>
<tr>
<td>77.5 mV</td>
<td>-20 dBu</td>
<td>-40</td>
<td>-24 dBfs</td>
</tr>
<tr>
<td>61.6 mV</td>
<td>-22 dBu</td>
<td>-42</td>
<td>-26 dBfs</td>
</tr>
<tr>
<td>48.9 mV</td>
<td>-24 dBu</td>
<td>-44</td>
<td>-28 dBfs</td>
</tr>
</tbody>
</table>

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What About Audio?
Balanced vs Unbalanced

Unbalanced wiring
What About Audio?

Balanced vs Unbalanced

Unbalanced wiring
What About Audio?

Balanced vs Unbalanced
What About Audio?

Balanced vs Unbalanced

Balanced wiring

EMI at the same level and phase in both conductors

EMI disappears when one signal is inverted and summed to the other
What About Audio?

Balanced vs Unbalanced

Balanced wiring

RFI is diverted to ground
What About Audio?

Mono vs Stereo

- Mono - One single Channel of Audio
- Stereo - Two Channels of audio (Left and Right)

Mono Audio → Mono Audio

Stereo Audio

Channel A (L) → Channel B (R)

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What About Audio?

Mono vs Stereo

When mixing stereo to mono, attenuate both channels by -6dB to the output bus and the sum will be at the same 0 dB as both input channels.
What About Audio?
Frequency, Loudness, and Timing

1-35 ms

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Microphones for Applications

- Handheld
- Shotgun - Theatre
- Parabolic – Sporting events
- Lavalier – Attach to clothing
- Contact pickup – Musical instruments
- Pressure response – Lay on flat surface
• Two common types of microphones are...
  – Dynamic Microphones
  – Condenser Microphones

(Requires phantom power)
## Microphone Pick Up Patterns

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Omni-directional</th>
<th>Cardioid</th>
<th>Super-cardioid</th>
<th>Hyper-cardioid</th>
<th>Bi-directional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polar response pattern</td>
<td><img src="image1" alt="Pattern" /></td>
<td><img src="image2" alt="Pattern" /></td>
<td><img src="image3" alt="Pattern" /></td>
<td><img src="image4" alt="Pattern" /></td>
<td><img src="image5" alt="Pattern" /></td>
</tr>
<tr>
<td>Coverage angle</td>
<td>360°</td>
<td>131°</td>
<td>115°</td>
<td>105°</td>
<td>90°</td>
</tr>
<tr>
<td>Angle of maximum rejection (null angle)</td>
<td>–</td>
<td>180°</td>
<td>126°</td>
<td>110°</td>
<td>90°</td>
</tr>
</tbody>
</table>
Microphone Pick Up Patterns

Cardioid

Hyper-Cardioid

Omni-Directional

90°

180°

90°

0°

MICROPHONE

SOUND SOURCE

SHURE.co.uk
Depends on Frequency!
More money is typically better (features)

- VHF
- UHF
- UWB

Ultra Wide Band
- Traditional
  - Skill Required
- Plug and Play
  - Not Hard Lid
  - Limited Futureability
- Twisted Pair
  - Solid conductor plugs
  - 2 cables = 1 UTP/1 STP
  - Pay attention to A vs. B
  - Cat5E better for analog (Skew Free/Low Skew)
Step 2 – Share
4 Steps of AV

Input Sources -> Process -> Distribute

Share
- SEE IT
- HEAR IT
- RECORD IT
- STREAM IT
Projector Types

- Pico
- Portable
- Multi-purpose
- Professional \ Large Venue
- Interactive
Projector Types

- Standard Throw
- Short Throw
- Ultra Short Throw
- Ultra WIDE Throw
Laser vs Bulb

Bulb Projector
- Bulb
- Optical dFluser
- Microdisplay (LCOS, DMD, or LCD)
- Projector lens
- Light exits at rear
- Screen

RGB Laser Projector
- RGB Laser
- Optical dFluser
- Microdisplay (LCOS, DMD, or LCD)
- Projector lens
- Light exits at front
- Screen

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Projector Specs

• **Lumens**
  – Minimum 3000
  – Double is noticeable
    • fade over time
  – Keystone can half
  – Color Brightness

• **Contrast Ratio**
  – Light cancels

CAUTION: Use specs MOSTLY to compare models by same manufacturer
Projector Specs

- Throw Ratio
  - Multiply by width
- Native Resolution
  - Rescales to within
- Warranty
- Inputs
Distance from bottom of screen to floor should be 3-4 feet.

Typical Screens are Matt White
• PC-free presentations
• Wireless
• AUTO keystone
• Wireless mouse control
• Lens Shift
• Network Capable
  • Control and Monitor
  • Content
• Use furthest distance to determine HEIGHT
• IF showing...
  – Video ÷ 8
  – Data ÷ 6
  – Graphics ÷ 4
• WIDTH is determined by ratio...
  • 4:3 = 1.33
  • 16:9 = 1.78
  • 16:10 (8:5) = 1.6
<table>
<thead>
<tr>
<th>Aspect Ratio</th>
<th>Formula</th>
<th>Formula</th>
<th>Formula</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>4:3 NTSC Video</td>
<td>( H = D \times 0.6 )</td>
<td>( W = D \times 0.8 )</td>
<td>( D = H \times 1.667 )</td>
<td>( D = W \times 1.25 )</td>
</tr>
<tr>
<td>16:9 HDTV</td>
<td>( H = D \times 0.49 )</td>
<td>( W = D \times 0.87146 )</td>
<td>( D = H \times 2.04 )</td>
<td>( D = W \times 1.1475 )</td>
</tr>
<tr>
<td>16:10</td>
<td>( H = D \times 0.5299 )</td>
<td>( W = D \times 0.848 )</td>
<td>( D = H \times 1.8868 )</td>
<td>( D = W \times 1.1793 )</td>
</tr>
<tr>
<td>5:4 Data Graphics</td>
<td>( H = D \times 0.625 )</td>
<td>( W = D \times 0.781 )</td>
<td>( D = H \times 1.601 )</td>
<td>( D = W \times 1.281 )</td>
</tr>
<tr>
<td>1.85:1 WideScreen (Letterbox)</td>
<td>( H = D \times 0.4762 )</td>
<td>( W = D \times 0.881 )</td>
<td>( D = H \times 2.1 )</td>
<td>( D = W \times 1.135 )</td>
</tr>
<tr>
<td>2.35:1 CinemaScope</td>
<td>( H = D \times 0.3915 )</td>
<td>( W = D \times 0.92 )</td>
<td>( D = H \times 2.554 )</td>
<td>( D = W \times 1.0868 )</td>
</tr>
<tr>
<td>15:9</td>
<td>( H = D \times 0.5146 )</td>
<td>( W = D \times 0.8576 )</td>
<td>( D = H \times 1.9433 )</td>
<td>( D = W \times 1.166 )</td>
</tr>
</tbody>
</table>
## QLED TV
![QLED (Samsung Q7F)](https://www.rtings.com/tv/reviews/by-type/qled-vs-oled-vs-led)

### QLED Pros and Cons

**Pros:**
- Brilliant whites
- Ultra-bright (1,500nits)
- Variety of screen sizes between 49-88-Inch

**Cons:**
- Not as slim (25.4mm)
- Overly bright
- Less convincing blacks
- Slower refresh rate

## OLED TV
![OLED (LG B6)](https://www.rtings.com/tv/reviews/by-type/qled-vs-oled-vs-led)

### OLED Pros and Cons

**Pros:**
- Lighter and thinner (2.57mm)
- Self-lighting pixels
- More convincing blacks
- Faster refresh rate (0.001ms)
- Judder and blur-free

**Cons:**
- Only found in three screen sizes: 55, 65 & 77-Inch
- Muted brightness (1,000nits)
- Expensive

## LED TV
![LED (Samsung KS8000)](https://www.rtings.com/tv/reviews/by-type/qled-vs-oled-vs-led)

### LED Pros and Cons

<table>
<thead>
<tr>
<th></th>
<th>QLED</th>
<th>OLED</th>
<th>LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Level</td>
<td>Good</td>
<td>Perfect</td>
<td>Good</td>
</tr>
<tr>
<td>Motion Blur</td>
<td>Great</td>
<td>Perfect</td>
<td>Good</td>
</tr>
<tr>
<td>Viewing Angle</td>
<td>Poor</td>
<td>Great</td>
<td>Poor</td>
</tr>
<tr>
<td>Color Volume</td>
<td>Great</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Gray Uniformity</td>
<td>Average</td>
<td>Good</td>
<td>Average</td>
</tr>
<tr>
<td>Luminosity</td>
<td>Good</td>
<td>Good</td>
<td>Great</td>
</tr>
<tr>
<td>Image Retention</td>
<td>Great</td>
<td>Poor</td>
<td>Great</td>
</tr>
<tr>
<td>Price and Availability</td>
<td>Poor</td>
<td>Average</td>
<td>Great</td>
</tr>
</tbody>
</table>

[https://www.rtings.com/tv/reviews/by-type/qled-vs-oled-vs-led](https://www.rtings.com/tv/reviews/by-type/qled-vs-oled-vs-led)

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E.R.I.C.
Low Voltage Services
Projector Mounting Examples
Monitor Display Mounting Examples
Pitch, Roll, & Yaw
A Word About Digital Signage
A Word About Video Walls
Ceiling (Flush Mount) Speakers
Wall (Surface Mount) Speakers
Wall (Flush Mount) In-Wall Speakers
Pendant Speakers
Hidden Speakers
Constant Voltage vs 4/8 ohm direct
1 active and 3 passive Dante network enabled speaker set

Dante Speakers
• Speakers frequency ranges…
  – **Tweeters**-High freq.
    (2,000-20,000 Hz)
  – **Horns**-Mid.-High freq.
    (300-8,000 Hz)
  – **Midrange cones**-Mid. freq.
    (200-8,000 Hz)
  – **Woofers**-Low freq.
    (40-600 Hz)
  – **Subwoofers**-Lower freq.
    (20-200 Hz)
Speaker dispersion

Work with architect to determine ceiling height for speakers and adequate screen height!
Speaker dispersion
Speaker Placement

- *Turning volume up does not increase coverage area only loudness*

- Ceiling Speakers
  - Determine # of speakers using ceiling height X2 rule

- Wall Baffles
  - Determine # based on height from floor to speaker
    - 8’ high = space 20’ apart
    - 16’ high = space 30’ apart
    - Stagger on opposing walls
Recording
Streaming

Works with these hosting services

USTREAM
WOWZA STREAMING CLOUD
YouTube
Facebook LIVE

INput

OUTput

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Step 3 – Process
STEP 3 - Process

• Can be separate pieces of equipment or built into equipment used in step 2
  - Best to use separate
• Can be separate pieces of equipment for each option or one box can do several processing options
  - Save money and space with a box that does many features
Split

Distribution Amplifier
Switch

Switcher

Mixer for Audio
Matrix Switcher
re-Size

SCALER

720P 1080P

1080p

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Superimpose

Title Generator / Graphic Processor

Mixer for Audio
Side by Side

PIP Processor

PIP = Picture in Picture

Window Wall Processor
Swap
Audio Processing

A Simple, Ideal Case

Diagram:
- Program Source
- Mixer
- Signal Processor
- Amplifier
- Loudspeaker
Audio Processing

A Real-World System

"Line Level"

Program Source  Mixer  Signal Processor  Amplifier  Ldspk
Audio Processing

Line Input Building Blocks – Gain Levels

- Individual gain is added based on operating level of the source (gain compensation)
- Target level -17dBFS (allow enough headroom)

<table>
<thead>
<tr>
<th>Input Type</th>
<th>Operating Level</th>
<th>Gain Compensation</th>
<th>Target Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Codec Rx</td>
<td>+6 dBu</td>
<td>0 dB</td>
<td>-17dBFS (+4dBu)</td>
</tr>
<tr>
<td>Program Audio</td>
<td>+6 dBu</td>
<td>0 dB</td>
<td>-17dBFS (+4dBu)</td>
</tr>
<tr>
<td>Computer Sound Card (analog)</td>
<td>0 dB</td>
<td>+1.8 dB</td>
<td>-17dBFS (+4dBu)</td>
</tr>
<tr>
<td>DVD Player</td>
<td>-10 dBv</td>
<td>+11.8 dB</td>
<td>-17dBFS (+4dBu)</td>
</tr>
<tr>
<td>Blu-ray Player</td>
<td>-10 dBv</td>
<td>+11.8 dB</td>
<td>-17dBFS (+4dBu)</td>
</tr>
<tr>
<td>iPod (analog)</td>
<td>0 dB</td>
<td>+1.8 dB</td>
<td>-17dBFS (+4dBu)</td>
</tr>
<tr>
<td>VCR/DVD Combo</td>
<td>-10 dBv</td>
<td>+11.8 dB</td>
<td>-17dBFS (+4dBu)</td>
</tr>
<tr>
<td>Pro Level CD/DVD Player (bal)</td>
<td>+4 dBu</td>
<td>0 dB</td>
<td>-17dBFS (+4dBu)</td>
</tr>
</tbody>
</table>

Wireless Microphone Building Blocks

<table>
<thead>
<tr>
<th>Microphone Type</th>
<th>Operating Level</th>
<th>Gain Compensation</th>
<th>Target Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wireless Mics (+4 dBu)</td>
<td>+4 dBu</td>
<td>0 dB</td>
<td>-17 dBFS (+4dBu)</td>
</tr>
<tr>
<td>Wireless Mics (-10 dBv)</td>
<td>-10 dBv</td>
<td>+11.8 dB</td>
<td>-17 dBFS (+4dBu)</td>
</tr>
<tr>
<td>Wireless Mics (-30 dBv)</td>
<td>-30 dBv</td>
<td>+34 dB</td>
<td>-17 dBFS (+4dBu)</td>
</tr>
</tbody>
</table>
Audio Processing
Audio Processing

Mini-Mic Preamp

MP13

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Audio Processing
Audio Processing

A Real-World System
Audio Processing

Gain Structure – Not Optimized

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Audio Processing

Gain Structure - Optimized

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Audio Processing

The Signal Chain

1mV -> G -> 10V -> G -> 100V

Program Source, Mixer, Signal Processor, Amplifier, LDspk

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Audio Processing

The Signal Chain

Program Source  Mixer  Signal Processor  Amplifier  Ldspk

1mV 10V 100V
1V 10V 10V

"Sensitivity"

VU

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Audio Processing

The Signal Chain

Program Source → Mixer → Signal Processor → Amplifier → Ldspk

1mV → 10V → 100V

VU
Audio Processing

The Signal Chain

Program Source → Mixer → Signal Processor → Amplifier → Ldspk

1mV → 10V → -12 → 100V → ?

VU Meter

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Audio Processing

Gain structure

Goal
• Maximize signal to noise ratio
• Maintain sufficient headroom for signal peaks

General procedure
• Use proper signal for calibration
• Follow the signal path—i.e. don’t start at the amplifier
  • Get the signal to operating level as soon as possible
  • Maintain unity gain
  • Adjust amplifiers last
• Use meters
Audio Processing

Summarizing
Audio signals can be measured in RMS, Peak or Full Scale values
- RMS gives a better idea on how loud a signal is
- Peak indicates where the signal is in relation to the limits of a sound system
- Full Scale indicates when digital saturation will occur
There’s no rule as to which meter to use where in the signal chain… but
<table>
<thead>
<tr>
<th>Volts</th>
<th>dBu</th>
<th>VU</th>
<th>dBfs (SMPTE RP155)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.283 V</td>
<td>24 dBu</td>
<td>+2</td>
<td>0 dBfs</td>
</tr>
<tr>
<td>9.757 V</td>
<td>22 dBu</td>
<td>0</td>
<td>-2 dBfs</td>
</tr>
<tr>
<td>7.750 V</td>
<td>20 dBu</td>
<td>-2</td>
<td>-4 dBfs</td>
</tr>
<tr>
<td>6.156 V</td>
<td>18 dBu</td>
<td>-4</td>
<td>-8 dBfs</td>
</tr>
<tr>
<td>4.890 V</td>
<td>16 dBu</td>
<td>-8</td>
<td>-8 dBfs</td>
</tr>
<tr>
<td>3.884 V</td>
<td>14 dBu</td>
<td>-10</td>
<td>-10 dBfs</td>
</tr>
<tr>
<td>3.085 V</td>
<td>12 dBu</td>
<td>-12</td>
<td>-12 dBfs</td>
</tr>
<tr>
<td>2.451 V</td>
<td>10 dBu</td>
<td>-14</td>
<td>-14 dBfs</td>
</tr>
<tr>
<td>1.947 V</td>
<td>8 dBu</td>
<td>-16</td>
<td>-16 dBfs</td>
</tr>
<tr>
<td>1.346 V</td>
<td>6 dBu</td>
<td>-18</td>
<td>-18 dBfs</td>
</tr>
<tr>
<td>1.0728 V</td>
<td>4 dBu</td>
<td>-20</td>
<td>-20 dBfs</td>
</tr>
<tr>
<td>0.976 V</td>
<td>2 dBu</td>
<td>-22</td>
<td>-22 dBfs</td>
</tr>
<tr>
<td>0.775 V</td>
<td>0 dBu</td>
<td>-24</td>
<td>-24 dBfs</td>
</tr>
<tr>
<td>0.616 V</td>
<td>-2 dBu</td>
<td>-26</td>
<td>-26 dBfs</td>
</tr>
<tr>
<td>0.499 V</td>
<td>-4 dBu</td>
<td>-28</td>
<td>-28 dBfs</td>
</tr>
<tr>
<td>0.388 V</td>
<td>-6 dBu</td>
<td>-30</td>
<td>-30 dBfs</td>
</tr>
<tr>
<td>0.309 V</td>
<td>-8 dBu</td>
<td>-32</td>
<td>-32 dBfs</td>
</tr>
<tr>
<td>0.245 V</td>
<td>-10 dBu</td>
<td>-34</td>
<td>-34 dBfs</td>
</tr>
<tr>
<td>0.195 V</td>
<td>-12 dBu</td>
<td>-36</td>
<td>-36 dBfs</td>
</tr>
<tr>
<td>0.155 V</td>
<td>-14 dBu</td>
<td>-38</td>
<td>-38 dBfs</td>
</tr>
<tr>
<td>0.123 V</td>
<td>-16 dBu</td>
<td>-40</td>
<td>-40 dBfs</td>
</tr>
<tr>
<td>97.6 mV</td>
<td>-18 dBu</td>
<td>-42</td>
<td>-42 dBfs</td>
</tr>
<tr>
<td>77.5 mV</td>
<td>-20 dBu</td>
<td>-44</td>
<td>-44 dBfs</td>
</tr>
<tr>
<td>61.6 mV</td>
<td>-22 dBu</td>
<td>-46</td>
<td>-46 dBfs</td>
</tr>
<tr>
<td>48.9 mV</td>
<td>-24 dBu</td>
<td>-48</td>
<td>-48 dBfs</td>
</tr>
</tbody>
</table>
Audio Processing

Gain structure

Adjust input gain for proper operating level
- Use peak meters
- Adjust gain until the peak indicator starts to flash
  - Usually 3~6dB before actual clipping
- Then reduce gain 6~12dB to provide additional headroom

Maintain unity gain throughout the signal chain
- Maintain faders and level controls at 0dB
- Compensate level where needed
Audio Processing

– Mixer = adjust sound levels
– Equalizer = adjust frequencies (filter or enhance)
– Reverb and Delay = adjust for reflections
– Compressors & Limiters = adjust frequency range
– Gates and Expanders = eliminate low noise
Audio Processing

– Mixer = adjust sound levels
Automatic mixer suggested settings:

- Threshold: -40 dB
- Attenuation: -40 dB
- Attack: 1.0 ms
- Release: 50 ms
- NOM Gain: On
- Hold: 1.0 seconds
- Last Mic: Last
- NOM Limit: 4
Audio Processing

- EQ

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– EQ – Starting Points

**Vocals**
- < 200 Hz: Cut for clarity
- 150 Hz – 600 Hz: Warmth
- 500 Hz – 2 kHz: Nasal (Cut to eliminate)
- 3 kHz – 5 kHz: Sibilance (Cut to eliminate)
- 1.5 kHz – 8 kHz: Clarity and Presence
- 10 kHz+: Airy (Breathy)
– EQ

First, understand that prerecorded program sources like Blu Rays, DVDs, and music CDs have been optimized as audio sources when produced.

Therefore, other than gain, these sources do not need any other input processing.

If these don’t sound good through the system loudspeakers, look to improper equalization on the output processing strip feeding the loudspeakers.
- EQ

Input source parametric equalization is only for

- Microphone
- Telephone
- CODEC optimization

Fixing its response if:

It is too thin or tinny
Has too much bass

To notch out feedback ringing in the case of local mics
Audio Processing

– Filters

- Low Pass Filter
- Low Shelf Filter
- All Pass Filter - 3 Band
- Uber Filter - 7 Filter
Audio Processing

– Filters

<table>
<thead>
<tr>
<th>Filters</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use High Pass Filters on speech microphones to reduce rumble</td>
</tr>
<tr>
<td>• Use Low Pass Filters on conferencing microphones to reduce noise and reflections in problematic rooms</td>
</tr>
<tr>
<td>• Boost to 2KHz range for enhanced speech intelligibility</td>
</tr>
<tr>
<td>• User higher “Q” filters to remove unwanted resonances</td>
</tr>
</tbody>
</table>
Audio Processing

– Dynamics
Input CoMPression (CMP):

A compressor is used to reduce the level of overly loud signal sources.

Since recorded and broadcast sources are already level-limited, only microphone, telephone and CODEC conference sources can benefit from compression.

A good rule of thumb for setting parameters of an Avia input compressor is:

- Threshold: -12 dB, Ratio: 3:1
- Attack: 5.0 ms, Release: 50 ms
- Soft knee: On, Makeup gain: Off
Input Automatic Gain Control (AGC):

Automatic Gain Control (AGC) is generally used in broadcasting to limit the dynamic range of a signal source whose nominal level varies too much.

It is tempting to employ AGC for that soft talker who is afraid to speak loudly into their mic, and isn’t loud enough in the local loudspeakers.

But often feedback will occur before they are loud enough.

AGC should only be used if absolutely necessary, and only on remote outputs like far-end teleconferencing telephones & CODECs or recording feeds.
Output LIMiter (LIM):

To prevent excessive output levels:
- Threshold: -3 dB
- Ratio: 20:1
- Attack: 0.1 ms
- Release: 50 ms
- Soft knee: ON
- Makeup Gain: 0 dB

For a 14-dB crest factor (headroom):
- Threshold: -10 dB
- Ratio: 10:1
- Attack: 0.1 ms
- Release: 50 ms
- Soft knee: ON
- Makeup gain: +6 dB
## Dynamics

- Use limiters on outputs to amplifiers and recording devices to prevent overdriving.
- Use compression on microphones:
  - 2:1 to 4:1 on conversational speech
  - 4:1 to 6:1 on lecture/presentation
  - 4:1 or greater on dynamic instruments
- Use gates on conferencing microphones when automixing is not used.
- Use AGC on telephone and recording device feeds.
### Audio Processing

#### Automixing
- Use gated automixing for conferencing
- Use gain sharing automixing for panel discussions and recording applications

#### General Procedures
- Equalize using a “subtractive” process (use cut rather than boost)
- Understand the bandwidth of any content
- Know loudspeaker frequency response and power handling capabilities
- Perform delay alignments before performing equalization
- Understand the target levels for your application
- Understand how to accurately use your test equipment
- Practice
Audio Processing

Room Acoustics

Reflection

Absorption

Diffusion
Audio Amplifiers

Rules of Thumb

1. Get an amp 50% more powerful than your speakers.

- Continuous Power Capacity
- RMS
- Program

500 watts
500 watts

amp

(®)(®)

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Audio Amplifiers
Audio Amplifiers

CEA Compliant

Certifies that your amplifier’s output power ratings are real power numbers, not inflated marketing ratings.
Audio Amplifiers

Rules of Thumb

1. Get an amp 50% more powerful than your speakers.

2000 watts 2000 watts

Continuous Power Capacity
RMS
Program
Audio Amplifiers

Rules of Thumb

1. Get an amp 50% more powerful than your speakers.

- 500 watts
  - amp
- 600 watts
- 500 watts

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Under-Powered Amp Nearing MAX Output

- Distortion
- Damaged Voice Coil
Audio Amplifiers

Rules of Thumb
1. Get an amp 50% more powerful than your speakers.

\[
\text{Math: } \frac{500}{2.50} = 200 \text{ watts}
\]
RMS Input Rating = RMS Output Chosen

Resistance (Ohms) = Load (Ohms)

350W RMS + 350W RMS = 700W RMS
Sub RMS x 1.20 = POWER RANGE
Sub RMS x 0.90

700 RMS x 1.20 = 840W RMS
700 RMS x 0.90 = 630W RMS
Audio Amplifiers

**Rules of Thumb**

1. Match your speakers' ohms to the ohms your amp can handle.

- 4, 8, 16 ohms
Audio Amplifiers

Rules of Thumb

2. Match your speakers' ohms to the ohms your amp can handle.

\[ \text{4 ÷ 2 = 2 ohms} \]

- 4 ohms
- 2 speakers

4, 8, 16 ohms
Audio Amplifiers

Rules of Thumb

2. Match your speakers' ohms to the ohms your amp can handle.

4/2 = 2 ohms

4 ohms / 2 channels = 2 ohms per channel.
Audio Amplifiers

Rules of Thumb

2. Match your speakers' ohms to the ohms your amp can handle.
Audio Amplifiers

Impedance

Parallel Formula
\[
\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}
\]

Series Formula
\[
R_T = R_1 + R_2
\]

\(R = \text{Resistance (Voice Coils)}\)  \(R_T = \text{Total ohms}\)
Over-Powered Amplifier

COOLER

Amplifier Power Output

2 Ohms 4 Ohms
700W RMS 350W RMS
runs WARM runs COOL

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250W RMS 4 ohm

Four 4 ohm subs wired in parallel equals a 1 ohm load!

1,000W RMS 1 ohm

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Standard meter (DC)  Impedance meter (AC)
OUTPUT LOADING
Loading 8Ω Minimum eg
1 x 8Ω Speaker, or 2 x 16Ω Speakers
100V (100 Volt Line)
30 Watts Maximum or 333Ω.

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The power amplifier is dependent on the AC power source to produce the power it was designed to deliver.
Amplifier sizing:

Class D amplification is fairly efficient, so given 80% efficiency:
IF THE AC SOURCE IS NOT CLEAN,

OR IF PROPER GROUNDING IS NOT IMPLEMENTED,
There is a voltage difference between the ground points on each outlet.
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Visit www.alectrosystems.com to learn more about Professional Audio and Video
BRIDGED?
Sound Pressure Level –SPL:

Loudspeaker Sensitivity: dB
SPL 1 watt @ 1 meter
Power: +3dB for every 2x watts
Distance: -6dB for every 2x distance
• 0dB faintest audible sound
• 50-60dB normal conversation
• 120dB painful

96 dB SPL @ loudspeaker 1W/1M
+ 24 dB (250 W) [8 x 3dB] Amplifier Gain
-30 dB (32 M) [5 x -6dB] Distance Loss
-------------------
90 dB SPL at the listener
To make the system appreciably louder, the amplifier should be replaced with an amplifier 4 to 10 times more powerful

- 4X the power = 6 dB louder, which is perceptively louder in volume
- 10X the power = 10 dB louder, which is perceptively twice as loud
- Be sure that the existing loudspeakers can handle the additional power
Crestron – “If you are without a 70-volt amplifier, but need to drive a 70-volt loudspeaker line, a low-impedance amplifier channel rated for 600 watts @ 8 ohms supplies a 69-volt line, for a 100-volt line, 1250 watts @ 8 ohms”
PAG/NAG (Potential Acoustic Gain/Needed Acoustic Gain):

Definitions:
- **D₀** Talker-to-farthest-listener distance
- **D₁** Mic-to-closest-loudspeaker distance
- **D₂** Listener-to-closest-loudspeaker distance
- **Dₛ** Talker-to-mic distance
- **EAD** Equivalent Acoustic Distance, the desired virtual distance between the talker and furthest listener
- **NOM** Number of Open Microphones, always set to 1 when using automatic mixer function
- **FSM** Feedback Stability Margin
Potential Acoustical Gain:

\[
P.A.G. = \text{Potential Acoustic Gain}
\]

\[
P.A.G. = 20 \log_{10} \left[ \frac{D_1}{D_3} \times \frac{D_0}{D_2} \right] \text{ in decibels}
\]
PAG/NAG (Potential Acoustic Gain/Needed Acoustic Gain):

NAG formula:
• NAG = 20Log(D0/EAD)

For example (imperial):
• NAG = 20Log(50 ft./8 ft.)
• NAG = 20Log(6.25)
• NAG = 15.9 dB
PAG/NAG (Potential Acoustic Gain/Needed Acoustic Gain):

PAG = 22.5 dB [22.4 dB]
NAG = 15.9 dB [15.6 dB]

PAG > NAG
The system parameters will provide enough gain-before-feedback to acoustically locate all listeners within 8 ft. [2.5 m] of the talker.
AEC
Step 4 – Distribute
Skew Free / Low Skew UTP

- Not to be used for Digital
- Mark with colored tag for easier identification
- Terminate with different colored jack than data
HD Base T

HDBaseT 5Play

HDBaseT Source

Video

Ethernet

Power

HDBaseT Display

100m/328ft Cat5e Cable

Audio

Control

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Audio over Ethernet
Audio over Ethernet

Dante Recommended Network Switch Features

- No EEE or Green Ethernet features enabled
- Gigabit switches
- Unmanaged Switches
  - Single network switch applications
  - Dedicated Dante traffic
- Managed Switches
  - Multiple network switch applications
  - Mixed traffic
Figure 7.3
Minimum Recommended AV Infrastructure
Make sure to have data connections:
- At input locations
- At displays
- At processing and control equipment
Step 5 – Control
• Control processor with touch panel/software app
• Button panel
• Browser control
• Control anything with
  - Serial
  - IR
  - Ethernet
  - Relay/Contact Closure
Programmable Systems
Configurable Systems
Conprogable Systems
Let’s Put into Practice
Let’s Put into Practice
What you do, ask, and look for in a job walk/review?
- Determine sources & outputs – “Uses of system”
  - Determine locations, distances, pathways
  - What’s existing – likes and dislikes
  - Customer Expectations
- Determine existing network and required additions
  - Who are the contacts and roles
  - Expected timelines
Let’s Put into Practice

What tools do you need on a job walk?

- Camera
- Digital Notepad
- Distance Meter
- Stud finder
- Ladder & Tools for access
- Keys
Let’s Put into Practice

Scenario 1
Customer wants a VHS, Blu Ray, Rack PC, and Laptop
Show on a TV in a room that seats about 6 people
Does not want multiple remote controls
Scenario 1
Customer wants a VHS
Scenario 1
Customer wants a Blu Ray

VHS  Composite  Scan Converter  HDMI  Blu Ray  HDMI
Scenario 1

Customer wants a Rack PC

- VHS (Composite) -> Scan Converter (HDMI)
- Blu Ray (HDMI) -> Rack PC (Display Port)
Scenario 1
Customer wants a Rack PC

- VHS (Composite) -> Scan Converter (HDMI)
- Blu Ray (HDMI)
- Rack PC (Display Port) -> Adapter (HDMI)
Scenario 1

Customer wants a Laptop
Scenario 1
Customer want a TV

- VHS (Composite)
- Scan Converter (HDMI)
- Blu Ray (HDMI)
- Rack PC (Display Port)
- Adapter (HDMI)
- Laptop (VGA (with audio))
- Wall Plate (CAT 6 Shielded)
- HDMI to TV
Scenario 1
Connect them

VHS ❯ Composite ❯ Scan Converter ❯ HDMI ❯ Switcher
Blu Ray ❯ HDMI
Rack PC ❯ Display Port ❯ Adapter ❯ HDMI ❯ Scalfer
Laptop ❯ VGA (with audio) ❯ Wall Plate ❯ CAT 6 Shielded ❯ HDMI ❯ TV
Scenario 1
Customer wants one remote

- VHS
  - Composite
- Blu Ray
  - HDMI
- Rack PC
  - Display Port
- Laptop
  - VGA (with audio)
- Wall Plate
  - CAT 6 Shielded
- Scan Converter
  - HDMI
- Adapter
  - HDMI
- Switcher Scaler
- Wall Plate
  - CAT 6 Shielded
- TV
  - HDMI
  - RS 232
- 8 Button Controller
  - On
  - Off
  - VHS
  - Blu Ray
  - Rack PC
  - Laptop
  - Vol+
  - Vol-
Let’s Put into Practice

Scenario 2

2 - Divisible Room with TV tuners, Floor Box Input, BYOD
   Automatic Switch of controls based on wall status
   Projector in each room and monitor at lectern
   Want Lesson capture/Streaming
Scenario 2

Customer wants TV Tuners

<table>
<thead>
<tr>
<th>Tuner 1</th>
<th>HDMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuner 2</td>
<td>HDMI</td>
</tr>
</tbody>
</table>
Scenario 2
Customer wants Floor Box Inputs

<table>
<thead>
<tr>
<th>Tuner 1</th>
<th>HDMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuner 2</td>
<td>HDMI</td>
</tr>
<tr>
<td>FB 1</td>
<td>CAT 6 Shielded</td>
</tr>
<tr>
<td>FB 2</td>
<td>CAT 6 Shielded</td>
</tr>
</tbody>
</table>
Scenario 2
Customer wants B.Y.O.D.
Scenario 2
Customer wants Projectors and Monitors

Tuner 1
- HDMI

Tuner 2
- HDMI

FB 1
- CAT 6 Shielded

FB 2
- CAT 6 Shielded

Wireless Collab
- HDMI

Wireless Collab 2
- HDMI

CAT 6 STP
Scaling Receiver
HDMI
Projector 1

CAT 6 STP
Scaling Receiver
HDMI
Projector 2

CAT 6 STP
Scaling Receiver
HDMI
Monitor 1

CAT 6 STP
Scaling Receiver
HDMI
Monitor 2
Scenario 2
Customer wants Lesson Capture and Streaming

Tuner 1
- HDMI

Tuner 2
- HDMI

FB 1
- CAT 6 Shielded

FB 2
- CAT 6 Shielded

Wireless Collab
- HDMI

Wireless Collab 2
- HDMI

CAT 6 STP
- Scaling Receiver

HDMI
- Projector 1

CAT 6 STP
- Scaling Receiver

HDMI
- Projector 2

CAT 6 STP
- Scaling Receiver

HDMI
- Monitor 1

CAT 6 STP
- Scaling Receiver

HDMI
- Monitor 2

HDMI
- L.C.

HDMI
- Streaming Box
Scenario 2
Connect our Video Pieces

Tuner 1
Tuner 2
FB 1
FB 2

Matrix Switch

CAT 6 STP
Scaling Receiver
HDMI
Projector 1

CAT 6 STP
Scaling Receiver
HDMI
Projector 2

CAT 6 STP
Scaling Receiver
HDMI
Monitor 1

CAT 6 STP
Scaling Receiver
HDMI
Monitor 2

HDMI
L.C.

HDMI
Streaming Box

HDMI

HDMI

HDMI

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Scenario 2
Don’t Forget the Audio!

Mic Receiver 1  STP 22
Mic Receiver 1  STP 22
Scenario 2
Don’t Forget the Audio!

Mic Receiver 1
STP 22

Mic Receiver 1
STP 22

AMP

SPK
Room 1 Speaker

SPK
Room 1 Speaker
Scenario 2
Don’t Forget the Audio!
Scenario 2
Don’t Forget the Audio!
Scenario 2
Don’t Forget Control!
Scenario 2
Don’t Forget Control!
Scenario 2
Don’t Forget Control!

Tuner 1
IR Emitter

Tuner 2
IR Emitter

Controller

FB?

FB?
Scenario 2
Don’t Forget Control!

Tuner 1
IR Emitter

Tuner 2
IR Emitter

Controller

CAT 6
LAN

FB?

FB?
Scenario 2
Don’t Forget Control!

Controller

Tuner 1

IR Emitter

Tuner 2

IR Emitter

Projector 1

Com 2

Projector 2

Com 3

Monitor 1

IR Emitter

Monitor 2

IR Emitter

CAT 6

LAN

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Scenario 2
Don’t Forget Control!

- Tuner 1
- Tuner 2
- IR Emitter
- IR Emitter
- Controller
- Com 2
- Com 3
- Projector 1
- Projector 2
- Monitor 1
- Monitor 2
- IR Emitter
- IR Emitter
- LAN
- CAT 6
- Stream
- CAT 6
- Touch Panel 1
- Touch Panel 2
- CAT 6
- CAT 6
- CAT 6
- CAT 6
- CAT 6
- CAT 6
- L.C.
Scenario 2

Don’t Forget Control!

- Tuner 1
- Tuner 2
- FB?
- FB?
- Projector 1
- Projector 2
- Com 1
- Com 2
- Com 3
- Controller
- IR Emitter
- DSP
- Room Sensor
- Touch Panel 1
- Touch Panel 2
- Monitor 1
- Monitor 2
- Stream
- L.C.
- CAT 6
- CAT 6
- CAT 6
- CAT 6
- CAT 6
- CAT 6
- LAN
- STP 22
- CAT 6

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Let’s Put into Practice
Scenario 3
Board Room with – Rack Pc, 1 Table inputs, BluRay, TV Tuner, 1 Guest Input, Document Camera, Two Room Cameras 2 Side TVs for Audience 10 preview monitors for Board Table Recording Streaming Video Conference Soft Codec conferencing
Scenario 3
Customer wants Rack PC
Scenario 3
Customer wants Table Input
Scenario 3
Customer wants Blu Ray

- Rack
- PC
- HDMI
- VGA w/audio
- Table Switcher
- CAT 6 STP
- D.P
- Blu Ray
- HDMI
Scenario 3
Customer wants TV Tuner
Scenario 3

Customer wants Guest Input

- Rack PC
  - HDMI
  - VGA w/audio
- Table Switcher
  - HDMI
  - D.P
  - CAT 6 STP
- Blu Ray
  - HDMI
- Tuner
  - HDMI
  - VGA w/audio
- Guest Input
  - HDMI
  - D.P
  - CAT 6 STP
Scenario 3

Customer wants a Document Camera
Scenario 3
Customer wants 2 Room Cameras
Scenario 3
Connect to Matrix

1. Rack PC
2. Blu Ray
3. Tuner
4. Doc CAM
5. Cam 1
6. Cam 2
7. Table Switcher
8. Guest Input

Connections:
- Rack PC: HDMI
- Blu Ray: HDMI
- Tuner: HDMI
- Doc CAM: HDMI
- Cam 1: HDMI
- Cam 2: HDMI
- Table Switcher: HDMI
- Guest Input: HDMI
- CAT 6 STP
- Matrix Switcher: Rx HDMI

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Scenario 3

Don’t Forget Outputs
Scenario 3

Don’t Forget Outputs

Matrix Switcher

- HDMI Tx to CAT 6 STP Rx
- HDMI Tx to CAT 6 STP Rx
- HDMI CAT 6 STP to Distribution Amplifier

Distribution Amplifier CAT 6 STP

Rx (8x) Monitor (8x)
Rx (2x) Monitor (2x)
Scenario 3

Don’t Forget Outputs

- Matrix Switcher
- TV 1
  - Tx
  - Rx
  - HDMI
  - CAT 6 STP
- TV 2
  - Tx
  - Rx
  - HDMI
  - CAT 6 STP
- Distribution Amplifier
  - Tx
  - Rx
  - HDMI
  - CAT 6 STP (8x)
- Monitor (8x)
  - Rx (8x)
- Distribution Amplifier
  - Tx
  - Rx
  - HDMI
  - CAT 6 STP (2x)
- Monitor (2x)
  - Rx (2x)
  - CAT 6 STP (2x)
- R.S.
  - HDMI
  - CAT 6 STP (8x)
- AV Bridge
  - USB
- Video Conference
  - HDMI
- 1
  - Video Conference
Scenario 3

Don’t Forget Outputs

- Matrix Switcher
- Tx HDMI CAT 6 STP Rx
- TV 1 HDMI
- TV 2 HDMI
- Distribution Amplifier HDMI CAT 6 STP (8x) Rx (8x) Monitor (8x)
- Distribution Amplifier HDMI CAT 6 STP (2x) Rx (2x) Monitor (2x)
- R.S. HDMI CAT 6 STP
- Video Conference HDMI
- AV Bridge HDMI
- USB

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Scenario 3

We need Audio De-embedders

Matrix Switcher

A.D. HDMI

Tx CAT 6 STP Rx HDMI

HDMI Tx CAT 6 STP

Rx HDMI

Distribution Amplifier

CAT 6 STP (8x)

Rx (8x)

Monitor (8x)

Distribution Amplifier

CAT 6 STP (2x)

Rx (2x)

Monitor (2x)

R.S.

CAT 6 STP

Video Conference

USB

AV Bridge

HDMI

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Scenario 3
We need Audio De-embedders
Scenario 3
Don’t Forget Audio
Scenario 3
Don’t Forget Audio
Scenario 3
Don’t Forget Audio

A.D. Source
STP 22

Table Mics (10x)
STP 22 (10x)

Lectern Mic
STP 22

A.D. Source
STP 22

BluRay/CD
STP 22
## Scenario 3

Don’t Forget Audio

<table>
<thead>
<tr>
<th>Equipment</th>
<th>STP 22</th>
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<tbody>
<tr>
<td>A.D. Source</td>
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<tr>
<td>Table Mics (10x)</td>
<td>STP 22</td>
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<tr>
<td>Lectern Mic</td>
<td>STP 22</td>
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<tr>
<td>Wireless Rx</td>
<td>STP 22</td>
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<td>Wireless Rx 2</td>
<td>STP 22</td>
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<tr>
<td>A.D. Source BluRay/CD</td>
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</table>
Scenario 3
Don’t Forget Audio

A.D. Source
Table Mics (10x)
Lectern Mic
Wireless Rx
Wireless Rx 2
VTC

A.D. Source
BluRay/CD

STP 22
(10x)
STP 22
STP 22
STP 22
STP 22
STP 22
STP 22
### Scenario 3

Don’t Forget Audio

<table>
<thead>
<tr>
<th>Source Type</th>
<th>STP 22</th>
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<tbody>
<tr>
<td>A.D. Source</td>
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<tr>
<td>Table Mics (10x)</td>
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<tr>
<td>Lectern Mic</td>
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<td>Wireless Rx</td>
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<tr>
<td>Wireless Rx 2</td>
<td></td>
</tr>
<tr>
<td>VTC</td>
<td></td>
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<tr>
<td>S.C. AV Bridge</td>
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<tr>
<td>A.D. Source BluRay/CD</td>
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</tbody>
</table>

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E.R.I.C.
Low Voltage Services
Scenario 3
Don’t Forget Audio

- A.D. Source
- Table Mics (10x)
- Lectern Mic
- Wireless Rx
- Wireless Rx 2
- VTC
- S.C. AV Bridge
- A.D. Source BluRay/CD

Diagram:
- STP 22
- STP 22 (10x)
- STP 22
- STP 22
- STP 22
- STP 22 Remote
- STP 22 Reference

DSP

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Scenario 3
Don’t Forget Audio
Scenario 3
Don’t Forget Audio
Scenario 3
Don’t Forget Audio

Diagram:
- A.D. Source
- Table Mics (10x)
- Lectern Mic
- Wireless Rx
- Wireless Rx 2
- VTC
- S.C. AV Bridge
- A.D. Source BluRay/CD
- DSP
- AMP
- ALS Tx
- Speaker
- R.S.

Connection:
- STP 22
- STP 22 (10x)
- EXP
- STP 22
- STP 22
- STP 22
- STP 22
- STP 22 Remote
- STP 22 Reference
- SPK

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Scenario 3
Don’t Forget Audio
Scenario 3
Push to Talk Buttons
Scenario 3
Don’t forget Control!
<table>
<thead>
<tr>
<th>Scenario 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Don’t forget Control!</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table Switcher</th>
<th>RS 232</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guest Input?</td>
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</table>
Scenario 3
Don’t forget Control!
Scenario 3
Don’t forget Control!
Scenario 3
Don’t forget Control!
Scenario 3
Don’t forget Control!
Scenario 3
Don’t forget Control!

Table Switcher
Guest Input?
Doc Cam
Cam 1
Cam 2
Tuner
B.R.

RS 232
RS 232
RS 232
IR Emitter
IR Emitter
Scenario 3
Don’t forget Control!
Scenario 3
Don’t forget Control!

Table Switcher
Guest Input?
Doc Cam
Cam 1
Cam 2
Tuner
B.R.

AV Controller
Power Supply with Ethernet Control

RS 232
IR Emitter
IR Emitter

LAN
Scenario 3
Don’t forget Control!

Table Switcher
- RS 232

Guest Input?
- RS 232

Doc Cam
- RS 232

Cam 1
- RS 232
- IR Emitter

Cam 2
- RS 232
- IR Emitter

Tuner
- IR Emitter

B.R.
- IR Emitter

AV Controller
- Power Supply with Ethernet Control
- Ethernet Connection

TV 1
- Power Supply with Ethernet Control

TV 2
- Power Supply with Ethernet Control

LAN
- Ethernet Connection
Scenario 3
Don’t forget Control!

Table Switcher
- RS 232

Guest Input?
- RS 232

Doc Cam
- RS 232

Cam 1
- RS 232

Cam 2
- IR Emitter

Tuner
- IR Emitter

B.R.

AV Controller
- RS 232

Power Supply with Ethernet Control

TV 1

TV 2

AV Bridge

Ethernet Connection

LAN
Scenario 3
Don’t forget Control!

- AV Controller
  - Table Switcher: RS 232
  - Guest Input?: RS 232
  - Doc Cam: RS 232
  - Cam 1: RS 232
  - Cam 2: RS 232
  - Tuner: IR Emitter
  - B.R.: IR Emitter
  - Power Supply with Ethernet Control: AV Bridge, VTC
  - TV 1
  - TV 2

- Ethernet Connection
- LAN

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Scenario 3
Don’t forget Control!

Table Switcher

Guest Input?

Doc Cam

Cam 1

Cam 2

Tuner

B.R.

RS 232

RS 232

RS 232

IR Emitter

IR Emitter

TV 1

TV 2

Power Supply with Ethernet Control

AV Bridge

VTC

R.S

AV Controller

LAN

Ethernet Connection
Scenario 3
Don’t forget Control!

Table Switcher
Guest Input?
Doc Cam
Cam 1
Cam 2
Tuner
B.R.

AV Controller
Power Supply with Ethernet Control
TV 1
TV 2
AV Bridge
VTC
R.S

RS 232
RS 232
RS 232
RS 232
IR Emitter
IR Emitter

LAN
Ethernet Connection
4 Steps of AV

Input Sources → Process → Distribute → Share

- SEE IT
- HEAR IT
- RECORD IT
- STREAM IT
5th Step of AV

Control

Input Sources

Process

Distribute

Share

SEE IT

HEAR IT

RECORD IT

STREAM IT

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