

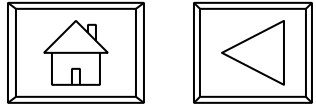
# Digital Audio Basics

What is Digital?

Bits

Quantization

Sampling

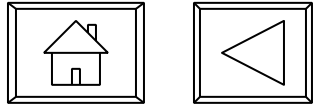


# What is Digital

---

- ◆ Need to be careful what you mean
  - ◆ Digital Display
  - ◆ Digital Processing
  - ◆ Digital Control
  - ◆ Digital Recording
  - ◆ Digital Transmission

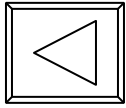
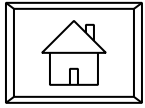
**What is DTV? Consumer Info Page**



# What is Digital

---

- ◆ A/D Converters (Analog to Digital)
  - ◆ Sound Card in Computer is Audio A/D and D/A
  
- ◆ Digital Audiotape Formats
  - ◆ Dat (Digital Audio Tape)
  - ◆ Mini Disc
  - ◆ Digicart



# What is Digital

## ◆ 8 Bits

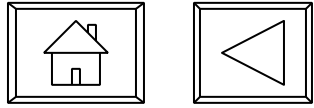
BINARY									
<b>MSB</b>							<b>LSB</b>		
1	1	1	1	1	1	1	1	8	
x 128	x 64	x 32	x 16	x 8	x 4	x 2	x 1	BIT	
128	64	32	16	8	4	2	1	=	255

**MSB = Most Significant Bit**

**LSB = Least Significant Bit**

**+ 0 = 256 Values**

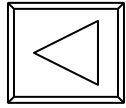
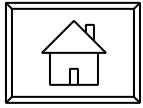
See Excel Bit Generator (digital.xls)



# What is Digital

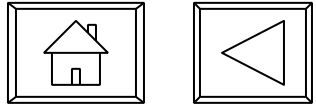
---

<u>Bits</u>	<u># of Possible Values</u>
◆ 8 bit	<b>256</b>
◆ 10 bit	<b>1,024</b>
◆ 16 bit	<b>65, 536</b>
◆ 24 bit	<b>16, 777,216</b>
◆ 32 bit	<b>4,294,967,296</b>



# Quantization & Sampling

---

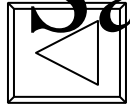
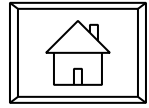


# Sampling

---

- ◆ Time Component – How often it samples per time period
- ◆ Sampling rate per Second
- ◆ EXAMPLE 48 kHz samples 48k times/second
  - ◆ With a time of  $1/48,000$  of a second

**Sampling: <http://www.adamwilt.com/pix-sampling.html>**

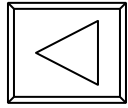
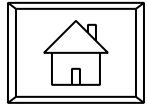


# Sampling – Nyquist theorem

---

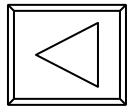
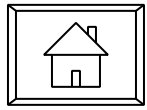
- ◆ Nyquist Theorem
- ◆ Sample rate at least TWICE the highest recorded frequency
- ◆ 20kHz signal must be sample at least at 40kHz
- ◆ Generally the sample rate is 44.1 kHz

**Sampling: <http://www.adamwilt.com/pix-sampling.html>**



# Quantization

- 
- ◆ Measures #of Amplitude Levels (Determines Bit-Depth)
  - ◆ Assigns a Numerical Value amplitude



# Quantization

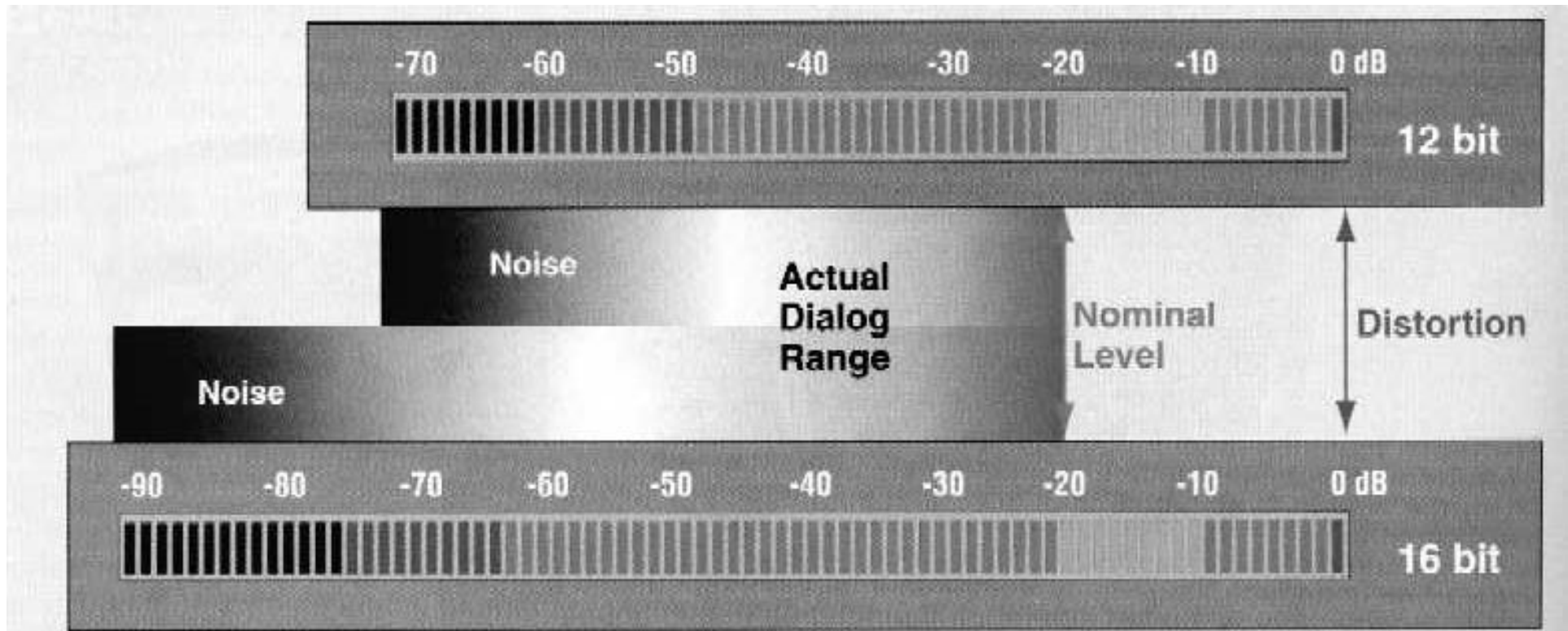


Figure 1—Dialog can actually be much softer than its nominal meter reading, and approaches the noise floor if you're using 12-bit mode.