Automatic Gain Control (AGC)

- Common function used at analog interfaces to a digital system
  - From an analog “front end”
    - In many applications, input signal gain may suddenly change dramatically (think of two cell phones, one near and one far away from a cell phone tower)
    - Before a D/A converter
- Want large signal to maximize signal-to-quantization-noise
- Want signal not so large that it saturates often and distorts signal
- AGC is also used to compensate for temperature and process variations
AGC Example

- Camcorder

Gain Control

Gain Control adjusts the amount of video signal generated depending upon lighting and shooting conditions. The XL1S includes gain controls that are switchable between automatic and manual control. The XL1S automatically controls the camera gain in the Green Mode or Spotlight recording programs and Automatic Gain Control (AGC) can also be selected via the gain control knob. AGC is typically used to maintain a constant video luminance level by boosting weak (low light) picture signals electronically. You can also manually adjust the GAIN dial to other preset levels that range from -3 to +30 dB. The gain level you select appears in the viewfinder. Use lowest gain levels for lowest noise recording for indoor, low light or low contrast scenes. Zero or balanced gain (0dB) is used for low noise, color reproduction of illuminated scenes. Higher gain settings are used to increase light capture to brighten indoor or low-light scenes when an open iris does not supply sufficient signal. Higher gain settings also enable you to increase the depth of field using a smaller iris aperture.
AGC Example

- Hearing aid

E 26 AGC BTE

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You can purchase this aid without having to make custom ear molds and without a prescription.

This miniature, output compression aid is ideal for a person with a mild to moderately severe hearing loss, but no greater than 60 decibels. This superior-quality, small, high-performance aid is designed for maximum comfort with minimum visibility.

The aid has (AGC) which automatically limits loud sounds, also a low and high frequency adjustment. The aid has a convenient on/off switch, telephone switch, readily accessible volume control on the top of this hearing aid and uses a common size (#13) battery. An added bonus is this hearing aid and tips will fit either the right or left ear.

All of our hearing aids come with a one-year manufacturer’s warranty along with a money-back guarantee.
AGC Architectures

• **Feedforward**
  – Fast convergence: sees input same time as VGA
  – Stable: no feedback
  – A/D after analog VGA
AGC Architectures

• Feedback AGC
  – Slower converging
  – Generally better control
  – Now have delay from signal to VGA control
  – Gain control now can be a digital circuit
AGC Enhancements

• Many algorithms are designed to adjust gain quickly and accurately
• In many communications systems, the faster an AGC can acquire and lock on a signal’s amplitude, the more time there is for training, which likely results in better system performance
• Search mode: maximum gain (this is required to detect minimum-strength signals)
• When a signal is detected:
  – Small signal is probably the simple case
  – Large signal will produce large amounts of clipping $\rightarrow$ drop gain faster
    – There are an endless number of algorithms to accurately estimate large signals (e.g., estimate slope) and many depend on signal specifics