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Camera Specifications

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What are specifications?

- A **specification** is an explicit set of requirements to be satisfied by a material, product, or service.

  A technical specification may be developed privately, for example by a corporation, regulatory body, military, etc: It is usually under the umbrella of a quality management system. It can also be developed by standards organizations which often have more diverse input and usually develop voluntary standards…

  Source: Wikipedia

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Why do you need specifications?

- To make sure the product you are considering will meet your needs.
- To help you compare different products from the same manufacturer or from competing manufacturers.
- To help you predict the quality and performance of the product.

Why do manufacturers need specifications?

- To help sell the product.
  - Position it in the marketplace.
  - Highlight advantages.
  - Minimize shortcomings.
  - Insure a good fit for the intended use.
  - Justify price – performance.

What are the key camera specifications?

- Configuration & Capabilities
  - Items that are purely objective.
  - Things that you can easily determine yourself if you had the camera in front of you.
- Performance parameters
  - Items that tell you how good the camera is.
  - To be meaningful, you must know how the performance is measured.
- Component design
  - Items that do not directly tell you how well the camera will perform, but that you can use to infer quality.

Caveat Emptor!

- Configuration & Capabilities
  - Don’t assume a feature is present if it isn’t listed.
  - It may or may not be an oversight.
- Performance parameters
  - Each manufacturer may use different methods to measure performance parameters. This makes it difficult, if not impossible, to accurately compare specifications.
- Component design
  - Predicating performance on component design is a trap.
  - Rules of thumb can change very quickly.
  - Just because a camera uses a certain technology doesn’t necessarily tell you how well the camera will actually perform.

Configuration & Capabilities

- Number and type of video inputs and outputs
- Number and type of audio inputs and outputs
- Control interface
- TC IN, TC OUT, TC Loop-through
- Genlock Input, Genlock Output
- Return video
- Transmission interface (fiber, triax)
- Intercom
- Lens mount
- Audio and Video monitoring capability
- Number and type of ND Filters
- Number and type of CC Filters

Configuration & Capabilities

- Supported Video Standards
  - NTSC
  - PAL
  - 24p
- Supported Formats / System Frequencies
  - 60p, 60i, 59.94i, 50i, 30p, 29.97p, 25p, 24p, 23.98p
- Supported Resolution
  - 1920x1080
  - 1280x720
  - 2k, 4k, 6k
  - 720x486
  - 720x480
  - 720x576

Configuration & Capabilities

- Size
- Weight
- Power consumption
- Power sources (battery types), DC input, AC input.
- Mounting
- Included accessories
- Optional accessories
- Viewfinder
- Recording Media

Configuration & Capabilities (Video – Advanced)

- Speed Ramping
- 3-2 Pull-down
- Dual Link / 3G
- S-Gamut
- Skin Tone Detail (How many)
- Matrix
- Gamma (Types, User, S-log)
- Metadata Support
- User interface
- Gain
- Shutter Speeds
- Over and Under Crank

Configuration & Capabilities (Audio – Advanced)

- Sample Rate
- Bit depth
- Uncompressed / Compressed
- Compression algorithm
- Data compatible (AC-3 or DolbyE)
- Timing & Delay

Configuration & Capabilities (Computer Interface)

- i.LINK / Firewire / IEEE-1394
- Ethernet
- USB

- Critical questions:
  - What capabilities are supported?
  - What is the real-world throughput?
  - What 3rd party vendors support the standard?

Performance Parameters (Video)

- Sensitivity
- Minimum Illumination
- S/N
- Horizontal Resolution (Optical Block)
- Horizontal Resolution (Output)
- Chroma sub-sampling
- Smear Level

Performance Parameters (Video)

- Sensitivity: Indicates a cameras ability to shoot in low-light areas without noise being introduced.

  Measured as: f__ @ 2000 lux (3200K, 89.9%, 0db gain)

- Minimum Illumination: Indicates the minimum amount of light required for shooting with a camera.

  Measured as: __ lux with f__

  Sensitivity defines a camera's raw response to light while Minimum illumination describes the lowest light level in which a camera can capture images without taking noise factors into account.

Performance Parameters (Video)

- S/N – Signal to Noise Ratio. Measured in db.
  - db is a logarithmic scale.
  - A 3db difference between two values is a doubling of the noise!
  - Be sure to look for any mention of Noise Reduction being turned On or Off

- Typical values:
  - Very high end cameras 56 to 55 db
  - High end cameras 55 to 54 db
  - Middle range cameras 53 to 54 db
  - Low end cameras May not be listed.

Performance Parameters (Video)

- Resolution
  - Optical block
    - Measured in pixel matrix, e.g. 1920x1080, 1440x1080
    - Measured in pixel count, e.g. 2.1 million pixels
  - Output
    - Measured as output standard, e.g. 1920x1080, 1270x720
  - Horizontal Resolution (Output)
    - Measured as horizontal lines resolved, e.g. 1000 lines

Performance Parameters (Video)

- Chroma sub-sampling: listed as a ratio between the luminance signal and the chroma signals.
  - 4:4:4 RGB signal – no sub-sampling
  - 4:2:2 Standard broadcast & production sub-sampling
  - 4:2:0 Chroma channels further sub-sampled vertically
  - 4:1:1 Chroma channels further sub-sampled horizontally
  - 3:1:1 Luminance and chroma channels are sub-sampled

- WARNING: Sub-sampling numbers are a ratio and are meaningless without reference to a video standard. All 4:2:2 are not created equal!

Performance Parameters (Video)

- Smear Level – Vertical line through extremely bright areas. This is caused by the intrinsic design of CCDs.

- CMOS imagers are immune to smear.

- Measured in db. Modern cameras may have values as high as 120 db to 160 db. At these levels smear is a virtual non-issue.

Performance Parameters (Audio)

- Frequency Response
- Dynamic Range
- Cross Talk
- S/N
- Wow & Flutter
- Total Harmonic Distortion (THD)

Component Design

- Type of optical block
  - CCD vs CMOS
  - 1-chip vs 3-chip
  - Native resolution vs derived or effective resolution
  - Size
- A/D resolution in bits
- DSP bit depth

- Trying to infer camera performance based on design is a useful but imperfect science. Designs quickly change negating rules of thumb. For example: today's IT CCDs outperform yesterdays FIT CCDs.

What's missing?

- Cost!
- In general, you get what you pay for.
- Quality and capability are constantly improving.
- The differences between the high-end and the low-end are no longer as obvious as they once were. But, the differences do exist and are critical for some applications.

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Questions?

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Thank you!

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