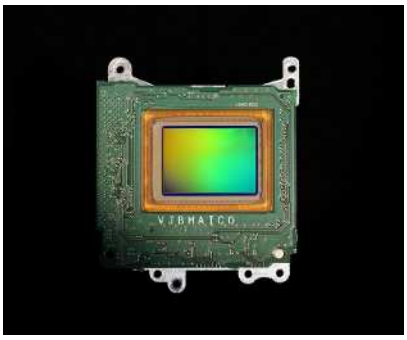
AG-AF100, Large Image Sensor Camcorder



Through 24p recording on the AG-DVX100, variable frame rate recording with the Varicams and AG-HVX200, Panasonic has continually been the first to provide new technologies for professional video creation.
A 4/3 inch image sensor, originally developed for use in digital still cameras is used in the AG-AF100 to record video. This camera represents the next generation of video cameras, and through the use of a large image sensor and interchangeable lenses, will greatly expand the creative options available to each user.

Image Sensor



A newly developed 4/3 inch MOS Image sensor is used in this camera. Normally, the aspect ratio for still images is 4:3 or 3:2 (some cameras are 1:1), while the aspect ratio for HD video is 16:9. In the case of the AG-AF100, the 16:9 aspect effective video area is positioned on the image sensor surface, and the total effective number of pixels on the image sensor is 12.4 million.

1. Pixel Count and RGB signals

In the most professional video cameras, the incoming light will be separated to R(Red), G(Green) and B(Blue) components by a prism, and then received by 3 individual image sensors. This is known as a 3CCD (or 3MOS) system. In the case of large-sensor still cameras, the RGB color filter is located in front of the light receiving component of the sensor, to create the RGB filter.

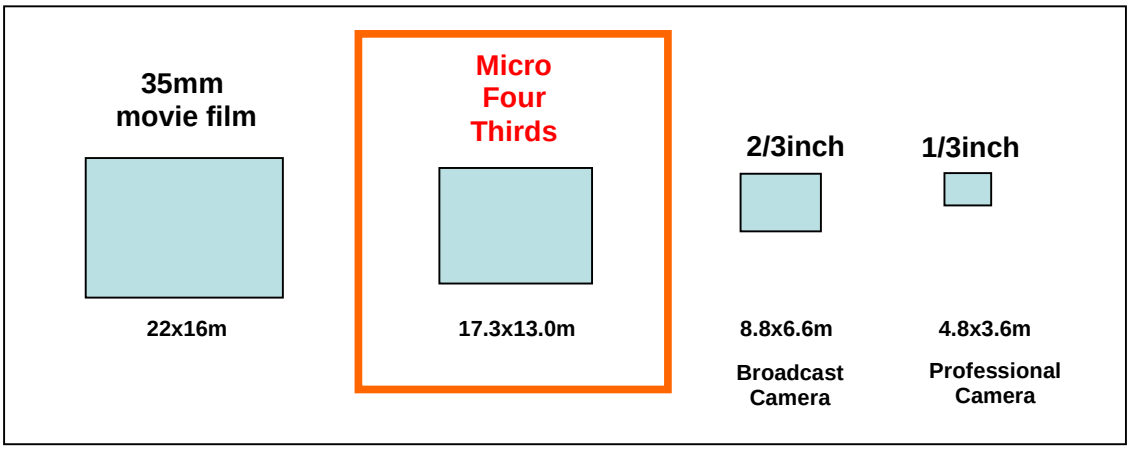
In order to create a video signal of Y, Pb, Pr, the ratio of RGB will be R:1, G:2, B:1. The reason for this is that the human viewing system is much more sensitive to green than to other colours, and cues for overall luminosity are taken from the green signal. In attempting to improve image quality, the most effective way is to increase the information contained in the green signal, so the pixels on the sensor are distributed in the ratio of R:1, G:2, B:1. Because the 12.4 million pixels on the sensor of the AG-AF100 are distributed in this way, there will be approximately six million green pixels, and three million each of red and green blue pixels. The camera outputs an HD video signal, or 1920 x 1080 pixels, and the ratio remains the same, so the luminosity signal (Y) is made from approximately two million dots, with the colour difference signals (Pb and Pr) containing approximately one million dots each. In the case of the luminosity signal, an approximately two million pixel signal must be created from the originally captured six million pixels. In order to do this, Panasonic's unique advanced signal processing technology is used to obtain the proper balance between image characteristics such as resolution, sensitivity and dynamic range to create the best, most natural looking image. (Many still cameras capable of shooting video use a process known as line skipping, but this is not used in the AG-AF100, as it causes aliasing.

2. Sensor size and cutout size

The size of a 4/3 inch sensor is defined as 17.3mm x 13mm, similar to the size of 35mm film (22mm x 16mm). The 2/3 inch sensors commonly used in high-end video cameras measure 8.8mm x 6.6mm, making 4/3 inch sensors about four times larger

than 2/3 inch sensors. A large sensor allows for achievement of shallow depth of field, increasing creative choices for the shooter, as well as the possibility to use brighter lenses.





There are even larger sensors, such as those used on 35mm still cameras (full frame), but these however cause numerous problems when shooting video:

1. Since the sensors are developed primarily for still photo use, they have a very high pixel count (ex. 20 million), and when in video mode, must process sixty images per second. This leads to an increase in the operating frequency, and makes it necessary to either reduce the recorded frames per second or record for short periods only to avoid internal overheating.
2. For shooters used to working with 35mm film, the depth of field when shooting with 35mm still (full frame) cameras is too shallow, resulting in the blur being too strong.
3. Prime and Master Prime lenses designed for 35mm or Super35 film do not cover the full image area of a 35mm still image (full frame).

4/3 inch image sensors do not carry any of the above problems, and because the flange back (the distance between the lens mount and sensor) is short, allowing for the use of nearly any available lens (details later in this document.).

On the AG-AF100, a 17.8mm x 10mm 16:9 section is used from the 4/3 inch sensor to create an HD signal. The actual sensor is slightly larger than the four thirds standard of 17.3mm x 13mm, which is used to its full extent for the most possible effective pixels.

There are many applications and websites available that will reproduce the angle of view and depth of field when the effective sensor size and lens characteristics are entered. Please try these tools to get detailed examples.

3. Optimizing the sensor for video images.

1. Reducing Aliasing with an Optical Filter

The resolution available on Digital Single Lens Reflex (DSLR) cameras has been rapidly increasing, to the point that now over 10 megapixels is commonplace. For still images, there is no restriction on resolution other than file size, but as previously discussed, the resolution of HD video is set at around two million pixels.
Still cameras are designed to allow high frequency optical elements to pass through as much as possible, for the highest possible resolution on the sensor. However, when using lenses designed for still photos for video, any high frequency light over two million pixels will cause noise, and when shooting a subject with a precise pattern, such as a brick wall, an inaccurately coloured pattern of noise, known as aliasing, can appear. Because the AG-AF105 has been designed to mainly shoot moving images, a filter optimized for HD video has been included in front of the sensor to eliminate all high frequency light not necessary for video.
In addition, the signal processing circuits have been developed to be able to reduce the amount of aliasing as much as possible, resulting in greatly improved aliasing in comparison to digital still cameras.



Original Image

AG-AF105



Digital Still Camera



2. Reduction of Skew with a High-Speed Shutter

The advantages to using a MOS sensor are a reduction in electricity consumption and an improvement in resolution, but due to the difference in timing between the scanning of the top and the bottom of the frame (rolling shutter), a phenomenon known as skew occurs. On the AG-AF100, high-speed scanning technology has been adopted, resulting in a drastic reduction in the appearance of skew.

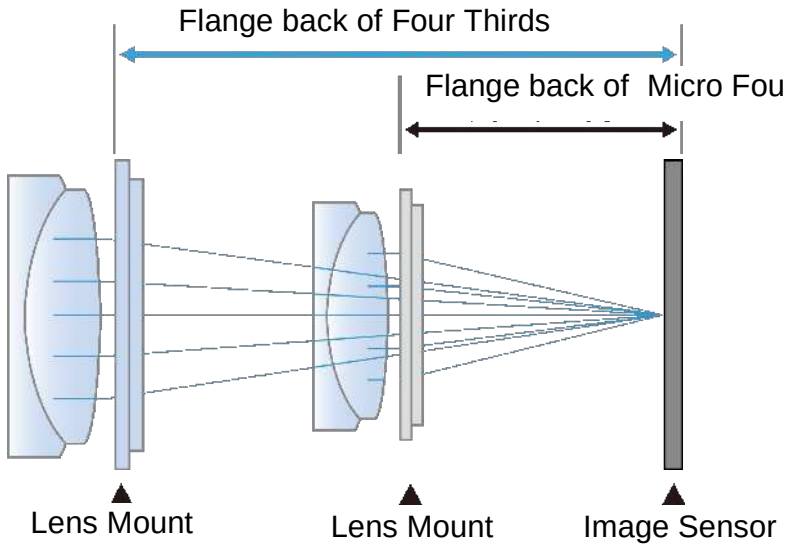
Mount and Various Lenses

In order to offer the ability to change lenses, the Micro Four-thirds mount, jointly developed by Panasonic and Olympus has been adopted in the AG-AF100. The mounts designed to cover a 4/3 inch sensor are Four-thirds (FTS) and Micro Four-thirds (mFTS). In order to achieve a compact camera body and be able to accept the greatest range of lenses, the AG-AF100 uses the Micro Four-thirds mount. The electronic signals are identical between the two mounts, so with the suitable Panasonic adapter, the auto focus and auto iris functions on Four-thirds lenses can be used with the AG-AF100.



Four-thirds Mount **Micro Four-thirds Mount**

The Flange back distance of mFTS is extremely short at approximately 20mm, meaning that nearly every lens, including those designed for 35mm still cameras can be used with an adapter.



Flange back distance of various mounts

Mount	Flange back (mm)
C mount (16mm movie)	17.5
Micro Four Thirds	Approx. 20
Leica M	27.8
Leica L	28.8
Olympus Pen F	28.9
Four Thirds	38.7
Canon FD	42.0
Minolta SR/MD	43.5
Canon EOS	44.0
SONY α (Minolta α)	44.5
Pentax K	45.5
Olympus OM	46.0
Nikon F	46.5
Leica R	47.15
PL	52.0



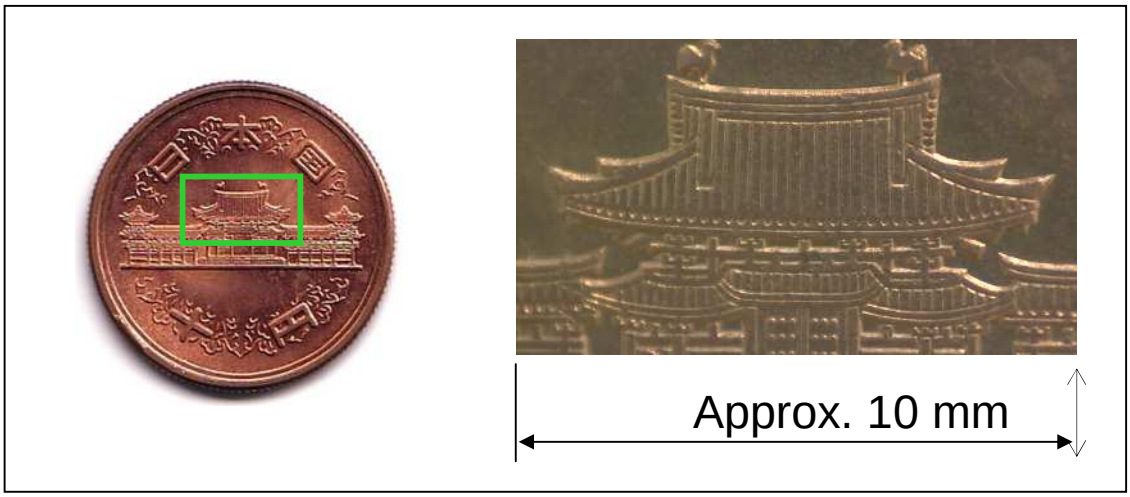
Caution: Depending on the lens and mount combination, some features may be unusable.

There are many adapters and lens-shift systems available on the market to further increase the creative options for shooters.
Below two such examples are introduced.

1. Shooting with a shift-lens adapter.
This is done by attaching the lens on a slant so that only one part of the frame is in focus and everything else is out of focus, giving the scene an appearance of being a diorama, or miniature scene.



2. Shooting with a Macro Lens.
By using a close-up lens, or a regular lens attached in reverse with an adapter, it is easy to shoot an extremely small area.



Features for Shooting Video

1. ND Filter

When shooting still photos, the amount of light allowed through to the sensor is normally controlled by adjusting the aperture of the lens and the shutter speed. When shooting moving images, however, the shutter speed is adjusted to create varied effects on movements, so ND filters are necessary to control the amount of light. For example, when shooting in bright conditions and wanting to have a shallow depth of field: the shooter wants to keep the aperture as wide open as possible, and wants to have the shutter set to 1/48 of a second in order to have movement suitable for shooting at 24p. In this situation, the scene will be far too bright without the use of an ND filter. The AG-AF100 includes three steps of ND filter, at 1/4, 1/16 and 1/64, increasing shooters' options in bright environments.

2. Audio Recording

In addition to video, audio recording is also a very important feature of video cameras. Because the AG-AF100 records audio in absolute synchronization with the video, it also features two XLR connectors for using external microphones, and supports phantom power for the microphones. Additionally, for the first time in an AVCCAM product, LPCM (Linear Pulse Code Modulation 16bit 48khz) audio recording is supported, in the highest quality PH mode.

3. Long Recording Times

The AG-AF100 uses SD/SDHC/SDXC cards as recording media. Using a 64GB SDXC card, the camera is capable of six hours of continuous recording even in the highest quality PH mode. Since the camera is equipped with two card slots, it is possible to record continuously for twelve hours in total.

4. 1080/24p & VFR

24p has been a mark of Panasonic products for a long time, so is obviously included in the AG-AF100. In addition, VFR (Variable Frame Rate) recording is available while recording at 1920 x 1080 resolution. The recording format is 24p or 30p (25p in 50Hz regions), but the recorded frames per second can be set to any of twenty choices

between 12 and 60. The result is the ability to easily use a variety of effects from quick motion to smooth slow motion.

5. Others

In the AG-AF100, in order to increase the freedom and convenience of shooters, the following features have been included.
For details, please see a catalogue or the Panasonic website.

1. Removable handle and grip
2. 1/4”, centre, 3/8” screw holes on bottom
3. Two 1/4”, 3/8” screw holes and shoe on top handle
4. Two 1/4” screw holes and shoe when top handle removed
5. Four 1/4” screw holes and shoe when grip removed.
6. Hook for measuring tape
7. Simultaneous HD-SDI and HDMI output (some restrictions depending on mode)
8. Multiple safety markers
9. In Film Cam mode, sensitivity is displayed in ISO, and synchro scan is displayed in degrees
10. Multiple gammas and DRS (Dynamic Range Stretch)
11. Focus Assist tools (Focus bar and focus in red)
12. WFM (Waveform monitor) and vectorscope display
13. Face tracking auto focus and exposure
14. Adjustable colour temperature settings.
15. Minus gain
16. Monochrome mode

The AF-100 is an HD video camera that provides professionals the full control over creative expression that they need. We look forward to it being used by professionals for work of all kinds.