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WHICH HD ENDOSCOPIC CAMERA?

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Welcome

Thank you for downloading this independent review. There are a few HD endoscopic cameras currently on the market to choose from - and (not surprisingly) everyone says theirs is the best. So how can you differentiate one from the other?

It is worth noting that all cameras (endoscopic or not) are fundamentally based on internationally standardised video technology (No endoscopic company makes a CCD camera chip or an LCD monitor, by the way). This is a good thing, otherwise you might be given non-standard, proprietary video images that can only be viewed on their own monitor and recorded on their recording device. It also means that a comparison is possible since they share common signal formats and transmission media.

The cameras covered in this review are rigid scopes and they are Olympus, Stryker, Storz, Smith and Nephew and ConMed Linvatec.

How independent?

Before you read much further, you will probably want to know exactly how independent is OR Networks Ltd – and what we actually do to be able to advise on HD endoscopic cameras.

Well, we do not manufacture or sell any endoscopes – but we do use them in our integrated theatres and they are often the primary camera source for our video teaching links.

In the interests of openness, I will state that we have closer working relationships with some manufacturers than others, but I offer no opinion as to which camera is better for you, only an explanation of the claims and some advice on terminology to help you select.

Of course, there are many other factors that should be considered – not least support and after sales service.

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So what is HD?

HD is the new thing in television, it stands for High Definition, or to be more accurate, Higher Definition [than what you used to have]. Your old cameras, and TV set at home, are now called SD – Standard Definition – although this term didn't exist before HD – it was invented to enable differentiation.

Typically SD is 768 pixels wide by 576 pixels high. This is only roughly; it could be as little as 480 pixels high.

HD is most commonly available in 720p, 1080i and 1080p. The numbers refer to the number of lines from top to bottom of the screen - a more detailed description of these terms follows.

HD is also commonly associated with these confusing sub-divisions:

- Progressive scan or interlaced
- HD Ready
- 16:9 or 4:3 aspect ratio(widescreen or not)
- 1080p, 1080i or 720p
- Native Resolution
- True HD

Progressive or Interlaced

Each moving picture you see is still achieved in the same way as the very first cinema films, i.e. a series of fast changing (flicking) still images.

In film, these "frames" are still photographs. In video, each frame is built up by a series of rapidly drawn lines from top to bottom.

The **i** or the **p** refer to whether these lines are drawn one after the other (line 1, then line 2, line 3 etc to line 1080, before going back to the top again for the start of the next frame), namely progressively. Or where every other line is drawn first (line 1, line 3, line 5……line 1079) and then the gaps (line2, 4….1080). The even lines being "interlaced" with the odd lines – we refer to these as odd and even fields.

Generally, interlaced offers better resolution for slow moving or still images and progressive is better for faster moving images (this statement is dependent on how fast, how bright and what type of exposure e.g. high speed shuttering).

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HD Ready

This is a bit of a marketing term – some displays will take in a high resolution HD image and offer you a "better" image than SD but not quite as high as the input it received.

The problem is that consumer HD (BBC or Sky) in your home TV is not as high as 1080p or 1080i – it operates at 720 lines (progressive).

So make sure that if your camera is 1080p, that your screen is "native" 1080p, otherwise you will be throwing away resolution.

Widescreen

Some HD endoscopes are widescreen and some are not – really that is it - however:

The manufacturers of models that are, make arguments for why widescreen is better and add that those that are not widescreen, are therefore, not "true" HD. *This is not true*.

4:3 in 1080 lines is 1440 pixels wide by 1080 lines top to bottom - much higher than SD 4:3 – and therefore can rightly claim to be HD.

The makers of this type (Olympus being one) pose the question of whether you need or want widescreen – the makers of widescreen ones (e.g. Storz) say of course you do.

The answer is to try it and see for yourselves – but they are both HD.

That said, widescreen may well suit you more, and it is true that it could potentially offer you a higher horizontal resolution (but only on a widescreen monitor).

1080p, 1080i or 720p

Under general conditions, it would be fair to say that 1080p and 1080i are higher resolution than 720p. However, things change dramatically when the subject is moving: then, the faster you can redraw the image the better and 1080p is most commonly only half the frame rate of 720p (24 fps c.f. 50) or 1080i and so this causes smearing of the image.

720p and 1080i can scan at twice the rate, so a moving image is sharper.
Only 1080p/50 can claim to be the best all round.

Native Resolution

Unfortunately, the resolutions stated above refer to the output resolution of the camera, and they are often called "native resolution" on the brochure, which is not necessarily true.

All endoscopes producing HD images have a CCD or three of them (one for each colour). The trouble with 1920 x 1080 pixels on a chip is that it is an odd shape and too big – so they do not do that.

Most use smaller chips to fit in the smaller housing but the manufacturers may be reluctant to tell you the size and make of the chip – they could be Toshiba, Sony who knows.

One thing for sure is that the are probably nowhere near 1920 x 1080. One manufacturer is reported to be using 960 x 540 pixels – some considerable way short – one quarter.

The reason I am reluctant to say who that is, is because it might very well not matter too much. All camera manufacturers play around with the raw data and use interpolation and pixel offset to increase their monochrome resolution - basically it makes it up in an educated way.

So when you are told that a camera is outputting "true HD" at 1920 x 1080. It may well be true, but the image didn't start out that way – *of course they may not tell you that*.

So, the question to ask is "what is the native resolution of the CCD(s) in the camera head?

True HD

The problem is that the term "true HD" does not mean very much and is often misused to differentiate one make from the other. For example, the big "widescreen" question or whether it is 1080p or not.

DVI, SDI or Analogue?

Digital is the "be all and end all" from a marketing point of view. However, I often see much better images from analogue VGA, YUV or RGB and there is good reason for it.

Basically, analogue will give you an infinite number of shades of one colour.

Digital must be compressed and will give you shades in steps (admittedly very small ones). But the more you compress the bigger and less accurate these steps become.

Equally, analogue signals will travel long distances (e.g. to seminar rooms with little degradation).

DVI

DVI is a computer graphics video format primarily designed to connect a PC to a computer screen – this input type is cheap now that billions of screens use it in offices, schools etc..

DVI has the advantage of easily offering 1080 progressive, it is very fast.

The disadvantage is that it is only good for short runs without converting to fibre or some other signal type, making the system more expensive and introducing a risk of failure.

SDI

SDI was designed for the broadcast market and so, not surprisingly, offers very good video output. In endoscopy, this tends to be limited to 1080 interlaced as opposed to 1080 progressive.

Those that offer 1080p obviously say that 1080i is rubbish, *this is not true*. Try and see if you can tell the difference.

SDI has the advantage of being able to run long distances without introducing more hardware. It is the perfect signal type for integrated theatres and seminar links – that is what it was designed for by the broadcasting industry.

Other factors to consider

The image on the screen is the sum product of a glass to glass, opto-electrical system. A system is often compared to a chain – with it being only as strong as the weakest link. There was never a truer analogy.

Poor light, a bad lens, a mismatched coupler, an old camera or monitor – any of these factors will probably render your image inferior.

Lenses/Couplers

This area is much overlooked in the quality of a video signal.

You must make sure that the optical couplers you have are matched to the size of the sensor in the chip. Older scopes will undoubtedly cast a larger image than required to cover the CCD optimally – this will result in an artifical magnification, with loss of light and will not be using the optimum surfaces of the lens efficiently.

You need to ask what the “effective size” of the camera chip is and make sure your adaptors/couplers are designed for that size chip.

The Acid Test?

The real test is to look at some images and if making a side by side comparision, make sure you have the following covered.

Do Use

1. the same subject and lighting conditions for both cameras
2. good quality lenses matched to the sensor size,
   i.e. the best recommended scope for each camera head.
3. the exact same monitor
4. the same signal type or the best on offer for each
5. a highly detailed image – minute detail – a fine mesh – varying colours

Look for detail in all zones, not just the centre of the screen:

At which magnification is the detail lost, one compared to the other?

Which system gives a better colour reproduction?

When the image moves, does one smear more than the other?

Outline Camera Specifications

Stryker	1280 x 1024 progressive 4:3 format
Storz	1920 x 1080p (output on DVI) widescreen
Conmed	1920 x 1080p (DVI) 1920 x 1080i (SDI)
Smith and Nephew	1920 x 1080i (SDI)
Olympus	1440 x 1080i (SDI)