By Les Simmonds

CCTV Lenses: Glass, Plastic or Coke Bottles?

Have you ever wondered why your CCTV images can end up looking like this distorted camera image?

Last year I wrote a CCTV lens article for Security Electronics Magazine similar to this which caused a stir with some CCTV lens manufacturers (as it turned out, mostly the guilty ones). In that article I didn't mention those funny little things some manufacturers call lenses which are used on low cost PCB cameras and in low cost mini domes. These funny little things are another subject for another day and today I will only talk about what is known as real CCTV lenses.

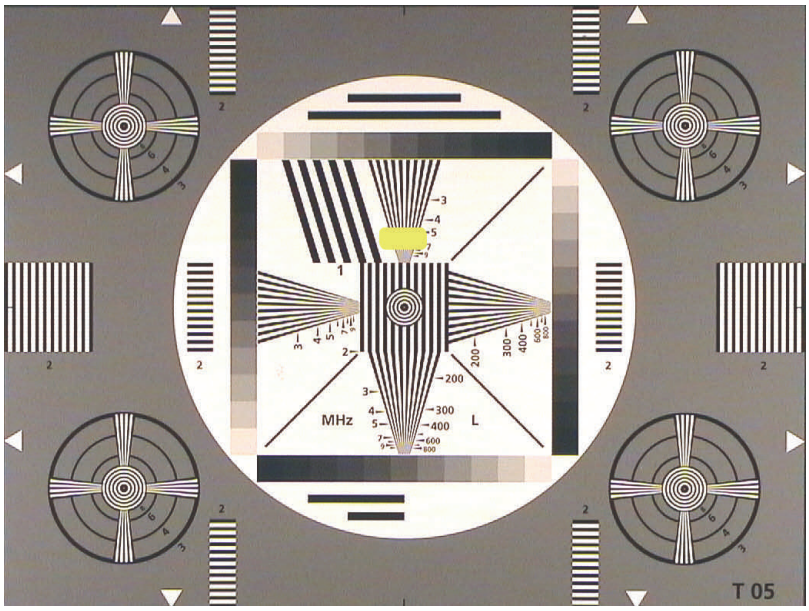
It is unfortunate that some in the CCTV industry forget that the first port of call for any CCTV camera image is the lens. The lens quality and its set up can be the weakest link in a CCTV system.

In this article we find that standard analogue cameras are impacted on by lens quality. If this concerns you, it might frighten you when you put these same lenses on a 3, or higher, Megapixel digital CCTV camera, or even use the supplied integrated lens on a 3, or higher, Megapixel CCTV camera which has not been manufactured by a recognised lens manufacturer. It is of no use at all to use a 3, or higher, Megapixel CCTV camera and then use a lens which does not perform equal to the camera resolution.

I will work you through some of the reasons I found for the reduction of CCTV image quality. My comments will be made taking dome optical distortions, dirty domes, dirty lenses, cobwebs and dirty camera housing face plates out of the equation as my experiences were on a clean test bench. First I will mention some of the issues from the lens article last year and then show the results of lens tests on a few well know brands.

CCTV camera technology and, generally, CCTV camera quality has improved over the past few years, but it does appear that lens quality has dropped in some cases, usually due to some new players and a few old lens manufacturers who have allowed their quality to be reduced as they appear to be catering to the cost driven low quality sector of the CCTV market.

High resolution colour camera manufacturers now claim horizontal resolutions of 460 to 540 TV lines. With these resolutions you would expect to see a similar result on your CCTV system, but when carrying out objective camera testing, we are sometimes lucky to see 350 TV lines or less from these high resolution cam-



Universal camera test chart (RETMA) image showing area of resolution measurements in yellow.

eras. Yes, I said 350 TV lines or less!

In some cases, instead of testing the camera we are actually testing the lens as some lens quality is so poor they mask a CCTV cameras performance. So if this is the case you may ask why spend big dollars on high resolution cameras? Well there are still a few good lens manufacturers out there and I suggest that when you carry out a camera shoot out you also carry out a lens shoot out. You will be amazed at the difference a good quality and correctly set up lens can make when combined with a high performance CCTV camera.

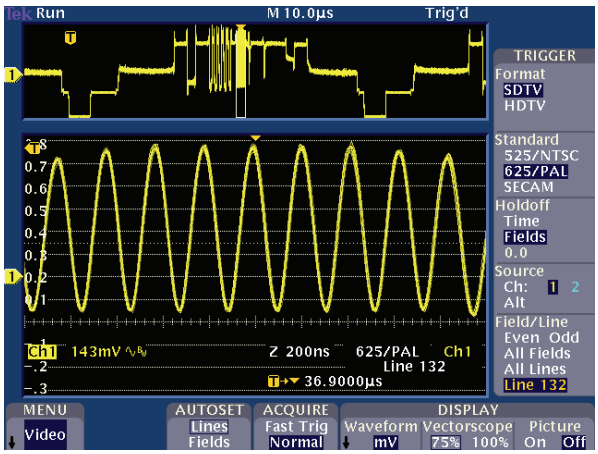
When we are asked to test a camera for a client we ask if they wish to actually test the camera or the camera/lens combination as the results can be vastly different. Up until recently we used a few trusty glass lenses from "real lens manufacturers", but even with these lenses we were not sure if we were testing the camera or the camera/lens combination. As it turns out we were fairly close.

But close isn't good enough when you might be testing cameras for a CCTV system with camera quantities in the hundreds or thousands. Suppliers and manufacturers are not known for their benevolence towards those who recommend against their cameras or other CCTV products so you need accurate test results and plenty of armour. Also, it is not fair to suppliers and manufacturers to eliminate cameras from a test if you have any doubt about the quality and/or calibration of your own test lens or test equipment.

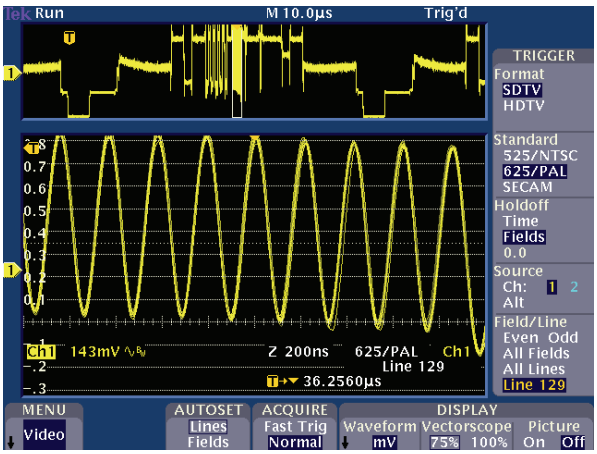
A few years ago we searched for test lenses that would be transparent to camera performance and allow us to truly say these are the performance results for a "CCTV camera". We took a two pronged approach and purchased a C mount to Nikon adaptor. Anyone who knows me knows of my one eyed view of Nikon's Nikkor lenses. We also purchased a Schneider Cinegon 8 mm f1.4 Manual Iris lens which is a very high quality C mount lens. We have found both solutions suitable with the Schneider the more practical of the two.

With our initial tests from the previous "Glass, Plastic or Coke Bottles" article we used a Ganz ZC-Y11PH4 CCTV colour camera which the industry would probably class as a low to medium quality performer. The difference between a high quality and a medium quality lens on this camera is noticeable and would be even more noticeable on a high quality colour or monochrome camera.

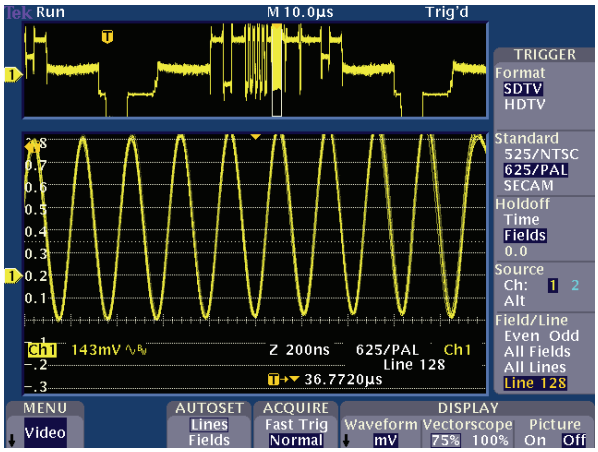
For our lens tests we pondered over supplying lens results as lines per millimetre, contrast transfer functions and/or modulation transfer functions. These results may not be readily identifiable to some readers, so we took the practical and understandable approach, of using a high quality monochrome camera with a true resolution of 570 TV lines and measured the camera output on the resolution wedge of a universal test chart with different lenses.



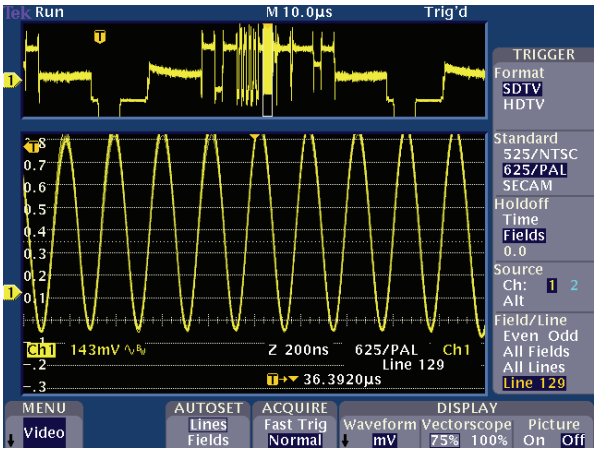
Cosmicar Pentax 8mm f1.4 fixed 1/2" format video controlled auto iris lens, model C814E waveform.



Panasonic 3.8 – 8mm f1.4 vari-focal 1/3" format DC controlled auto iris lens, model WV-LZA61/2E waveform.

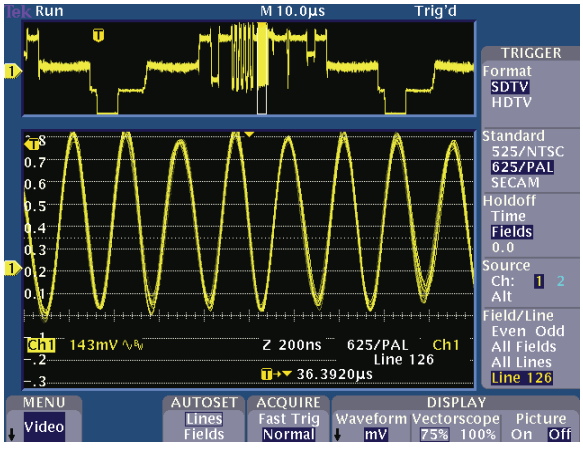


Bosch 3.3 – 8mm f1.4 vari-focal 1/3" format DC controlled auto iris lens, model V2631P waveform.



Fujinon 8mm f1.2 fixed 1/3" format DC controlled auto iris lens, model YF8A-SA2 waveform.

The test setup was a Bosch Dinion XF LTC0385 1/3" 570 TV line monochrome CCTV camera, viewing a universal test chart resolution response wedge, and moving the oscilloscope cursor down the wedge (increasing wedge resolution) until the waveform was about 80% to 100% modulation in the area shown on the universal test chart image. This is a quick and easy method of testing a quantity of lenses. The 80% to 100% modulation is used and usually referenced, instead of the standard resolution test of 5% modulation so that the fiddly variables that may occur at 5% modulation are eliminated. This method is acceptable for lens comparisons and with most lenses we found that by moving the oscilloscope cursor a few more lines down the wedge caused the wedge output to drop away to almost zero.



Computar 3.5 – 8mm f1.4 vari-focal 1/3" format DC controlled auto iris lens, model TG2Z3514FCS-2 waveform.

We tested the following fixed focal lenses and vari-focal lenses:

- Cosmicar Pentax 8mm f1.4 fixed 1/2" format video controlled auto iris lens, model C814E and found its resolution to be better than 570 TV lines (This was the test camera resolution limit).
- Panasonic 3.8 – 8mm f1.4 vari-focal 1/3" format DC controlled auto iris lens, model WV-LZA61/2E and found its resolution to be about 480 TV lines.
- Bosch 3.3 – 8mm f1.4 vari-focal 1/3" format DC controlled auto iris lens, model V2631P and found its resolution to be about 480 TV lines.
- Fujinon 8mm f1.2 fixed 1/3" format DC controlled auto iris lens, model YF8A-SA2 and found its resolution to be about 480 TV lines.
- Computar 3.5 – 8mm f1.4 vari-focal 1/3" format DC controlled auto iris lens, model TG2Z3514FCS-2 and found its resolution to be about 460 TV lines.

In conclusion we found that the Cosmicar Pentax 1/2" format lens had a resolution suitable for high resolution CCTV cameras and would not reduce the camera resolution of cameras up to 570 TV lines. The Panasonic, Bosch, Fujinon and Computar 1/3" format lenses listed above would generally be suitable for high resolution colour CCTV cameras and would not reduce the camera resolution of cameras up to approximately 460 TV lines.

Vari-focal lenses are often used by installers who are lazy and/or unable to do basic lens angle calculations and even though the vari-focal lenses stood up well in the tests above, they have other vices which cause us to recommend fixed focal lenses be used where ever possible.

The list of lenses above is not comprehensive and we acknowledge there may be other major brands that have similar performance, therefore, we strongly recommend you test several brand name lenses at the installation site before you make any purchase.

Les Simmonds is a truly independent CCTV consultant and CCTV testing authority.

Email:
les@cctvconsultants.com.au

Web:
www.cctvconsultants.com.au

This article was originally published in Security Electronics Magazine Australia.