

## SDXC U3 Class II – Don't Waste Your Money!

I had a question during the week about trying to speed up the buffer to memory card write delay. If you are burst mode shooting, and particularly if you shoot RAW + JPEG then the file transfer sizes are quite large and the camera buffer is used to hold these files temporarily until they have been written to the SD card.

Now it's the memory card write speed which will dictate how long it takes for the buffer to empty and allow new images to be captured.



The specific question I was asked was would using a SanDisk Extreme Pro SDXC II work in the FZ300/330 to help with this problem.

Well as you can see on the label these cards are capable of some very high read/write speeds However there are only a few cameras that can use them!

I thought that I would widen this answer to a whole review of memory cards – especially in the light of my recent card failure and loss of images.

### Not Only Relevant for Stills but also Video!

Cameras like the new Panasonic GH5 that can record at very high bitrates, and it's becoming routine for mirrorless and even compact cameras to be able to record at bitrates of up to and over 100 Mb/s when shooting 4K and 6K video. So that the recording doesn't stop unexpectedly or you start losing footage, you'll need a memory card that can keep up with the stream of data the camera is sending to it.

When memory card manufacturers advertise their cards' speeds, the first and largest number they typically use refers to the sequential read speed. That refers to how quickly data can be downloaded from the card. But when recording video or burst mode photos, what you want to look at is the sequential write speed. That's how fast you can get data on to the card. It's often not as clear as it could be; more manufacturers are starting to include it on the packaging, but it's by no means universal yet.

To take advantage of what UHS-II cards can provide, for instance, you'll need a camera or reader that's compatible with UHS-II. If it's not, the card will still work as they're designed to be backward compatible in nearly all cases, however you won't get the highest speeds the card is capable of.

Memory card manufacturers usually measure the speed of their cards in megabytes per second, or MB/s.

However, video recording bitrates are usually measured in megabits per second, or Mb/s (or Mbps, with a lowercase “b”). They’re not the same thing. There are 8 bits in a byte, so to get from megabits per second to megabytes per second you multiply by 8. So 80MB/s is the same as 640Mb/s.

### **X Rating vs MB/s.**

Some manufacturers use a more cryptic x rating in place of MB/s. Lexar, in particular, has long used this system. It comes from the old way of measuring the speed of CD-ROM drives when the standard speed of a CD-ROM drive was 150KB/s. Each x, therefore, equals 150KB/s.

Here are some common values converted to MB/s and Mbps

X Rating	Speed in MB/s	Speed in Mbps
133x	20	160
150x	23	184
200x	30	240
400x	60	480
600x	90	720
633x	95	760
1000x	150	1200

One of the several codes you’ll see on SD cards is either SDHC or SDXC. This isn’t a performance rating, as such. It refers to filesystem used on it, either FAT32 (SDHC) or exFAT (SDXC).

**SDHC** (Secure Digital High Capacity) is a design specification that refers to SD cards that are between 4GB and 32GB in capacity and formatted with the FAT32 filesystem. FAT32 supports individual files up to a maximum of 4GB (which is also why many cameras break up their video files into chunks that are 4GB or less).

**SDXC** (Secure Digital eXtended Capacity) refers to SD cards with a capacity larger than 32GB. They’re formatted in the exFAT filesystem.

### **Speed Rating Defined**

SD cards are given a speed class rating that refers to its category for writing data, with each category describing a real-world video recording use. These apply the same to SDHC and SDXC cards. The most recent types of speed class start with a U or V, as in U3 or V90. Some cards might carry both a U and V rating (and a Class 10 as well, for that matter), in which case you can focus on the higher, which would be the V rating.

**V90.** The V-class is a new designation created for cards that are designed to work with the speeds required for 4K and 8K video. The SD Association added some lower numbers to

make them backward compatible with the older class designations (e.g. Class 10 and Class 6), but the most important ones are V30 and above.

Memory cards in the V90 class are rated to support a minimum sequential write speed of 90MB/sec. Their primary market is for cameras that shoot 8K video, and for now, those are pretty rare, but the class provides room to grow, as it were.

**V60** is applied to cards that support a minimum sequential write speed of 60MB/sec. They're aimed primarily at cameras that record 4K and 8K video. Some of the newer cameras that record with ultra-high bitrates, like the Panasonic GH5, require V60 or above. With other 4K cameras that record at lower bitrates, you might get away with a V30 card.

**V30** is applied to cards that support a minimum sequential write speed of 30MB/sec. These are designed to support at least full HD video and some 4K video cameras.

**U3** is designed to support 4K video recording at a sustained video capture rate of 30MB/s. This class overlaps with the newer V30 class.

**U1** is designed to support real-time broadcasts and HD video (720p and 1080p) with a minimum serial write speed of 10 MB/s. This overlaps with the newer V10 class.

**Class 10** is designed to support 1080p recording at a minimum (but again, not at all framerates) with a minimum serial write speed of 10 MB/s.

**Classes 2, 4, and 6.** Class 2 supports SD video recording with a minimum serial write speed of 2MB/s. Classes 4 and 6 are designed to support from 720p and 1080p video (but not all framerates) with a minimum serial write speed of 4 MB/s and 6 MB/s respectively. Most newer cameras need cards faster than these, so memory cards in these speed classes aren't as commonly available now.

For practical purposes, the most common currently are Class 10, U1, U3, V30, V60, and V90, with V60 and V90 being the current fastest classes. It is technically still possible to find older, slower cards that are Class 2, 4, or 6, but most modern cameras are likely to work better with at least Class 10 cards, especially for recording video.

### **UHS-I vs UHS-II**

Newer SDHC and SDXC cards have a feature called ultra-high-speed bus, which refers to the interface. So far, there is UHS-I and UHS-II. UHS-I supports a maximum bus speed of 104Mb/s, while UHS-II supports up to 312MB/s. The spec for UHS-III, maxing out at 624MB/s, has been announced, but so far I've not seen any implementations of it in the camera world.

The product labelling for cards with this technology will have either UHS-I or UHS-II, or sometimes just I or II. Technically, it should be Roman numerals, but you'll sometimes see it listed with a number 1, like UHS-1, even by some manufacturers.

You can also tell them apart by looking at the cards themselves. UHS-I cards have a single row of pins on the back. UHS-II have two rows. In this example, both of these are SanDisk Extreme Pro cards, just different generations.



The double row of contacts on the later SDXC/SDHC II cards.

Currently very few consumer cameras will utilise the SDXC/SDHC II card structure.

- Olympus OM-D E-M5 II
- Olympus OM-D E-M10 II
- Olympus PEN-F UHS-II
- Olympus OM-D E-M1 II
- Panasonic G9
- Panasonic GH5



MicroSDX Cards are also available with SD adaptors or the micro SD form factor can be used with action cameras, drones and smartphones.

## Formatting SD Cards

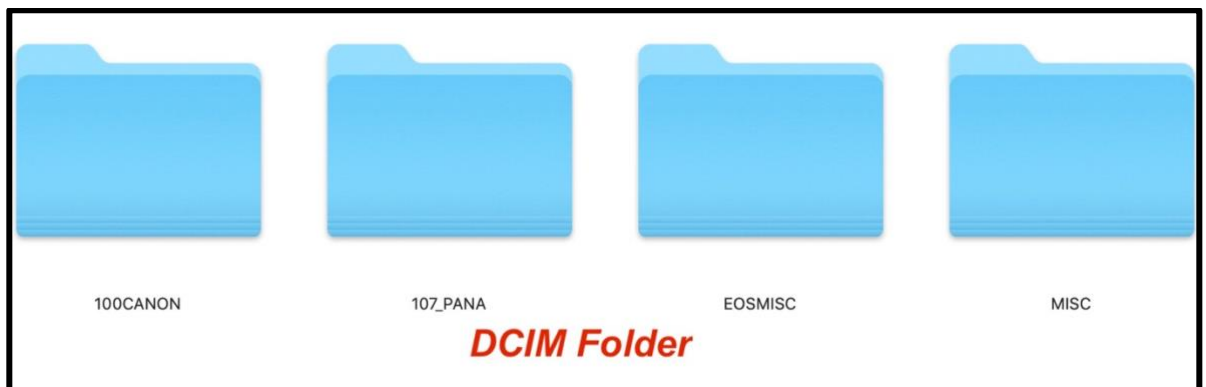
For the memory card to function correctly in your digital device it must be formatted. From the manufacturer it will come formatted in exFAT for the SDXC cards or FAT32 for SD cards 4GB and under. It won't, however, have the file structure required by the device. In a digital camera, for example, it will need the DCIM folder and other folders needed for specific cameras (PRIVATE, MISC and AVCHD for example).

When you first insert a brand new card into your camera you may notice some "write activity" indicated by the memory card access LED.

This is the camera preparing the file structure that it needs.

The DCIM folder is always created however each camera will create additional sub-folders within that for image writing like 100Canon or 100\_Pana.

If you use the same memory card in different cameras you may notice both folder types as shown below.



Just like any other digital storage device the memory card uses a "file allocation table" or FAT (actually its so important that the device maintains two copies of the FAT table) to act as the index to the physical sector on the memory device where the actual file is stored. As each new image is added it is stored on the memory card and its location is added to the FAT table.

If you delete an image the index is removed from the FAT table however the image data is still at the same location on the memory card.

Each image consists of a unique set of pointers and headers (like the EXIF data which describes the type of file structure and its file length).

When you do a "format" in camera normally this just over-writes the FAT table structure it does not erase the image data on the card. It's the same as performing a "Quick Format" on a Windows PC. Think of a book with an index – if you rip out the index the pages are still there will all the original material.

This is why image recovery programs can recover the images rom your memory card (or hard disk) provided that you have not done any subsequent writes to that device as this procedure will allow the memory management of the FAT to put new images into the memory locations that contain your image data as the FAT believes that they are empty!

If you have done a “write” after an accidental format this will reduce the number of files which can be recovered by the recovery software.

If you delete images in camera or in your computer then you mark them as deleted in the FAT table and, just like in a hard drive, create fragmented files.

This fragmentation, unlike on a hard drive where the head may have to move about the surface of the disk quite frequently to gather that data for an image, does not slow down the read/write speed.

In fact if you were to use a defragmentation program on a SD card you are actually contributing to its earlier failure as the cards do have a somewhat fixed number of read/write operations on the memory and defragmentation really adds to this count.

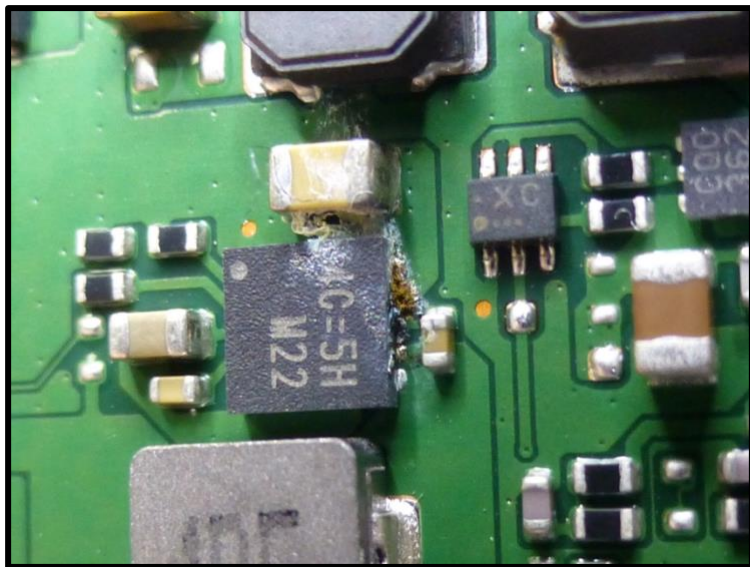
For this reason it is useful, once you have transferred the images from your card to your computer storage, that you reformat the card in the camera.

If your camera supports “Low Level” format (like some Canon cameras) selecting this option also forces the camera to not only clear the FAT structure but also the whole of the memory card.

This is a good way to format the card as it increases the possibility of image recovery should you suffer either some memory card failure or you accidentally format a card that you have not yet transferred the images from to your computer.

### **My FZ1000 II gets returned after repair.**

Finally, after being away for one month, my camera has now been returned after its repair. The total repair bill was £245 as the damage to the camera was due to water damage on the main PCB and also the ribbon flex cable of the viewfinder.



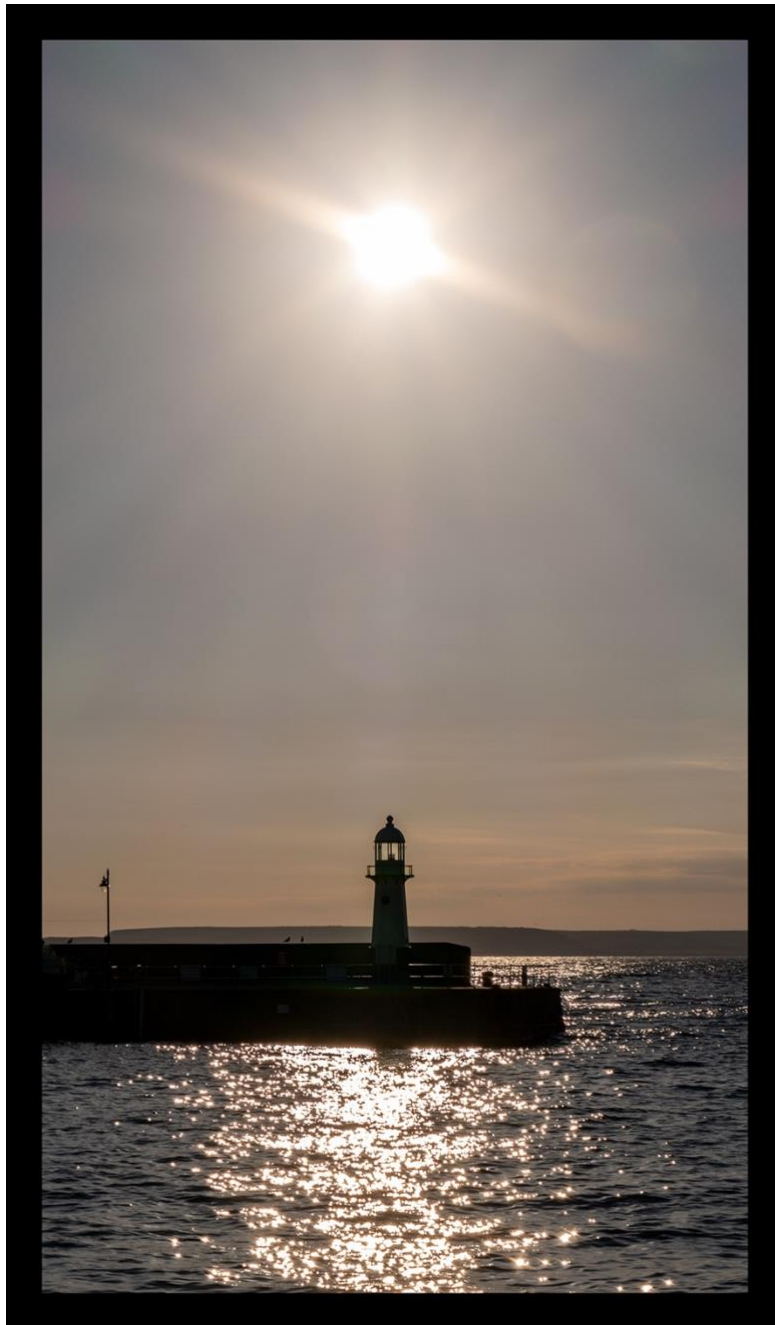
Now the camera has never been out in the rain but was subjected to quite dramatic changes from a cold to a warm and humid camping POD whilst on holiday on Arran during early May. So I can only assume that it was as severe case of internal condensation that formed on the PCB. As the battery was still installed this would set up all kinds of electrolytic action.

I suppose in theory the water would be pure but not de-ionised and any residual flux residue on the PCB could have contributed to the corrosion of the board/ribbon cable connections. *Moral of this story – be aware of condensation in modern electronics!*



One of the first images taken with the returned camera to check on focus and exposure  
JPEG image.

I'm always dubious about the quality of repairs made. After being a service engineer for over 30 years and seen the quality of repairs done by other engineers I'm aware that sometimes the quality of repairs are not done to professional standards or the repair is made treating the effect of the problem rather than really addressing the cause of it. I'm hoping that the repairs made to the camera are carried out with every due care but when a main PCB is replaced do the repair agents really go through all the set up needed that were initially done during the cameras factory set up – things like exposure and ISO gain settings, colour balance and focus? I hope so!

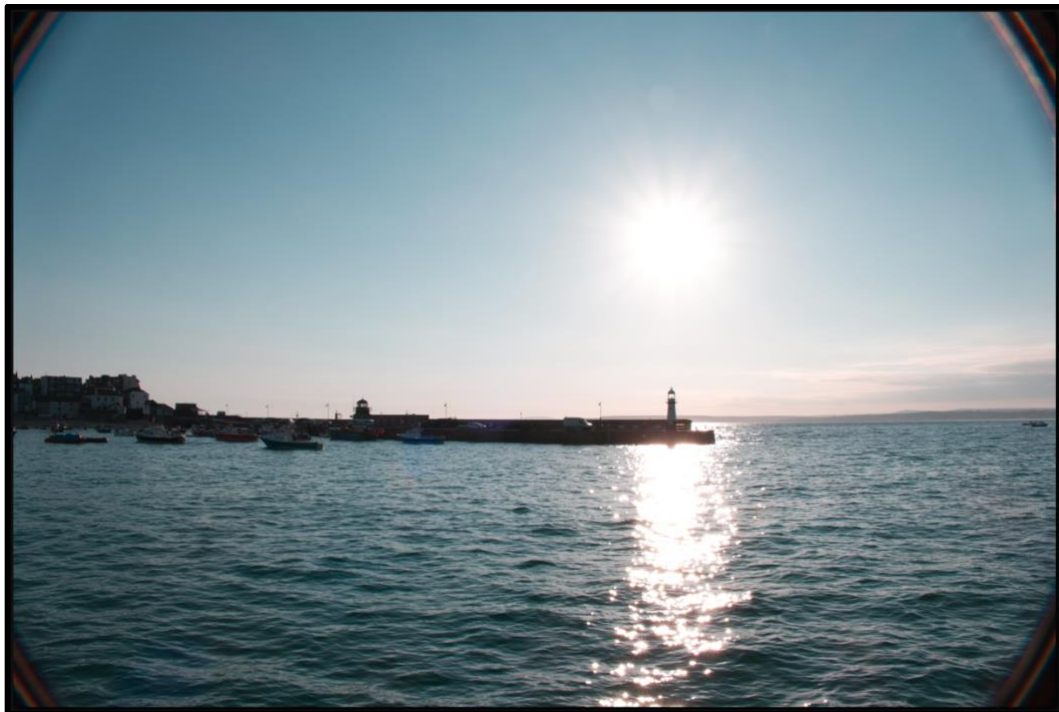


### Lens Flair Love/Hate

During my trip this week to St Ives, Cornwall, England I used my recently repaired FZ1000 II camera. One morning I was up early enough to capture a sunrise over the harbour, from the location that I could safely stand, and waited for the sun to rise directly behind the lighthouse on the harbour. I tried desperately to avoid the lens flair spots by angling the camera, using my spare hand as a “flag” to try and shield the sun but I always ended up with the flair spot on the image at some point. In this shot lens dust is apparent!



With the intensity of the light it is almost impossible to eliminate flare within lenses, even reflections from the sensor surface can double back and cause additional hot spots. Scrupulous lens cleaning of the front element is essential and removing any addition filters that you might have is also very important. Dust within the lens is also likely to show up as white “orbs” on the image and any dust on the sensor will show as darker areas.



Incidentally, using Luminar 3 or Affinity to develop the RW3 images from the FZ1000 II they show the actual image captured by the sensor before cropping and lens adjustments are made for the out of camera JPEG image, shown below.



## Which Bridge Camera Should I Buy?

Quite often I get asked for my opinion on the best of the Panasonic bridge cameras to purchase.

So, the current line up would be the FZ80/82, FZ300/330, FZ1000, FZ1000 II and the FZ2000/2500.



The FZ80/82 and the FZ300/330 are the cameras with the smallest sensor and have the following specifications

### **FZ80/82**

18MP - 1/2.3" BSI-CMOS Sensor  
ISO 80 – 3200 (expands to 6400)  
20-1200 mm F2.8-5.9 Zoom Lens  
Optical Image Stabilization  
3" Fixed Type LCD Screen  
1166k dot Electronic viewfinder  
10 fps continuous shooting  
4K - 3840 x 2160 video resolution  
240 fps High-Speed Video  
Built-in Wi-Fi  
Min Shutter Speed 4s  
Max Shutter Speed 1/2000s  
Continuous Shooting 10.0 fps

### **FZ300/330**

12MP - 1/2.3" CMOS Sensor.  
ISO 100 - 6400.  
25-600 mm F2.8 Zoom Lens.  
5-axis Optical Image Stabilization.  
3" Fully Articulated Screen.  
1440k dot Electronic viewfinder.  
12.0 fps continuous shooting.  
4K - 3840 x 2160 video resolution.  
Video Formats MPEG-4, AVCHD  
Weather sealed  
Min Shutter Speed 60s  
Max Shutter Speed 1/16000s  
Continuous Shooting 12.0 fps

The **FZ1000** has a type 1 inch sensor and the following specifications

20MP – 1” BSI- CMOS Sensor  
ISO 125 – 12800 (expands to 80-25600)  
25-400 mm F2.8-4.0 Zoom Lens  
5-axis Optical Image Stabilization  
3 Fully Articulated Screen  
2359k dot Electronic viewfinder  
12 fps continuous shooting  
4K - 3840 x 2160 video resolution  
Video Formats MPEG-4, AVCHD  
120 fps High-Speed Video  
Built-in Wi-Fi with NFC  
Min Shutter Speed 60s  
Max Shutter Speed 1/4000s  
Continuous Shooting 12.0 fps

The FZ1000 was replaced by the **FZ1000 II** with the following specifications

20MP – 1” BSI-CMOS Sensor  
ISO 125 - 12800  
25-400 mm F2.8-4.0 Zoom Lens  
5-axis Optical Image Stabilization  
3 Fully Articulated Screen  
2360k dot Electronic viewfinder  
12.0 fps continuous shooting  
4K - 3840 x 2160 video resolution  
Video Formats MPEG-4, H.264  
120 fps High-Speed Video  
Built-in Wi-Fi with no NFC  
Min Shutter Speed 60s  
Max Shutter Speed 1/4000s  
Continuous Shooting 12.0 fps

The **FZ2000/2500** was introduced to satisfy the needs of the video market and has the following features.

20MP - 1" BSI-CMOS Sensor  
ISO 125 – 12800 (expands to 80-25600)  
24-480 mm F2.8-4.5 Zoom Lens  
5-axis Optical Image Stabilization  
3 Fully Articulated Screen

2360k dot Electronic viewfinder  
12 fps continuous shooting  
4K - 4096 x 2160 video resolution  
Video Formats MPEG-4, AVCHD, H.264  
Microphone and headphone port  
Built-in Wi-Fi with NFC  
Min Shutter Speed 60s  
Max Shutter Speed 1/4000s  
Continuous Shooting 12.0 fps

I'm going to do a comparison video of the above cameras plus my Canon M50 which really does produce some great images and video. Here are the specs for the M50.

24MP - APS-C CMOS Sensor  
ISO 100 - 25600  
3" Fully Articulated Screen  
No native IS but 5 lenses have optical image stabilisation  
2360k dot Electronic viewfinder  
10.0 fps continuous shooting  
4K - 3840 x 2160 video resolution  
Video Formats MPEG-4, H.264  
Built-in Wi-Fi  
Min Shutter Speed 30s  
Max Shutter Speed 1/4000s  
Continuous Shooting 10.0 fps

The Canon M50 has a Canon EF-M lens mount and currently there are 20 native lenses available for this mount. Users can use the EF-M adapter to use the full selection of Canon EF and EF-S lenses with AF and Image stabilization.

Lenses with IS	35mm EFL
Canon EF-M 18-55mm F3.5-5.6 IS STM	(28.8-88mm)
Canon EF-M 11-22mm F4-5.6 IS STM	(17.6-35.2mm)
Canon EF-M 15-45mm F3.5-6.3 IS STM	(24-72mm)
Canon EF-M 55-200mm F4.5-6.3 IS STM	(88-320mm)
Canon EF-M 18-150mm F3.5-6.3 IS STM	(28.8-240mm)

Since the Canon M50 has a APS-C sensor, it has a focal length multiplier of 1.6x so you have to multiply lenses original focal length with this multiplier to find the Full Frame equivalent focal length (EFL) of the lens when mounted on M50.



FZ1000 II image at 400mm EFL ISO 125 F9 1/500sec

### Using Your Free 1.4x and 2X Teleconversion Lens with Your Panasonic Bridge Camera

I had a feeling that title would grab your attention. However, I'm not pulling your leg, I'm being totally serious. If you're saying "but Panasonic doesn't make teleconverters for their lenses", you would be completely right. However, you might be pleasantly surprised to discover that both of the teleconverters are probably already in your bag if you have any of the Panasonic Lumix bridge cameras (or even MFT ones)!

For those who may not be familiar with what a teleconverter is, think of it as a lens adaptor that turns your lens into a longer focal length lens. It sits normally between a mounted lens and the camera sensor and is usually an accessory.

The two most common optical teleconverter strengths are 1.4x and 2x. If you were using a telephoto lens that was 300mm f4, using the 2x you would end up with a 600mm f8. You can see that although your lens is now effectively twice as long, you've also lost two stops of light. Losing two stops (on a 2x) will really slow your shutter speed down, requiring you to raise your ISO higher than you might want.

For years there has been a feature on many Lumix cameras called "Ex Zoom" or Ext.Opt.Zoom.

The feature is usually found in the Rec (red camera) tab in the menu under image size. The manual isn't particularly clear and doesn't give this amazing feature enough attention.

The EX or EZ zoom mode is not digital zoom. It is achieved within the purely optical range of the camera lens. Some cameras have a separate digital zoom feature, which I suggest you never use, as the quality is usually horrible at best. The only caveat to shooting in the EX – EZ mode is that you can't shoot RAW but only JPGs.

EX- EZ zoom works by masking the sensor. Think of this as the camera putting a piece of tape on part of the sensor and leaving just the centre exposed. There is no interpolation or image degradation happening. The JPG image size setting will determine the amount of masking. More masking means a longer effective focal length (larger teleconverter power). On, say the FZ1000, the Extra Optical Zoom (Ext.Opt.Zoom) is enabled in most capture modes if Picture Size is set in the Rec Menu to [EX M 10Mpx] which allows up to 560mm focal length, or [EX S 5Mpx] which allows up to 800mm focal length. Normal control of the AF area is retained.

Here are some of my other reasons for trying EX or EZ zoom

Your camera is metering for only the area the lens sees, not the whole sensor. This will most likely give you a more accurate meter.

Since you are only focusing on what the lens sees, it'll be easier to focus on your subject. Your camera buffer won't fill up as fast with continuous shooting since the JPEGs are 1/3 to 1/4 smaller than a RAW file.

You'll get significantly more images per memory card. Although memory is cheap these days, getting more images on a card during certain shooting situations might be useful. Due to the masking, the sensor will only see the middle, or sharpest part of a lens.

Unlike i.Zoom, which always produces the same full size image it requires some image pixel interpolation (AKA Guesswork) to produce the increased pixel count, EX or EZ zoom on the other hand always results in the same number of pixels used (EX M or EX S) and requires no interpolation.

Of course all photography has compromises and if you need the large image sizes for larger enlargements then the full sized interpolated i.Zoom method is preferable over EX or EZ zoom method which produces 10M or 5M image sizes and only useful for smaller prints or web based images.

## **Newsletter Publication Changing**

Trying to balance the amount of time I can spend on producing this newsletter, instruction manuals and continue to still produce content for YouTube becomes quite an issue for me during the summer months as there are always lots of other jobs that are needed to be done around the house and garden.

In a couple of weeks our grandchildren have their summer break from nursery and school and I will be looking after both of them for at least 1 day a week over the next 4 weeks. Luckily my wife will be around to take some of the responsibility on the other 2 days that we are needed!

So I'm going to have to reduce the time that I can allocate to bring you this newsletter and it will now be every 4 weeks instead of the current three.

I really hate doing this as I do like to try and bring new content each publication and find topics that might have a wide general appeal.

It seems incredible that only a few years ago I used to do a 9-5 job, still maintained the house, enjoyed my electronics hobby and found time to produce 2-3 videos a week for YouTube and answer every comment and email from them.

Now I wonder where my time really does go!

Three days a week I'm in the gym for 6.30am and do a 1 hour session plus a swim and back home for 8.30am. I'm told this is beneficial for long term health so worth the time investment! After breakfast I respond to all the mails and post out the book orders that I receive and so by about 10.30 I usually begin my day.

If my wife is at her morning classes then I'm free to be productive however if she is at home somehow my time is diverted into other areas.

I'm lucky that she is fairly understanding about what I am trying to achieve but it's hard to ignore the jobs that really have to be done that can only be done at this time of the year.

Normally on Tuesday I have our grandson as my wife has a class to go to so that day is almost written off as at the end of it I'm just too exhausted to do anything!

Of course when I do get a day free and plan to go out and shoot a new tutorial it is inevitably raining here in the NW of England.

On the other, non-gym days I do try to still get up at 5.30am and either plan the next videos or continue to research material for them. I usually get a couple of hours before my wife is up for breakfast and that usually is the end of my free time.

How do you manage your time and prioritise the needs placed upon you. Maybe I've just become terrible at my time management and need some better disciplines in life!

Until the next one, stay safe and well.

*Graham*



*St Ives, 6.00am*