

Rico Pfirstinger

Fuji X Secrets

142 Ways to Make the Most of
Your Fujifilm X Series Camera

Covers the
Fuji X-T3

rockynook

Fuji X Secrets

Rico Pfirstinger studied communications and has been working as a journalist, publicist, and photographer since the mid-'80s. He has written numerous books on a diverse range of topics, from computing technology to digital desktop publishing to sled dog racing. He worked as the department head of special assignments for Hubert Burda Media in Munich, Germany, and he later also served as chief editor for a winter sports website.

After eight years as a freelance film critic in Los Angeles, Rico now lives in Germany and devotes his time to digital photography and compact camera systems.

Rico writes the popular X-Pert Corner blog and leads workshops called Fuji X Secrets where he offers tips and tricks on using the Fujifilm X series cameras.

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Rico Pfirstinger
www.fuji-x-secrets.net

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Project manager: Lisa Brazieal
Marketing manager: Mercedes Murray
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1. YOUR FUJIFILM X SYSTEM

Fujifilm's mirrorless X series consists of more than 30 different cameras with either fixed (FL) or interchangeable lenses (IL). They can be categorized into several families that share the same CMOS sensors and processing engines:

- X100 Classic (FL): 12 MP APS-C Bayer CMOS sensor (Fujifilm/Sony design with CDAF), EXR I engine



Fig. 1: The original X100 was Fujifilm's first X series camera. It features a trademark retro design with pseudo-analog controls, dedicated dials for aperture and shutter speed, and a hybrid viewfinder that can fill a dual role as EVF (electronic viewfinder) or OVF (optical viewfinder). Its Sony-based 12 MP sensor was already a little outdated when the camera launched in spring 2011, but thanks to competent image processing and a 23mmF2 leaf-shutter lens with almost "magic" qualities, the X100 earned plenty of praise, which led to three evenly successful follow-ups: the X100S(second), the X100T(third), and the X100F(fourth).

- X-T3 (IL): 26 MP APS-C X-Trans CMOS 4 sensor (Fujifilm/Sony design with hybrid CDAF/PDAF), X-Processor 4 engine



Fig. 11: The X-T3 is the original fourth-generation model in Fujifilm's system camera lineup. It's not hard to imagine that its back-side-illuminated 26 MP X-Trans CMOS 4 sensor and X-Processor 4 will also appear in future cameras, like a potential X-T30, X-E4, or X-Pro3.

All X series models contain sensors that were manufactured by either Toshiba (2/3") or Sony (APS-C & medium format). They feature on-sensor autofocus with either contrast detection autofocus (CDAF) or hybrid-AF. The latter combines CDAF with phase detection autofocus (PDAF).



BAYER OR X-TRANS?

Another useful X camera categorization is the use of either a Bayer or an X-Trans color filter array (CFA) on the sensor. Cameras from most manufacturers use Bayer sensors (with a simple 2×2 CFA). However, Bayer sensors are quite susceptible to unpleasant moiré effects. That's why cameras with Bayer sensors typically use an anti-aliasing (AA) filter in front of the sensor to mitigate moiré, but at a cost of detail resolution.

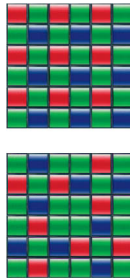


Fig. 12:

Bayer vs. X-Trans: Most cameras use Bayer sensors with a simple repetitive 2×2 color matrix that consists of two green, one blue, and one red pixel (top). Fujifilm's custom X-Trans sensor matrix (bottom) is built upon a more complex 6×6 matrix that mitigates moiré even without an anti-aliasing (AA) filter.

Fujifilm's "exotic" X-Trans color filter array was designed as a better Bayer alternative. X-Trans works without anti-aliasing filters, but thanks to its larger and more complex 6×6 color pattern, it is still quite moiré-proof.

However, not all X series cameras use Fujifilm's X-Trans design. For example, models like the classic X100, the X10, XF1, or X-S1, and the entry-level X-A line all use Bayer sensors with anti-aliasing (AA) filters. The X-T100 and the high-end GFX 50S and GFX 50R even use Bayer sensors without an AA filter.

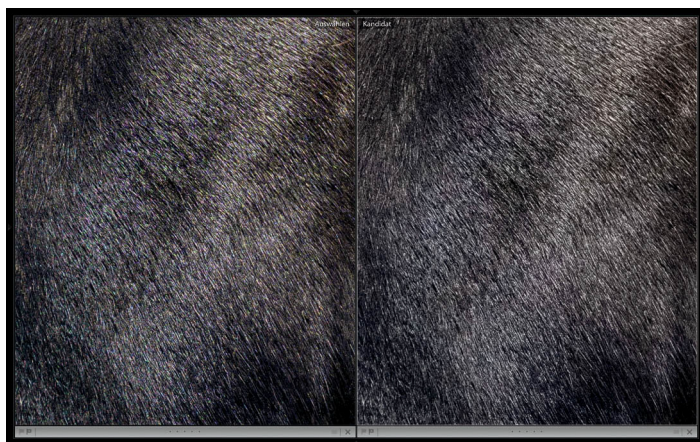


Fig. 13: Using **Bayer sensors without AA filters** can lead to unpleasant moiré effects, especially in the fine structures of textiles, hair, or foliage. This example was taken with the GFX 50S (top). Below you can see a magnified portion with visible moiré (left) in Adobe Lightroom Classic CC. On the right, you can see the same portion of the image after applying Lightroom's anti-moiré brush: the moiré is gone.

The difference between the regular and the newer S-type battery is the latter's improved ability to manage heat. For high-performance applications such as long 4K video recordings in a hot environment, the newer NP-W126S type is favorable, if not mandatory. However, if you already own a bunch of older NP-W126 batteries, you can still use them in your cameras.

There are a few exceptions: The X-H1 and X-T3 demand the newer S-type batteries and will issue a warning when they detect the older type or third-party batteries. These cameras will still work with non-S-type batteries, but there's an increased chance for malfunctions such as freezes as well as compromised performance.

You can obtain NP-W126S batteries from Fujifilm, or you can try compatible products from a variety of third-party vendors. A word of caution: Despite their vendors claiming otherwise, pretty much none of the aftermarket batteries offer the same quality, safety, and capacity as the more expensive Fujifilm batteries. You are likely to experience inaccurate battery life displays with third-party offerings, and the camera may unexpectedly switch off with an empty battery even though the indicator shows there was some power left. To avoid such trouble, use original Fujifilm NP-W126S batteries.

If you store your camera for an extended period without a charged battery, the body's built-in emergency power source may run out of juice, and all camera and user settings will reset to factory conditions.



Fig. 15:
Fujifilm's original NP-W126S battery is without doubt the safest and best-performing choice. It's also more expensive than third-party knock-offs.

Fujifilm's GFX medium format cameras use larger **NP-T125** batteries. As of December 2018, I'm not aware of any third-party alternatives for this rather expensive battery.

Several (mostly older) X series cameras use batteries that are smaller than the standard NP-W126(S): The X100, X100S, X100T, X30, X70, XF10, and X-S1 all require **NP-95** batteries. The X10, X20, and XF1 use even smaller **NP-50** batteries, and the XQ1 and XQ2 require tiny **NP-48** batteries. You can get third-party alternatives for all three types. However, the same reservations as for the NP-W126 knock-offs do apply.

Battery chargers and travel adapters

TIP 3

Along with spare batteries, the aftermarket also offers chargers that work with regular power outlets, USB ports, or a car's cigarette lighter jack. This way, you can charge your batteries not only at home or in your hotel room, but also on your computer's USB port or when you are traveling in a car or plane.



Fig. 16: My personal travel charger is the **Nitecore FX1** [2] with dual slots and a status display (left). This charger connects to any USB-A port (right) and can smart-charge original Fujifilm NP-W126 and NP-W126S batteries with temperature monitoring.

While traveling, don't forget that different countries use different formats for power outlets, so you may want to carry a suitable travel adapter.



Fig. 17:
Some **third-party chargers** can get their power from more than one source, such as power outlets, USB ports, and car cigarette lighter jacks.

As an alternative to external battery chargers, the battery can also be charged inside the camera via the camera's built-in USB port. Use a USB 2 micro cable to connect the camera to pretty much any power source with a USB port, such as your laptop or your cell phone charger. With the X-T2 and X-H1, you can also use a USB 3 micro cable. The X-T3 uses USB-C with Power Delivery support, so you can speed-up charging by using a USB-C power supply with at least 30W and cables that support Power Delivery.

As of December 2018, the X series models that support USB charging are the XQ1, XQ2, X30, X70, XF10, X100T, X100F, X-A3, X-A5, X-A10, X-A20, X-T3, X-T2, X-T20, X-T100, X-E3, and X-H1.

USB chargers and mobile power banks can not only charge X cameras with USB charging capability, they can also power some models while they are switched on and in use. You can find more information on compatible cameras and batteries in a support document on Fujifilm's website [3].



Fig. 18: USB chargers (left) and power banks (right) are useful accessories for road warriors and users who want to power the camera externally for long exposures, video, timelapse, and interval shooting.

Where to find the latest firmware

TIP 4

Fujifilm keeps improving the firmware of your cameras and lenses.

- To check which firmware version is installed in your camera and lens, switch the camera on while pressing and holding the DISP/BACK button.
- You can and should download the latest firmware versions for your cameras and lenses online [4]. While you are there, you can also download current versions of Fuji's application software, such as RAW File Converter EX, Fujifilm X RAW Studio, and Fujifilm X Acquire.
- A step-by-step video guide illustrating the firmware upgrade process is available online [5]. At this Fujifilm support website, macOS [6] and Windows [7] users can also find detailed firmware download instructions for their operating systems.

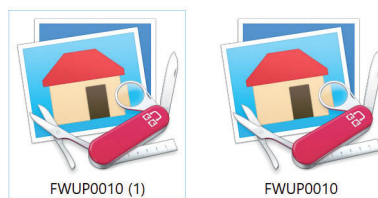


Fig. 20: The **most common mistake** in concert with **Fujifilm firmware updates** is users downloading new firmware into a folder on their PC that already contains older firmware for the same camera model or lens. In this example, the folder already contained an earlier firmware for the X-T2 with the name FWUP0010.DAT. Downloading a newer FWUP0010.DAT firmware file from the Fujifilm webpage lead to a name conflict which was automatically resolved by the PC's operating system: It changed the name of the newer file to FWUP0010 (1).DAT. However, FWUP0010 (1).DAT will not be recognized by the X-T2, because the camera is only looking for firmware update files with the name FWUP0010.DAT.

If the firmware in your camera or lens needs to be updated due to compatibility issues, the camera may alert you of this problem when you switch it on. If that's the case, download the new firmware from the website links provided in tip 4 and update your camera and/or lens.

TIP 6**Wireless firmware updates** using Bluetooth and Wi-Fi

If your camera supports Bluetooth, you can perform wireless firmware updates using your smartphone or tablet and Fujifilm's Camera Remote app, which is available for iOS and Android. As of December 2018, only the X-E3, X-H1, X-T3, and GFX 50R supported this feature—and only for body firmware, not for lenses or accessories. However, it's clear that upcoming X series cameras will support wireless updates, as well, and there's also a chance of firmware enhancements that might bring wireless updates to other Bluetooth-enabled models like the X-A5, X-T100, and XF10.

To use wireless firmware updates, your camera needs a Bluetooth connection to a tablet or smartphone via the Camera Remote app. This app is a free download for iOS and

Android, and there's a useful online manual explaining its various functions [8].

When your Bluetooth-enabled camera is paired with your wireless device, the Camera Remote App will announce the availability of new camera firmware and offer to download it to your smartphone or tablet. From there, the firmware file is transferred to the camera via the camera's Wi-Fi hotspot.

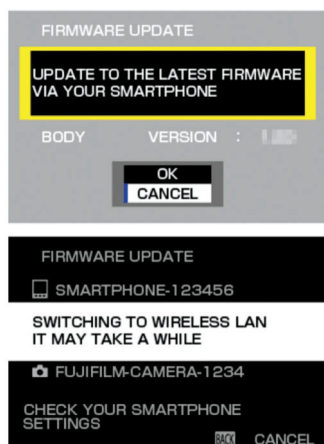


Fig. 21:

Wireless firmware updates:

After the Camera Remote app on your smartphone or tablet has finished downloading a new camera firmware, its Wi-Fi network must be switched to the camera's own hotspot to transfer the firmware file to the camera.

Using Camera Remote is a good alternative for users who want to install new firmware without access to a personal computer. You can find step-by-step instructions for wireless firmware updates online [9].

Which memory cards to use

TIP 7

Turbo-charge your camera and its built-in buffer memory by using the fastest and most reliable UHS-I and UHS-II memory cards:

- For cameras with a superfast UHS-II slot, which offers transmission speeds of up to 300 MB/s, I highly recommend **Sony SF-G** cards with write speeds up to 299 MB/s.

These cards are also known to be particularly reliable and freeze-resistant when used with higher-end camera models like the X-T2, X-H1, X-T3, and GFX. As of December 2018, X series cameras that support UHS-II are the X-T1, X-Pro2 (slot 1 only), X-T2 (both slots), X-H1 (both slots), X-T3 (both slots), GFX 50S (both slots), and GFX 50R (both slots).

- All remaining X series cameras support speeds up to the slower UHS-I standard with transfer rates of 95 MB/s or less. For these cameras (and for slot 2 of the X-Pro2), I recommend **SanDisk Extreme Pro 95 MB/s** cards.



Fig. 22: Fast SanDisk Extreme Pro 95 MB/s SD memory cards are popular workhorses for many serious X series users. They are the perfect choice for cameras with UHS-I support, such as the X-T10, X-E2(S), X-T20, X-E3, X70, and the X100 family. They are also recommended for slot 2 of the X-Pro2 and older models such as the X-Pro1 and X-E1, entry-level cameras like the X-A series and X-M1, the X-T100, and all X series compact cameras.



Fig. 23: For maximum UHS-II performance and compatibility, I recommend superfast Sony SF-G cards. Please note that these cards only make sense in cameras that explicitly support UHS-II, such as the X-T1, X-Pro2 (only slot 1), X-T2, X-H1, X-T3, and GFX. If your camera or card slot doesn't support UHS-II, you are better off using a fast UHS-I card like the SanDisk Extreme Pro 95 MB/s.

Important: Look out for fakes! Sadly, there's a fair share of fake SD cards on the market. High-end brands and models are particularly affected, so make sure to buy your fast UHS-I and UHS-II cards from reputable sources. Fake cards aren't just slower and less reliable than the originals, they also tend to lie about their actual capacity. A fake 64 GB card could, in reality, contain a cheap 8 GB chip with a manipulated controller that simulates 64 GB to the camera, resulting in severe data loss.

Working with dual card slots**TIP 8**

Some X cameras, such as the X-Pro2, X-T2, X-T3, X-H1, and GFX, offer two SD card slots numbered “1” and “2”. This means that you can use two SD cards at the same time.

Please note:

- The primary SD card slot of your dual-slot camera is always slot 1. If you are working with a single SD card, always put it in this slot.
- Firmware upgrades are only supported in slot 1.
- In the X-Pro2, only slot 1 supports UHS-II. The secondary slot only supports UHS-I.
- In the X-T2, X-T3, X-H1, and GFX 50, both slots support UHS-II, making them both suitable for very fast memory cards like the Sony SF-G series. However, it is my experience that the second UHS-II card slot works a little bit slower than the primary slot.

Using two memory cards at the same time gives you three different options to configure how image data is transferred to your SD cards. To do so, select SET UP > SAVE DATA SET-UP > CARD SLOT SETTING (STILL IMAGE) and pick one of the following options:

- **SEQUENTIAL:** In this default mode, the camera saves all image data (RAW and JPEG) to a manually selected card slot. You can change the slot for sequential image recording in the SET UP > SAVE DATA SET-UP menu. When the card in the active slot is full, the camera automatically switches to the card in the other slot.
- **BACKUP:** In this mode, the camera is sending all image data (RAW and JPEG) to both slots at the same time, creating a backup copy that can be useful if one of the cards gets lost or suffers data loss. In this mode, the overall data transfer rate is limited by the slower of the two cards (and

slots) that are in use. This can become a performance issue in situations that require many images being taken with high burst rates while shooting FINE+RAW, so make sure that the cards in both slots are equally fast.

- **RAW/JPEG:** This setting splits the image data up by saving RAW files to slot 1 and JPEGs to slot 2, so this setting is only useful when you are shooting FINE+RAW or NORMAL+RAW. If you shoot RAW-only or JPEG-only, RAW/JPEG mode turns into BACKUP mode, saving your RAW or JPEG data to both cards at the same time.

I always recommend shooting FINE+RAW (or NORMAL+RAW). If you follow this advice, selecting RAW/JPEG mode (and using the fastest compatible cards in slots 1 and 2, respectively) will give you the best camera performance in terms of continuous burst rates.

However, RAW/JPEG data save mode also has its quirks:

- Splitting up RAW and JPEG image data to slots 1 and 2 only works in regular shooting mode (i.e., when you take a fresh picture), not when you are using the camera's built-in RAW converter to create a JPEG from an existing RAW file on card 1. JPEGs generated from RAWs on card 1 are also saved on card 1 (the RAW card) instead of card 2 (the JPEG card).
- In playback mode, the camera will display smaller-sized JPEG images that are embedded in the RAW files on card 1 instead of showing the full-resolution JPEGs on card 2. To access the full-resolution JPEGs (e.g., in order to zoom in and check critical focus), you have to manually switch slots in playback mode by pressing and holding the playback button until the camera confirms the switch. Sadly, the camera will revert playback mode back to card 1 after you take another picture, so you have to go through the motions of switching slots in playback mode each time you take another shot.



Fig. 24: Dual-slot cameras like the X-T2 can work with **two SD memory cards at the same time**. For maximum performance, you should use fast UHS-II cards (such as the Sony SF-G with 300 MB/s).

Resetting the frame counter and assigning a new image starting number

TIP 9

Follow these steps to reset the image counter to zero (if you have a dual-slot camera, make sure that you only use a single SD card in slot 1):

- Select SET UP > SAVE DATA SET-UP > FRAME NO. > RENEW, then format the SD card with SET UP > (USER SETTING >) FORMAT and take a picture. The frame counter will start from zero.
- To avoid another automatic image counter reset when you are reformatting an SD card, select SET UP > SAVE DATA SET-UP > FRAME NO. > CONTINUOUS.

You can assign pretty much any number as the camera's new frame-counter starting number. The method is similar, but involves an extra step in your computer:

by companies like *Photographic Solutions* and *Visible Dust*. They consist of wipers that are wetted with special cleaning fluids (such as *Eclipse*). Wipe one side of the swab from left to right over the full width of the sensor, and then from right to left with the other side of the swab. Your X-mount camera requires swabs that match APS-C-sized sensors. At Photographic Solutions, this translates into product size number 2.

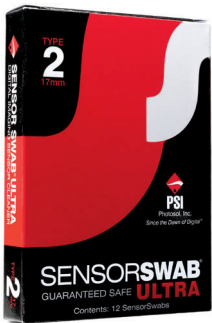


Fig. 29:
Wet cleaning: **sensor swabs** from Photographic Solutions.

Inexpensive and effective alternatives to products from Visible Dust or Photographic Solutions are APS-C-sized swabs from the Asian brand VSGO.



Fig. 30:
My personal sensor cleaning choice for X-mount cameras: **VSGO** swabs and cleaning fluid.

Sadly, VSGO swabs aren't available for medium format sensors. GFX users can use swabs and solutions from Visible Dust as an alternative [11].

Important: *There's a small chance that sensor spots are caused by dust particles enclosed **behind** the protective surface of the sensor. If some spots simply won't go away, the camera needs to be serviced by Fujifilm.*

Sensor cleaning and IBIS

TIP 13

If your X camera features in-body image stabilization (IBIS), DIY sensor cleaning is a little bit trickier. As of December 2018, IBIS was only available in the X-H1, but upcoming models like the GFX 100 are supposed to offer this useful feature, too.

Here are step-by-step instructions on how to prepare an X-H1 for wet and dry sensor cleaning:

- Make sure that the IBIS is turned off by selecting SHOOTING MENU > SHOOTING SETTING > IS MODE > OFF. This setting locks the sensor in place while you are cleaning it.
- Select SET UP > BUTTON/DIAL SETTING > SHOOT WITHOUT LENS > OFF. This makes sure that you don't accidentally release the shutter while you are cleaning the sensor (which could have disastrous consequences).
- Select SET UP > POWER MANAGEMENT > AUTO POWER OFF > OFF. This makes sure that the camera doesn't automatically power down while you are still cleaning the sensor.
- Remove the lens or body cap and clean the sensor as usual. Make sure that the camera is switched ON during the cleaning process.

- When you are finished cleaning the sensor, don't forget to revert the Power Management, Shoot Without Lens, and IBIS settings to their previous operational states.

Please note that keeping the camera turned on during sensor cleaning is an exception that we only make for cameras with IBIS. All other cameras should always be powered down during sensor cleaning.

TIP 14

Pixel mapping

Cameras with X-Processor Pro and X-Processor 4 offer an automatic pixel mapping feature. To use it, select SHOOTING MENU > IMAGE QUALITY SETTING > PIXEL MAPPING. Pixel mapping detects defective pixels on your sensor and maps them out, meaning they are interpolated with the information of surrounding pixels. Since the number of hot pixels increases with sensor temperature, pixel mapping is only available when the camera hasn't already heated up.



Fig. 31: Pixel mapping is a very useful function that is unjustly overlooked by many users. To avoid unpleasant pixel malfunctions in your images, it's best to apply it on a regular basis.

Please note that a few defective pixels are perfectly normal in every digital camera. As the sensor ages (even when the camera is not in use), the number of dead pixels increases along with it. In addition to the manufacturing process, defective pixels are also caused by cosmic radiation. For ex-

ample, frequently taking your camera on long-haul flights will increase the risk.

Knowing all this, it's a good idea to regularly use the pixel mapping function in order to keep the defective pixel map inside your camera up-to-date. It only takes a few seconds.

If you are experiencing an unhealthy number of defective pixels, but your X camera doesn't offer pixel mapping, you can still have the camera remapped by Fujifilm's service department.

1.2 THE BASICS (2): THINGS YOU SHOULD KNOW ABOUT YOUR LENSES

Your camera is compatible with the following native X-mount (APS-C) or G-mount (44×33mm medium format) lenses:

- Fujinon XF lenses (X-mount prime and zoom lenses)
- Fujinon XC lenses (compact, affordable X-mount lenses)
- Zeiss Touit X-mount lenses (prime lenses)
- Fujinon GF lenses (G-mount medium format prime and zoom lenses)

In addition to native X-mount and G-mount lenses, you can also attach a host of current and older lenses from other manufacturers via suitable adapters. Remember that by using a “dumb” mechanical adapter, adapted lenses will always operate at the set working aperture. Autofocus, program AE, and shutter priority AE will not be available, either. Third-party *smart* adapters (which are mostly available to adapt Canon EF lenses to the X-mount or G-mount) are more expensive and can overcome these limitations.

TIP 21 XF56mmF1.2 R: APD or not?

Fujifilm offers two versions of the XF56mmF1.2 R portrait lens: a regular version and an APD version. Please note that the newer and more expensive APD version is not replacing or succeeding the classic XF56mmF1.2 R lens. It's not even per se considered an overall improvement. It's just *different*. APD presents itself as another option for photographers who shoot portraits at a wide-open aperture and want very smooth bokeh.



Fig. 38: The XF56mmF1.2 R lens is available in a regular (left) and in a special APD version (right).

Let's first establish what the APD (apodization) filter is actually doing. This non-removable filter sits in the same optical plane as the aperture, and its effect is actually quite similar: It reduces the amount of light that reaches the sensor.



Fig. 39: The regular XF56mmF1.2 R lens is a popular choice for smooth portraits with pleasant bokeh and great subject separation.

Here's the difference from regular aperture blades: Normal blades feature hard edges, whereas the APD filter works with a smooth gradient (like a radial neutral density filter) that gets increasingly translucent from edge to center of the image circle.



Fig. 40: The XF56mmF1.2 R APD is a specialty lens that can further smoothen already blurry backgrounds by filing off the edges of blur discs.

The gradient of the APD filter has an additional softening effect on out-of-focus areas: the hard and defined edges of blur discs are literally filed off. The effect decreases as the lens is stopped down, and at apertures of $f/5.6$ and smaller, the APD filter has no effect at all. That's why Fujifilm recommends using the XF56mmF1.2 R APD between $f/1.2$ and $f/2$.

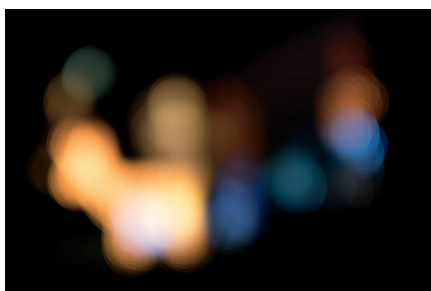
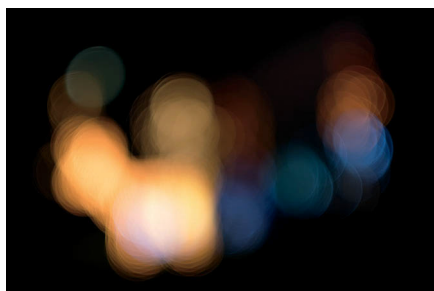


Fig. 41: To understand the difference between a regular 56mm lens and one with a built-in apodization filter, it's best to take a picture that consists of nothing else but blur discs. The example on the left shows how such a scenario looks with a regular 56mm lens at $f/1.2$. The example on the right shows the same subject shot using the APD version. It clearly illustrates how the apodization filter is shaving the hard edges off blur discs.



Fig. 42: Here's a more life-like example that demonstrates the effect of the APD filter: The image on the left was taken with a regular XF56mmF1.2 R lens, while the image on the right displays the APD version.

So why not dump the regular XF56mm lens and replace it with the APD version? It's because the APD filter introduces shortcomings of its own:

- The brightness of the APD lens is reduced between $f/1.2$ and $f/5.6$. For example, setting the APD lens to $f/1.2$ results in an *effective* lens speed of $f/1.7$. Since the APD lens is slower, shooting wide-open in poor light requires slower shutter speeds and/or higher ISO settings. At least you don't have to guess, because the *effective* aperture is shown by red markings on the aperture ring.
- The APD filter has a negative impact on autofocus performance. Fast PDAF (phase detection AF) is not available at all, and CDAF (contrast detection AF) performance is reduced in poor light along with the decreased lens brightness.



Fig. 43: This example illustrates how the **Lens Modulation Optimizer (LMO)** improves the edge and corner sharpness of Fujifilm's native XF and GF lenses. It was shot with an X-E2 and an XF23mmF1.4 R WR lens at f/8. Let's have a closer look at the lantern situated near the left edge of the scene: The two crops in the center row show the lantern with LMO OFF (left crop) and LMO ON (right crop). There's a small visible improvement in the version with the active LMO. However, if you compare crops of the sign taken from the center of the scene (bottom row), there's no visible difference between the versions with and without LMO. That's no surprise: Lenses achieve their maximum resolution around the image center, so the LMO's job is to only compensate the inevitable loss of resolution near the edges of the frame.

Things you should know about digital lens corrections:**TIP 23**

Most modern lenses achieve their optimal image quality through a combination of optical and digital corrections. Corrections are mostly applied to the three following phenomena:

- **Vignetting:** This effect results in a loss of brightness from center to corner. Vignetting [20] is more pronounced at large (open) apertures.
- **Distortion:** There are pincushion- and barrel-type distortions [21], both of which make straight lines seem curved. Several premium primes like the XF14mm, XF23mm (F1.4 and F2), XF35mmF1.4, XF56mm, and XF90mm are fully optically corrected for distortion. Others (such as the Zeiss Touit range, compact pancake lenses, the XF35mmF2, or zoom lenses) require a combination of optical and digital distortion correction.
- **Chromatic aberration:** Chromatic aberration [22] results in color fringing. This effect can be corrected (or mitigated) with apochromatic lenses, or digitally corrected during RAW conversion.

Some camera makers rely on dedicated correction profiles that must be provided by each RAW converter maker. Fujifilm isn't one of these companies: all current Fujifilm cameras save digital corrections as metadata in the RAW file. RAW converters can access this lens-specific metadata and use it to apply appropriate corrections. This way, the built-in RAW converter and external RAW conversion software, such as Adobe Lightroom, SilkyPix, Iridient Developer, or Capture One, can use the metadata in the RAW file to correct or mitigate vignetting, distortion, and chromatic aberration.

A major benefit of this method is that many RAW converters automatically support new lenses since Fujifilm delivers the correction data via the RAW metadata. However, there's also a drawback: some RAW converters (such as



Fig. 49: Like its smaller X-mount siblings, the **GF1.4x TC WR** (left) protrudes deeply into the rear barrel of the host lens, disguising much of its actual size when it's sandwiched between the camera and lens (right).

Unlike screw-on conversion lenses for the X70 and X100 series, XF and GF teleconverters have an impact on the speed (maximum brightness) of the resulting lens package.

To give you an example, the XF2x TC WR effectively turns the ultra-sharp XF80mmF2.8 R LM OIS WR Macro lens into an XF160mmF5.6 R LM OIS WR Macro. Setting the aperture of this combo to f/2.8 actually means setting an effective aperture of f/5.6. Using a 2x teleconverter, the light loss comprises two stops, whereas 1.4x converters take away one stop of light.

Luckily, all this is recognized and handled by the camera and lens firmware (as long as you have kept them up to date). The firmware will automatically adjust the on-screen displays and the EXIF [23] data to reflect the *effective* aperture values. It will also change the lens-correction metadata (factoring in updated values for distortion, vignetting, and chromatic aberration) and include the presence of the teleconverter in the EXIF lens description. For example, a GF250mmF4 R LM OIS WR becomes a GF250mmF4 R LM OIS WR +1.4x.



Fig. 50: The **GF1.4x TC WR** in action. It was attached to a **GF250mmF4 R LM OIS WR**, effectively turning it into a **GF350mmF5.6 R LM OIS WR** lens.

Depending on the quality of your individual lens copy, using the **XF100–400mmF4.5–5.6 R LM OIS WR** in concert with an **XF2x TC WR** tends to stretch things thin with regards to performance and image quality, particularly at the long end of the lens. At effectively an 800mm focal length (that's a full-frame equivalent of 1200mm), the wide-open aperture of this combo is $f/11$, which can make it hard for your cam-

era's autofocus to gather enough light to operate quickly and precisely. There's also some loss of resolution—not only because of the optics involved, but also often due to atmospheric effects when you are capturing far-away subjects.



Fig. 51: XF100–400mmF4.5–5.6 R LM OIS WR & XF2x TC WR: Shooting the moon with effectively 800mm (or 1200mm in full-frame terms) during a warm summer night resulted in some unwelcome atmospheric effects. That's why astronomic telescopes are usually placed on mountains or in space. This example is based on a square 5 MP crop.

TIP 26**Macro extension tubes**

You can add macro capability to many of your GF, XF, and XC lenses by using Fujifilm's electronic macro extension tubes: MCEX-11 or MCEX-16 for X-mount, and MCEX-18G WR or MCEX-45G WR for G-mount.

You can download PDF files ([24] and [25]) from Fujifilm's website that show how the different extension tubes enhance the magnification factor of each X-mount or G-mount lens. Please note that the camera's electronic depth-of-field/distance scale doesn't reflect the use of macro extension tubes.



Fig. 52: The **MCEX-18G WR** and **MCEX-45G WR** macro extension tubes for the GFX can be combined with most GF lenses. According to Fujifilm, the 18mm version is the smallest possible size that meets the structural requirements, while the 45mm tube was designed to add 1:1 magnification to the GF120mmF4 R LM OIS WR Macro lens.

A word of caution: Stay away from cheap third-party macro extension tubes with electronic contacts. Some of them turned out to be a bad fit, damaging cameras and lenses.

It's also not recommended to stack more than one macro extension tube on your camera.



Fig. 58:
A 39mm protection filter by Fujifilm. A filter like this can also be used as a spacer between the lens (XF60mm or XF27mm) and a step-up ring.

Don't forget that screw-in lens hoods are an absolute no-go for a lens with retractable inner barrels like the XF27mmF2.8.

TIP 30

Switch off the camera when exchanging lenses!

The user manual of your system camera asks you to switch off the camera before exchanging lenses. Then again, who cares, right? In the heat of the moment, many of us forget (or simply don't have the time) to follow this advice, and so far, nothing terrible has happened.

However, instead of making a bad habit out of this, we should consider why Fujifilm is actually asking us to exchange lenses only when the camera is turned off:

- Several lenses (like the XF60mmF2.4 R Macro or the XF27mmF2.8) have moving inner barrels. During focusing, the inner barrel can protrude way outside the protective edge of the outer barrel. The secure storage and transport state for these lenses is always with a fully retracted inner barrel, and this secure state is automatically entered when you turn off the camera *before* you remove the lens.
- The same applies to lenses like the new XC15-45mm F3.5–5.6 OIS PZ power zoom: Switch off the camera while the lens is still attached, and the power zoom will safely retract to its compact transport and storage position. On the other hand, if you remove the lens before turning off

the camera, your lens may end up in a less compact and more vulnerable state.

- When the camera/lens is powering off, a lock mechanism holds the linear motor driven inner-focusing element of the GF250mmF4 R LM OIS WR and XF200mmF2 R LM OIS WR in place. This suppresses “clacking” noises (caused by the loose lens group) when you carry the lens around off-camera. If you remove the lens while the camera power is still on, this lock mechanism isn’t activated. By the way: “Clacking” is perfectly normal for other lenses with inner-focusing mechanisms, such as the XF90mmF2 R LM or XF50–140mmF2.8 R LM OIS WR, so don’t worry: nothing is broken. Off-camera, there’s simply no camera-powered magnetic field to hold the rear element in place, so it is loosely moving in the barrel when you shake the lens.



Fig. 59: The GF250mmF4 R LM OIS WR (left) and the XF200mmF2 R LM OIS WR (right) are lenses with a **lock mechanism** to hold the inner focusing element in place when the lens is off-camera. However, this mechanical lock is only activated when you switch off the camera *before* you remove the lens.

Lens sample variation and how to deal with it

TIP 31

It’s true: Not all copies of a specific lens type are the same. Some copies are better than others, often also depending on what you shoot, what settings you use and what you



Fig. 66: The **Canon RS-60E3** is my favorite electronic cable release for Fujifilm X cameras—thanks to its attention to detail. For example, the 90-degree angle of the plug ensures that the release can be used in concert with L brackets when the camera is sitting upright on a tripod. Also, two carvings make it easy to neatly spool the cable around the release after shooting. Finally, there's a built-in socket for the 2.5mm plug that prevents the cable from unspooling in the bag.

Alternatively, you can remotely control Wi-Fi-enabled X cameras with the free Fujifilm Camera Remote app [29] for iOS or Android devices. Step-by-step instructions are available online [30].

If you own an X camera with Bluetooth, you can use that semi-permanent connection to your smartphone or tablet to remotely release the shutter [31].

2. USING YOUR X SERIES CAMERA

2.1 READY, SET, GO!

New users often ask about how to achieve the perfect settings for their camera. Short answer: there are no perfect settings. If they existed, Fuji could have saved us the trouble of navigating piles of menu options and simply implemented those ideal settings as the factory default. That said, allow me to suggest some basic settings that are meant to provide good overall performance and as much flexibility as possible.

- Many settings (such as film simulation modes, color saturation, contrast, sharpness, noise reduction, film grain effect, etc.) belong in the “JPEG settings” category. They don’t affect the RAW files; only the out-of-camera JPEGs that are generated during RAW conversion. These settings aren’t global or camera-specific—they are *image-specific*, and each image should be adjusted individually.
- In addition to the recommended standard settings, there are many shortcuts and key combinations that can make choosing the optimal camera settings for any situation much easier.

Recommended default settings for your X series camera

TIP 36

There is no perfect set of basic camera settings that could suit all users in all situations. However, the following settings will allow you to use current (and also many older) X camera models in a flexible manner with good overall performance.

- Select **FINE+RAW** or **NORMAL+RAW** under **SHOOTING MENU > (IMAGE QUALITY SETTING >) IMAGE QUALITY**. This will get you high-resolution out-of-camera JPEGs (digital prints) *and* flexible RAW files (digital negatives). Using the RAW files, you can create a variety of diverse JPEGs with different looks and settings using the camera's built-in RAW converter (**PLAYBACK MENU > RAW CONVERSION**). Specifically, you can adjust JPEG parameters such as white balance, film simulation, contrast, brightness, noise reduction, and color saturation. This enables you to create different versions of a shot from a single RAW file; for example, you can make color and black-and-white versions of the same image, including different contrast settings. You don't have to worry about finding the perfect JPEG settings prior to taking a shot because you can always change and optimize those settings afterward in the camera's internal RAW converter.



Fig. 67: Shooting **FINE+RAW** immediately gives you a ready-to-use JPEG (left), and the freedom to generate different or improved versions from the RAW file later, either in-camera (center) or with an external RAW converter like Adobe Lightroom (right).

- Make sure to use the camera's **mechanical shutter** as your default setting by selecting **SHOOTING MENU > (SHOOTING SETTING >) SHUTTER TYPE > MS**. Use of the

electronic shutter (ES or MS+ES) can create all kinds of issues and should be limited to the rare cases where the ES is beneficial: shooting with a wide-open aperture (and without an ND filter) in bright daylight, or situations that require you to shoot in complete silence (with the alternative of not shooting at all). If your camera offers an electronic first curtain shutter (EFCS), feel free to set this option in order to eliminate shutter shock. Examples for X cameras with EFCS are the X-H1, X-T3, and GFX 50.

- The most flexible and accurate AF-S setting is **Single Point AF** (SHOOTING MENU > AF/MF SETTING > AF MODE > SINGLE POINT). This mode allows you to select the area of the image where the camera should be focused. Even better, if your X camera supports the new AF mode **ALL** (several recent models do), select this mode as your default setting. That way, you can seamlessly cycle between Single-Point, Zone, and Wide/Tracking AF modes simply by changing the AF frame size. This is fast and convenient, and any Fn button that was previously used for changing the AF mode can now be reassigned to serve a different purpose.
- Set SHOOTING MENU > AF/MF SETTING > RELEASE/ FOCUS PRIORITY > FOCUS for both AF-S and AF-C. **Focus Priority** makes sure that the camera records a picture only when the autofocus thinks that it has locked onto a target. In RELEASE mode, the camera will take the shot even if the autofocus couldn't lock on a target. Please note that if you are using AF+MF mode, AF-S will always operate with release priority. That's why my recommended default setting for AF/MF SETTING > AF+MF is OFF.
- If you want to quickly take a series of single shots, I recommend selecting SET UP > SCREEN SET-UP > IMAGE DISP. > OFF to not interrupt your flow. However, I *normally* set **Image Display** to the shortest available time span, which in most X cameras is 0.5 SEC. Why? I like to see a quick

preview of the final image that represents the camera's exposure and dynamic range (DR) settings. To cancel an ongoing image preview and continue shooting, simply half-press the shutter button.

- If available, use the VIEW MODE button to activate the **eye sensor**, which will allow the camera to automatically switch from LCD to electronic viewfinder when you look through the EVF.
- For **exposure metering**, I recommend using MULTI metering as your default mode. Intelligent matrix metering usually delivers results that don't require a massive amount of exposure correction.
- Set SHOOTING MENU > (IMAGE QUALITY SETTING >) WHITE BALANCE > AUTO to let the camera determine and set the correct **white balance** for a scene. Since you are shooting FINE+RAW, you can always adjust the white balance later, either with the camera's built-in RAW converter or with external RAW conversion software such as Adobe Lightroom. That said, AUTO will deliver very good results in most scenarios.
- Select SHOOTING MENU > (IMAGE QUALITY SETTING >) DYNAMIC RANGE > DR100% as your default setting. If you require more **highlight dynamic range** (DR) for a specific subject in order to avoid blown highlights, you can manually set DR200% (for *one* extra stop of dynamic range in the highlights) or DR400% (for *two* extra stops of dynamic range in the highlights). Setting DYNAMIC RANGE to AUTO is *not* recommended. Extending the dynamic range can bring back texture to otherwise blown areas of your shot (such as white clouds on a sunny day).



Fig. 68: All Fujifilm X cameras feature a powerful and often misunderstood **DR function** that can increase highlight dynamic range by up to two full stops (EV). The default setting is DR100% (top). Seeing blown highlights that you do not like? Increase dynamic range to DR200% (center) or DR400% (bottom) to get an extra one or two stops worth of highlight detail.

- To use **adapted lenses** with your X-mount or G-mount camera, you need either Fujifilm's Leica M or Hasselblad H adapter, or a suitable third-party adapter. To make third-party adapters work, you must select SHOOT WITHOUT LENS > ON. Depending on your camera, you'll find this option either under SET UP > BUTTON/DIAL SETTING or in the SHOOTING MENU. This is necessary because adapted lenses (and mechanical third-party lens adapters) do not feature electronic X-mount/G-mount contacts, so the lens will not register as being connected to the camera. When you are working with a manually adapted lens, you should also enter its focal length in SHOOTING MENU > (SHOOTING SETTING >) MOUNT ADAPTOR SETTING. This ensures that the EXIF [32] data will reflect the proper focal length. In the X-Pro1 and X-Pro2, it will also determine the proper size and position of the bright frame in the optical viewfinder (OVF), and in the X-H1, entering the correct focal length is essential for the IBIS to work correctly with adapted lenses.
- Do you sometimes shoot with very slow shutter speeds lasting several seconds? In this case, I recommend setting SHOOTING MENU > (IMAGE QUALITY SETTING >) LONG EXPOSURE NR > ON to improve the quality of your results. In this mode, the camera performs a so-called dark-frame subtraction [33] to reduce noise and eliminate hot pixels. With this process, the total exposure time is at least doubled because the camera is taking the shot twice: once normally and once with a closed shutter curtain. The second shot is then subtracted from the first to improve the overall result.



Fig. 69: Long exposures like this Melbourne cityscape benefit from the **dark-frame subtraction** that is automatically applied by the LONG EXPOSURE NR > ON setting.

- I recommend *not* using the AUTO setting for the **brightness control for the EVF** because it tends to show an overly bright live view image in bright sunlight and a very subdued image when it's dark. Instead, I set SET UP > SCREEN SET-UP > EVF BRIGHTNESS > MANUAL > 0. I use the same setting for the rear LCD.
- For the purpose of this book, we assume that SHUTTER AF and SHUTTER AE (in the SET UP > BUTTON DIAL SETTING menu) are both set to ON, which is also the factory default setting of those X series cameras that offer these options (several recent models do). This ensures that autofocus and exposure (including the working aperture) are locked when you half-press the shutter button in AF-S mode, so the camera is primed for the least possible shutter lag once

TIP 39

Recommended My Menu and Quick menu configuration

To keep the shooting process effortless and free of interruptions, it's vital to assign frequently used functions to Fn buttons that are immediately accessible. However, the number of available buttons is often limited, especially since Touch-Fn still isn't universally available.

Luckily, we have My Menu and the Quick menu (Q button) to quickly access frequently used functions and menus that didn't fit into the Fn button lineup. My Menu is available in all cameras with X-Processor Pro and X-Processor 4, and most X cameras also offer a configurable Quick menu page.

- To configure **My Menu**, select SET UP > USER SETTING > MY MENU SETTING, where you can add new items, rank existing items (= change their position in My Menu), or remove items from the menu.
- To configure the **Quick menu**, press and hold the Q button until the Quick menu configuration page appears, where you can change each of the 16 items and assign them either a new function or no function at all (NONE).

The following figures illustrate the My Menu and Quick menu settings in my X-H1. Neither is set in stone.

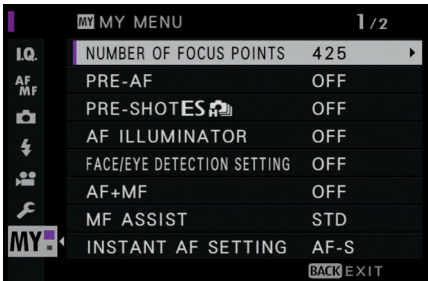


Fig. 74: My Menu in my X-T3 and other current X-series cameras consists of two menu pages with a total of 16 possible entries. I use the first page to quickly change and review the autofocus configuration.

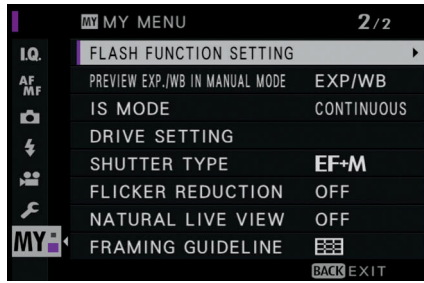


Fig. 75: The second **My Menu** page is reserved for exposure settings and general parameters such as OIS/IBIS mode, shutter type, flash configuration, or the DRIVE mode.

Please note that in cameras without IBIS, the OIS mode menu is only available when a lens with OIS has been attached. In a similar fashion, manual exposure mode **M** must be enabled to access the PREVIEW EXP./WB IN MANUAL MODE setting.



Fig. 76: The **Quick menu** page of my X-H1 and X-T3 isn't very different from the factory default setting. I always make sure that I can access the flash mode and the flash exposure compensation directly from this menu, and I like to have direct access to the shutter-type setting and flicker reduction. Since I don't need quick access to the COLOR and SHARPNESS items, I replaced them with the flash configuration items.

Always shoot FINE+RAW or NORMAL+RAW!

TIP 40

Should you shoot RAW [34] or JPEG [35]? The best option is using both formats by setting SHOOTING MENU > (IMAGE QUALITY SETTING >) IMAGE QUALITY > FINE+RAW (or

NORMAL+RAW). It doesn't matter if you consider yourself a diehard RAW shooter or a JPEG shooter.

This is how **RAW shooters** benefit from shooting FINE+RAW or NORMAL+RAW:

- During external RAW processing, the camera-made JPEG can be used as a (sometimes hard-to-beat) reference image.
- Checking critical focus is only possible at 100% magnification, which only a full-size JPEG can provide. The JPEG that's embedded in the RAW file for preview purposes is too small. Make sure you select one of the available L (Large) options under SHOOTING MENU > (IMAGE QUALITY SETTING >) IMAGE SIZE.
- The IMAGE SIZE menu isn't available in RAW-only mode. Different image formats, such as 1:1 or 16:9, are only available in JPEG-only mode or FINE+RAW (NORMAL+RAW) mode. Autofocus and exposure metering adapt to the currently selected format (aspect ratio) and deliver more accurate readings when you are shooting with odd formats like 1:1. No worries, though: the RAW is always recorded in the sensor's native format (3:2 or 4:3, depending on your camera model), so you don't lose any image information.

This is how **JPEG shooters** benefit from shooting FINE+RAW or NORMAL+RAW:

- Nobody is capable of always setting the *perfect* shooting parameters (exposure, white balance, and dynamic range, as well as JPEG parameters such as film simulation, color, sharpness, noise reduction, shadow and high-light contrast, grain effect, etc.) in advance. FINE+RAW solves this problem by allowing you to change and adjust those settings *after* the fact, either with the built-in RAW converter or external RAW conversion software. This means you can worry about those JPEG settings later and

concentrate on more important factors of your shot, such as focus, framing, and timing.

- Even if you chose the perfect settings in advance, it's possible that you'd like to have more than one version of a shot, such as a color version and a black-and-white version, or versions with different color film simulations. Again, FINE+RAW does the trick because you can use the built-in RAW converter to create (and compare) different JPEG versions of a shot.



Fig. 77: All X cameras feature a **built-in RAW converter** that allows users to quickly create different JPEG versions of a shot. It only takes a few seconds to modify exposure, contrast settings, and noise reduction of a color image (above), or to create a black-and-white version (below). All you need is the shot's RAW file.

- There's always progress in the digital domain. Things that appear impossible today may be a reality in just a few years. It's perfectly feasible that future RAW converters will be able to extract much better image quality from your RAW files than today's cameras and RAW processors. It pays to be prepared by archiving the RAW files of your valuable shots. Storage space is cheap; some of your images may be priceless.
- Your skills may improve as well! Several months or a few years from now, you may be much more comfortable using post-processing software than you are today. Wouldn't it be sad if you couldn't revisit great shots of the past and process them in a better way? Don't forget: only RAW files contain the full potential of an image. JPEGs are a processed and compressed subset with limited latitude for post-processing. RAW files feature much better tonality and dynamic range. By the way, using the built-in RAW converter of your X camera isn't more complex or complicated than using the camera's JPEG settings in the shooting menu (which should be familiar to you as a JPEG shooter).

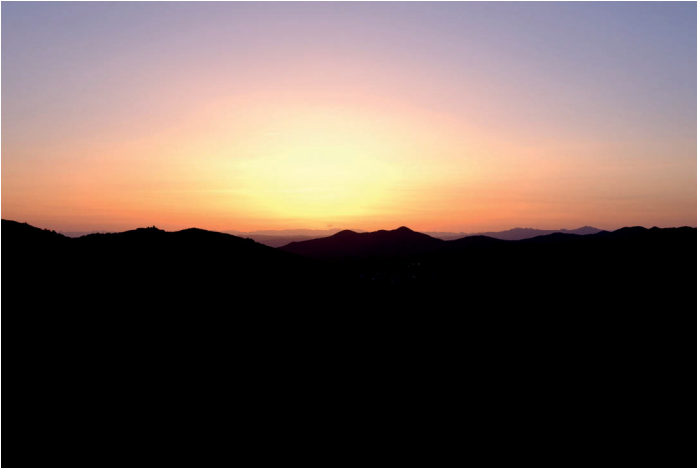


Fig. 78: X series cameras feature competent JPEG engines with terrific film simulations, but that doesn't mean that **JPEG-only shooting** is the way to go. This JPEG of a moody sunset was processed with the Velvia film simulation in my X-T20, and while this result may be exactly what you're looking for, it clearly illustrates the limited dynamic range of straight-out-of-camera JPEGs, which often render high-contrast scenes with blown highlights or blocked shadows (or both). There is no meaningful way to restore what has been lost in processing the JPEG. Instead, you must process the RAW file of this shot.



Fig. 79: This sample is a **Lightroom-processed version** of the RAW file of the previous shot, showcasing the superior dynamic range of the camera's original sensor data. Despite their small size and affordable price, all Fujifilm APS-C cameras offer a dynamic range that rivals or even surpasses that of several current full-frame cameras from Canon and Leica, but you need the RAW file to unlock their huge potential.

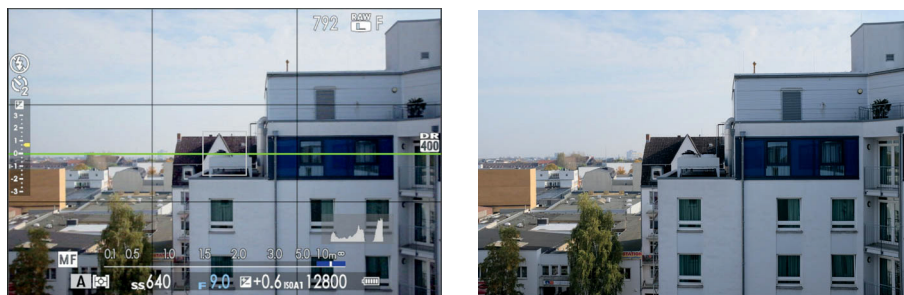


Fig. 85: **WYSIWYG**: This X100F example illustrates how closely the live view (left) represents the actually taken JPEG from the camera (right). The live view doesn't just simulate exposure, white balance, film simulation, and other JPEG settings, it also previews fixed dynamic range settings like DR400%.

In manual exposure mode **M**, most X cameras allow you to switch off the exposure simulation by selecting SET UP > SCREEN SET-UP > PREVIEW EXP./WB IN MANUAL MODE > OFF. That way, the camera will always display a bright live view image in manual mode, regardless of the actually selected exposure parameters (shutter speed, aperture, and ISO). This can be useful in a studio setting with flash photography. For example, you may want to eliminate the surrounding-light component by stopping down the aperture and fully illuminating your subject with strobes.

Please note that in this mode, both the live view and the live histogram aren't representing the actual exposure of your image, so don't forget to switch the exposure simulation back on if you want to work with a proper exposure simulation and live histogram in manual mode **M**.

The live view's exposure simulation may be restricted in situations with very low light and slow shutter speeds of several seconds—the live view and the live histogram may appear darker than the actual result. In such scenarios, you should first take a test shot and review it in playback mode. The information display (which you can select with the DISP/BACK button) will show you a playback histogram of the recorded JPEG image. This includes a preview with “blinkies,” which indicate blown (overexposed) highlights.

Using the Natural Live View

TIP 48

The so-called Natural Live View is a display mode that's available in most X series cameras. It disables the WYSIWYG simulation of JPEG settings such as Film Simulation, Highlight Tone, Shadow Tone, or Color. Instead, it will display a rather flat live view image with increased dynamic range in the highlights and shadows, and with colors that are supposed to resemble what our eyes would see through an optical viewfinder. It will also set the live view to Auto white balance, so there will be no simulation of any white balance custom settings or presets. However, all current JPEG and white balance settings will still be applied to the *actual image* that's recorded.

Depending on your camera, select either SET UP > SCREEN SET-UP > PREVIEW PIC. EFFECT > OFF or SET UP > SCREEN SET-UP > NATURAL LIVE VIEW > ON to set the camera to Natural Live View mode. This setting enables generic-looking previews for color, black-and-white, and sepia shots that do *not* reflect the look of the actual JPEG results. This makes Natural Live View particularly useful: you can see what's going on in the dark parts of a high-contrast scene while composing the shot.

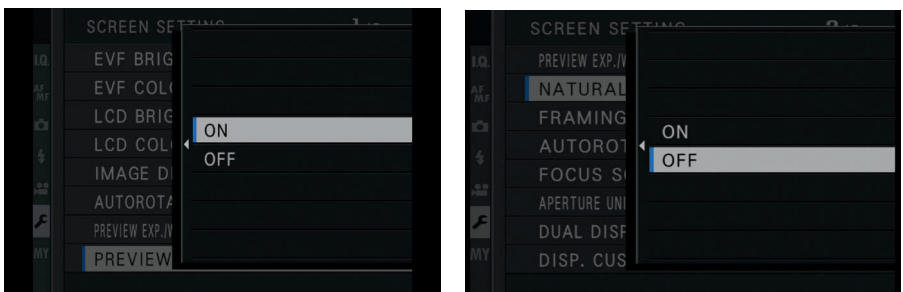


Fig. 86: PREVIEW PIC. EFFECT ON (left) equals NATURAL LIVE VIEW OFF (right). They are the same setting. With the X-H1 and X-T3, Fujifilm has changed the name of the function in the menu.

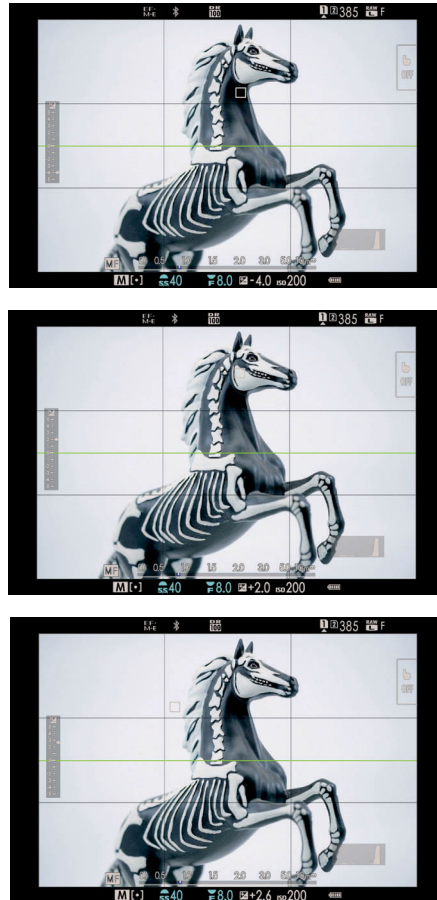


Fig. 90: Spot metering and manual exposure mode: Metering different parts of an image is easy with spot metering. Simply set an exposure (aperture, shutter speed, and ISO), then point the small spot-metering area at different parts of the scene. The exposure scale at the left or bottom of your live view tells you the brightness of any metered spot, with 0 representing middle gray (= zone 5 in the Ansel Adams zone system). To make things easier and most effective, interlock spot metering with the size and position of the currently active focus frame and select the smallest available focus frame size in AF-S or MF mode.

In this example, I spot-metered the darkest part of the model horse at -4 EV (top), its brightest part at $+2$ EV (center), and the brightest overall part of the scene at $+2.66$ EV (bottom). This means that the dynamic range of this scene comprises less than 7 EV ($2.66 + 4 = 6.66$), a range that fits neatly into a regular DR100% JPEG image.

Using the live view and live histogram

TIP 52

Unlike optical viewfinders in DSLRs, the electronic live view of modern mirrorless cameras provides an accurate simulation of the resulting JPEG image. The live preview encompasses color, contrast, exposure, and effect settings.

In standard display mode, this WYSIWYG preview is complemented by a live histogram [39]. I strongly recommend using the live histogram because it provides a useful overview of the brightness distribution in your scene. It also helps you identify areas of over- and underexposure in advance, so you can take corrective measures:

- If bars are piling up like a bell curve at the right end of the histogram, but cut off mid-peak, parts of your shot will be overexposed with blown highlights. If this affects important parts of your image, you should correct the exposure downward. Alternately, you can expand the shot's dynamic range by selecting DR200% or DR400% in the respective menu.
- If the histogram leans to the left, leaving plenty of unused space on the right, the shot might end up underexposed. In this case, you can adjust the exposure upward.

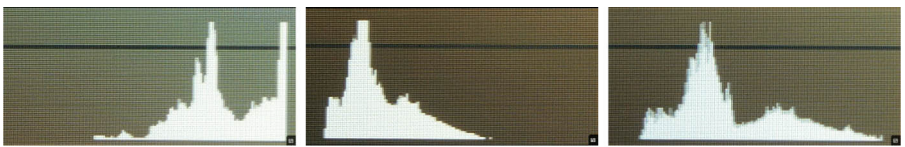


Fig. 91: Different **live histograms** showing a tendency for overexposure, underexposure, and a balanced exposure of the same scene.

The histogram provides a technical representation of the live view simulation. When the Natural Live View is turned off, both the live view and the live histogram will reflect the current JPEG settings of the camera (white balance, film simulation, color, and highlight and shadow contrast). For

example, the VELVIA film simulation delivers more contrast and more saturated colors than PRO NEG. STD, and this is reflected in the live view and the live histogram.

It's important to note that in many recent X camera models, the live view and live histogram now also represent (simulate) the effect of manual DR200% or DR400% dynamic range settings. However, if you set the camera to DR-Auto, the live view and live histogram will always display a DR100% preview.

When you half-press the shutter button, the camera's live view will also try to give you an accurate representation of the resulting image's dynamic range. That said, there is no live histogram when you half-press the shutter button, so you'll have to fully rely on the visual impression provided by the live view image.

With the exception of the X100F, all cameras with X-Processor Pro or X-Processor 4 also offer an **RGB histogram** [40], which is only available by assigning it to an Fn or Touch-Fn button. The RGB histogram is once again based on the current live view image, so it represents the resulting JPEG image. In fact, the color histogram displays four different histograms at once: overall luminance distribution (a larger version of the standard histogram) and separate histograms for the three color channels: red, green, and blue. That way, you can immediately recognize clipping of individual color channels in your JPEG. For example, shooting a red rose, the red channel is the first to clip and, thus, lose texture.

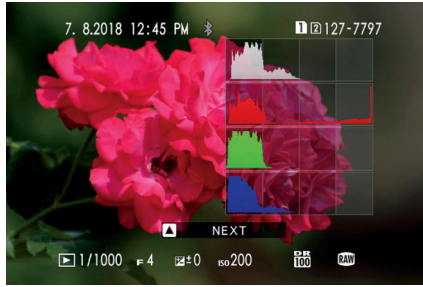


Fig. 92: The **RGB histogram** of this image of a rose illustrates how the red channel is already clipping (indicated by the peaking line at the right edge of the red channel histogram), while green, blue, and overall luminance are barely touching the right half of the histogram. Please note that as long as the Natural Live View is turned off, the histogram always reflects the current JPEG settings (film simulation, contrast settings, color saturation setting, etc.). This JPEG was created with the Provia factory settings of my X-H1.



Fig. 93: This is the same RAW image, but this time processed with **flat JPEG settings**: Eterna film simulation, Shadow Tone -2, Highlight Tone -2, and Color -4. These settings reflect the flattest possible color profile that you can achieve in an X-H1, and there's now plenty of additional headroom in the shadows and highlights. Thanks to the much higher dynamic range of the flat JPEG, there's also no clipping of the red channel in the histogram. This flat JPEG reflects the dynamic range of the actual RAW file much better than the camera's default JPEG settings, and many RAW shooters use these or similar flat JPEG settings in concert with the RGB histogram because it makes it easier to determine the optimal exposure right at the sensor's saturation limit.

The RGB histogram also includes “blinkies,” which are live overexposure or clipping warnings. If bright parts of your scene start to blink in RGB histogram mode, the blinking

In program AE, the slowest possible shutter speed is limited. In several recent models, the maximum duration is 4 seconds. When this (in concert with an already wide-open aperture) is not sufficiently slow to achieve the set exposure, the camera will display a red underexposure warning.

Even in program AE, you can influence shutter speed and aperture to a degree by using program shift [55]. Program shift allows you to select more suitable combinations of aperture and shutter speed compared to the one originally proposed by the camera's program AE. You can cycle through different combinations of apertures and shutter speeds that all result in the same exposure. When the camera is in program AE mode, you can activate program shift by turning the command dial that is otherwise responsible for adjusting the shutter speed.

Let's say you are shooting a portrait with the XF16–55mmF2.8 R LM WR zoom lens. It's a bright day, so program AE offers a shutter speed of 1/500s with an aperture of f/5.6. However, you prefer to shoot the portrait wide open at f/2.8 to achieve a blurrier background. In this situation, you have two choices: You can either switch to aperture priority mode by manually setting an aperture of f/2.8, or you can use program shift by turning the command dial until the aperture display shows f/2.8. Opening the aperture two stops from f/5.6 to f/2.8 won't change the original exposure because program shift will automatically adjust the shutter speed two stops from 1/500s to 1/2000s.

Important: Program shift is **not** available if Dynamic Range is set to AUTO or if a TTL flash unit is in use.

TIP 58

Playing it safe with auto exposure bracketing

As you know by now, the automatic exposure (AE) modes **P**, **A**, and **S** are merely responsible for automatically filling exposure variables. The exposure itself is the respon-

sibility of the photographer. You can use metering (multi, center-weighted, average, or spot), the live view, and the live histogram to determine the correct exposure.

Nobody is perfect! If you want to play it safe, auto exposure bracketing [56] can be a helpful feature. In this mode, the camera takes a series of at least two shots in quick succession, each with a different exposure. Mostly it's one shot with normal exposure, one underexposed shot, and one overexposed shot.

Exposure bracketing is especially useful with subjects that don't move. After you've taken the shot, you can decide which of the differently exposed versions you want to keep.



Fig. 97: **Auto exposure bracketing** automatically takes two or more images with varying exposure. Contrary to its name, AE bracketing even works in manual exposure mode, so you can manually set an exposure (aperture, shutter speed, ISO) that you think is right, and AE bracketing will give you additional options with different shutter speeds that are brighter and/or darker than your original exposure. In this example, the image in the middle shows the originally set exposure. The image to the left was bracketed 2/3 EV darker, and the one on the right was bracketed 2/3 EV brighter.

Depending on your X camera model, you can find AE BKT in the DRIVE menu or by selecting BKT on the DRIVE dial. In the latter case, you also have to make sure that AE bracketing is selected in the BKT settings of the shooting menu. There,

you can also configure your AE bracketing parameters (such as the exposure distance between images).

TIP 59**Long exposures**

Long exposures can lead to impressive results. Fireworks, night shots, interesting water surfaces, stars, or clouds: exposure times of several seconds or even minutes capture the course of time in a single photograph. Of course, this only works if you put the camera on a tripod or a solid, non-vibrating surface.

You have two basic options:

- Set the shutter-speed dial to **T** (Time) and then use the command dial to set the shutter speed. To avoid camera shake, use a remote shutter release or the self-timer to take the shot.
- Set the shutter speed dial to **B** (Bulb), then press and hold the shutter button for as long as you want the camera to expose. Obviously, it makes sense to use a remote shutter release that can be locked for the duration of the shot.
- If your camera has a mode dial instead of a shutter speed dial (like the recent X-T100), set exposure mode **M** or **S** and select a shutter speed or **Bulb** with the command dial that is responsible for changing the shutter speed.

For good-quality results, make sure to set SHOOTING MENU > (IMAGE QUALITY SETTING >) LONG EXPOSURE NR > ON. By doing so, the camera will perform a dark-frame subtraction [57] depending on what ISO and exposure time you used. Dark-frame subtraction doubles the effective exposure duration, so be patient.



Fig. 98: A **long exposure** of 30 seconds taken in T mode. Make sure to use a tripod for these kinds of shots.

Long exposures in bright daylight

TIP 60

To achieve long exposure times under normal daylight conditions, you can't just stop down the lens. Even at $f/22$, your shutter speed would still be too fast. Besides, diffraction blur is kicking it beyond $f/10$ (assuming a 24 MP APS-C model), so stopping down beyond this point is only recommended when it cannot be avoided.

To realize long shutter speeds in good light, it's best to use a so-called ND filter [58], or neutral density filter. This is a fancy name for a gray filter that you can put in front of the lens to block a portion of the light from reaching the sensor.

For example, a filter with an ND 3.0 specification will extend your exposure time by a factor of about 1000 (or 10 f-stops). This means that by using such a filter, a scene that would normally require a shutter speed of $1/50\text{s}$ at $f/8$ can be shot at the same aperture with an exposure time of 20 seconds.

However, there's a catch: since X series cameras are equipped with a rather weak infrared (IR) cut filter in front of their sensors, long exposures (typically one minute or longer) in bright daylight should be performed with a regular neutral density (ND) filter *and* a dedicated IR cut filter in front of the lens. This will help you avoid false colors. A few ND filters already include an IR cut filter.

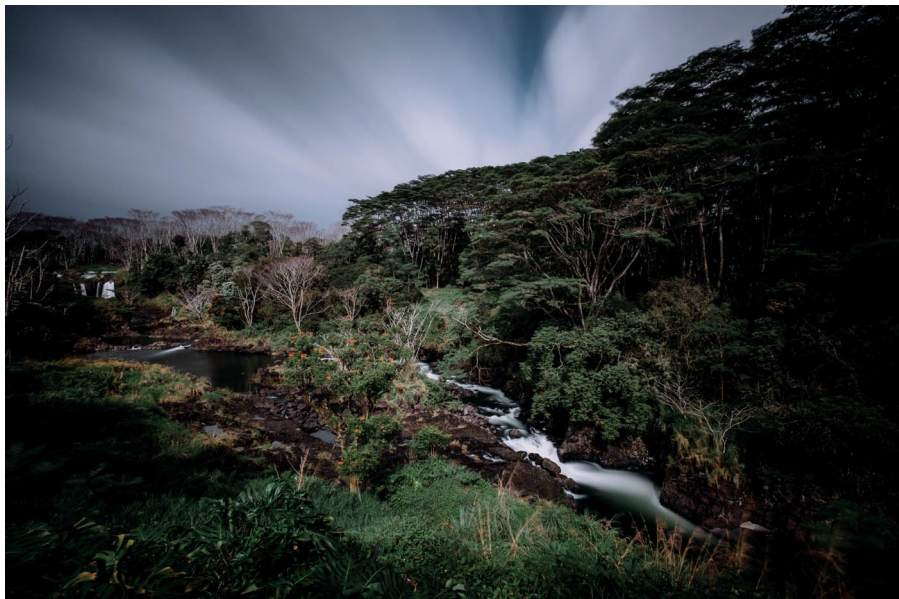


Fig. 99: This long daylight exposure lasted almost 4 minutes and was made possible by using a strong ND filter.

TIP 61**ISO settings—what's the deal?**

The meaning of ISO in the digital realm is often misunderstood. Unlike film, higher ISO settings *don't* increase the sensor's sensitivity. For example, the sensors in Fujifilm's APS-C cameras before the X-T3 are all calibrated to a native ISO 200 (based on the popular SOS standard) [59], and this remains the same no matter what ISO you set in these cameras.

To be clear, there's no difference between taking a shot with $f/5.6$ and $1/60s$ at either ISO L (100) or at ISO H (25600). In both cases, the sensor is exposed to the exact same amount of light (or photons) due to the fixed $f/5.6$ and $1/60s$ setting. The amount of light (the actual exposure) is solely determined by aperture and shutter speed.

So, what exactly is ISO doing? ISO determines the amount of *signal amplification* that's applied to the image. ISO 200, the APS-C sensor's native setting in our example, is equivalent to the camera's basic calibration. At ISO 400, the signal (or sensor data) is amplified by one aperture stop (1 EV) to brighten the image and increase its exposure. At ISO 800, the amplification amounts to two stops (2 EV), and so on. At ISO 25600, the additional amplification of the light recorded by the sensor amounts to seven stops or 7 EV. It's not surprising that image quality decreases when ISO amplification increases, because noise and artifacts are amplified along with the actual image data.

The amplification we are talking about means brightening the image by increasing its exposure. If you are familiar with RAW converters such as Adobe Lightroom, you know there's an exposure slider. Moving this slider to the left or right changes the exposure (and hence the ISO) of an image after the fact. The concept of ISO amplification isn't limited to the camera itself—it's part of the entire workflow from in-camera exposure via RAW file (digital negative) to the final JPEG or TIFF file (digital print).

If you take a shot with an ISO 800 setting, you're telling the camera's Auto-exposure (AE) to expose the image two stops darker than it would at its base ISO of 200, then amplify (brighten) that image two stops to compensate for the underexposure.

Regarding image quality and ISO, there's a basic rule: lower ISO settings lead to higher-quality results—hence the general recommendation to keep the ISO settings as low as possible. However, we obviously can't shoot with base ISO all the time, especially in low-light situations.

There are two basic methods to amplify a digital image:

- **Analog/digital hybrid amplification *prior* to writing the RAW file:** This method applies a mix of analog and digital signal processing to amplify or push the image to the brightness level that corresponds to the ISO setting. The digitized result of this process is then saved as a RAW file.
- **Digital amplification (push) *after* writing the RAW file:** This method changes the brightness of an image during RAW processing, *after* the RAW file has been written. The metadata (a.k.a. instructions) in the RAW file will tell the RAW converter what to do. You can also use your X camera's built-in RAW converter to adjust the effective brightness (and hence, ISO) of an image after it has been recorded, or by moving your external RAW converter's exposure slider.

Digital amplification during RAW processing is beneficial because it's reversible. If the digital amplification (exposure) was too strong, you can always take it back. If it was too weak, you can push it up. ISO (a.k.a. exposure amplification) is a volatile aspect of the photography process because it can be changed anytime: in-camera, prior to writing the RAW file, or later during RAW processing.

The sensor in your X series camera is a so-called ISOless sensor. This means there's no relevant quality difference between conventional signal amplification prior to writing a RAW file and digital amplification later during RAW conversion. This is great, because it allows you to digitally increase the ISO (a.k.a. brightness/exposure) of your shots during RAW processing, either in-camera or with external software such as Lightroom. Pushing the exposure up later in Lightroom won't look much different from choosing a higher ISO setting when you take the shot.



Fig. 100: **ISOless sensor (1)**: This shot was taken with an X-Pro2 at ISO 1600, with classic analog/digital in-camera amplification from base-ISO 200 to ISO 1600. The ISO 1600 result was then burned into the RAW file.



Fig. 101: **ISOless sensor (2)**: This shot was also *effectively* taken at ISO 1600. However, it was shot with an ISO 200 base-ISO setting, using the same aperture and shutter speed as the previous shot, effectively underexposing it three stops (3 EV). The amplification from ISO 200 to ISO 1600 took place digitally during RAW conversion, simply by moving the exposure slider 3 EV to the right, compensating for the underexposure. You won't be able to see any quality difference between the two shots in this book, so I invite you to look at full-size samples that are uploaded to Flickr [60].



Fig. 104: Misomatic combines manual exposure with Auto-ISO. It can be helpful in situations with quickly and suddenly changing light conditions, such as concerts and other stage events, sporting events, action shots, or street photography. Basically, it's about situations that don't leave us enough time to manually adjust the exposure, and where catching the decisive moment is our priority. In misomatic mode, we can set the desired depth-of-field (aperture) and motion blur (shutter speed), while the camera auto-exposes the images by applying the right amount of ISO amplification. To protect against accidental overexposure (top image), we can buy "insurance" by setting the camera to DR200% in misomatic mode. That way, overexposures can be corrected during RAW conversion (bottom image).

Don't forget: ISO is just an amplification of the image signal. Using the misomatic, the amount of light that reaches the sensor is solely determined by your manual aperture and shutter speed settings. It always stays the same, regardless of the automatic ISO setting chosen by the camera. In misomatic mode, the only exposure variable is the amount of signal amplification (a.k.a. ISO), and with an ISOless sensor, this variable can also be adjusted later during RAW conversion. In this context, choosing DR200% ensures that there's ample leeway for after-the-fact exposure corrections of at least ± 1 EV.

Extending the dynamic range

TIP 65

If the dynamic range of a subject is larger than the dynamic range of the camera's sensor or image processing, one of the following phenomena occurs:

- The highlights of the image are blown out or appear too bright (overexposed).
- Midtones appear too dark (underexposed) and shadows lose detail in the blackness.

In both cases, the shot's exposure is out of balance. Sadly, it's very difficult (if not impossible) to restore blown highlights. It's much easier to lift underexposed midtones and blocked shadows. This procedure is called tone-mapping, and it's the only way to access a camera's full dynamic range potential. Certain tonal values of the original exposure are reassigned and changed, either by employing a tone curve or by using a more complex procedure known as adaptive tone-mapping.

To record the full tonal range of a high-contrast subject, it's best to expose the image in a way that preserves the color and texture of the important bright parts of the scene. Of course, doing so can lead to an image with underexposed midtones and blocked shadows that need further processing to look natural, realistic, and pleasing. You can correct these issues with most external RAW converters.

While every RAW converter is different, most programs offer functions to selectively manipulate the exposure of a shot after the fact. For example, you can change the overall exposure with the exposure slider, and you can restore blown highlights with a highlight recovery slider. Most converters also offer sliders that only target shadow tones.

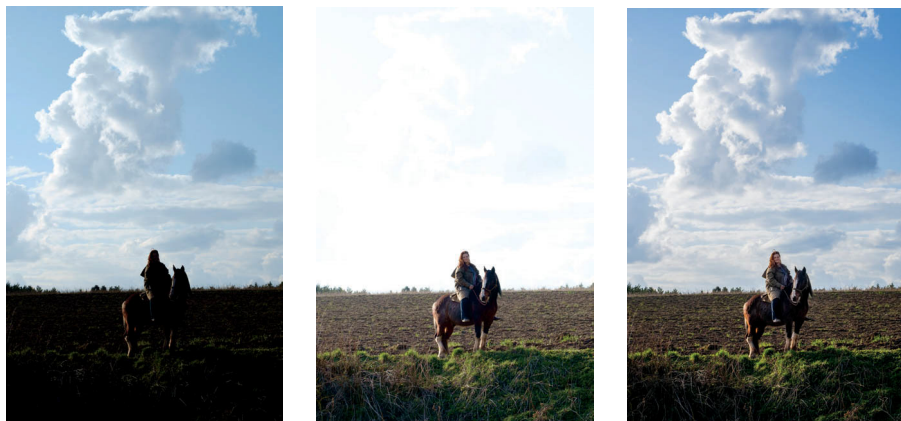


Fig. 105: In many instances, the **dynamic range** of a JPEG is often smaller than the dynamic range of the scene, so no matter how you expose it in your camera, some parts of the result will end up either too dark or too bright (or both). Here's a practical example using an X-E1 with Astia film simulation.

The image on the left was exposed to the highlights, showing color and texture in the blue sky and white clouds. However, the darker foreground is clearly underexposed, resulting in blocked shadows. Horse and rider are almost reduced to a silhouette.

The image in the middle depicts the same scene, but this time it was exposed about two stops (EV) brighter, removing blocked shadows and adding detail to the main subject. However, the cloudy blue sky is now overexposed and has all but disappeared.

This is a catch-22, because no matter how you expose this scene, the JPEG from the camera will always display essential parts either too dark or too bright. Quite obviously, different parts of this scene require different exposures. To pull this off, we use the RAW file of the image on the left, which was exposed to preserve the clouds and the sky. By applying tone-mapping in a state-of-the-art RAW converter, we selectively push (brighten) shadows and midtones without brightening the highlights of the clouds and sky. We can even add additional contrast to the clouds and darken the sky a bit. The example on the right shows the result out of Adobe Lightroom Classic CC, where different pixels received different levels of (after-the-fact) amplification.

The built-in DR function of your X camera can help you automate the tone-mapping procedure. It works in two stages:

- The RAW file is exposed one (DR200%) or two (DR400%) stops darker than indicated in order to preserve bright highlights of a scene.
- During the RAW conversion in the camera, the underexposed shadows and midtones are digitally amplified by one (DR200%) or two (DR400%) stops to restore their natural brightness, while the (already correctly exposed) highlights are mostly left alone in order to preserve them.

The resulting JPEG from the camera has undergone a selective exposure correction. The DR function restores the shadows and midtones of a shot that was initially exposed one or two stops darker to preserve the highlights of the scene. Looking at the resulting JPEGs, this leads to an effective gain in dynamic range (DR): one additional stop of highlight DR at DR200%, and two stops of additional highlight DR at DR400%.

In DR-Auto mode, the camera will automatically select a suitable DR setting. Please note that in this mode, all but the very first X series models will only choose either DR100% (no highlight DR expansion) or DR200% (one stop of highlight DR expansion). DR400% (two stops of highlight DR expansion) is only available when it is manually selected.

You can change the DR settings of your camera in the Quick menu or by selecting SHOOTING MENU > (IMAGE QUALITY SETTING >) DYNAMIC RANGE and then either AUTO, DR100%, DR200%, or DR400%.



Fig. 107: The example above shows an image that has been **exposed to the highlights**. The exterior is perfectly exposed, but this means that the interior is literally left in the dark. If that's what you want, great! If not, you must apply some tone-mapping to the RAW file.

The example below shows the same image after tone-mapping in Adobe Lightroom. The dark shadow regions have been lifted, revealing plenty of detail where the previous image only displayed a dark patch. This method is also known as applying adaptive ISO, because different parts of the image received a different degree of exposure-push amplification. While the shadows were pushed up (ISO increase), the highlights mostly remained as they were.

JPEG settings for RAW shooters**TIP 67**

The previous tip explained the procedure to capture, compress, and later decompress scenes with high dynamic range. Since our exposure relies on the live view and the live histogram, it's useful to find camera settings that force the live histogram and live view to display as much dynamic range as possible. After all, we are shooting RAW and aren't really interested in the JPEGs from the camera, so we want the live view and live histogram to closely represent the data that will be recorded in the RAW files. This goal can be achieved by choosing JPEG parameters in the IMAGE QUALITY SETTING menu that display as much dynamic range as possible:

- Set FILM SIMULATION to ETERNA. This setting results in JPEGs with less contrast than the other film simulation modes.
- If ETERNA isn't available in your X camera, set PRO NEG. STD.
- If PRO NEG. STD isn't available either, or if you are using a first-generation EXR I engine camera like the X-Pro1 or X-E1, select PROVIA.
- Set HIGHLIGHT TONE to -2. This setting reduces the highlight contrast of the JPEG in the live view and in the live histogram.
- Set SHADOW TONE to -2. This setting reduces the shadow contrast of the JPEG in the live view and the live histogram.
- If you are shooting scenes with bright and saturated tones of red, blue, or green, you can also dial back the COLOR setting.



Fig. 111: Comparing dynamic range settings in an X-Pro2: The upper-left image shows our scene taken with extended ISO L (100), f/13, 1/50s, which is basically the missing DR50% setting. Highlight dynamic range is very poor; most bright parts of the image are blown.

The upper-right image shows the same subject shot with the camera's base ISO 200 (DR100%), f/13, 1/100s. Many parts of the shot are still without texture.

On the lower left, you can see an ISO 400 (DR200%), f/13, 1/200s version of the scene, which gives us another stop of highlight dynamic range. In this example, the clouds and the sky are already looking much better.

The lower-right example is an ISO 800 (DR400%), f/13, 1/400s version of our scene, which has two added stops of highlight dynamic range compared to a standard ISO 200 (DR100%) shot. Here, everything is smooth and shiny, with plenty of texture in the clouds and no discoloration of the sky.

All four images were captured with an X-Pro2 in AE mode **A**.

High-contrast scenes: Using the DR function to the benefit of RAW shooters

TIP 69

Fujifilm's DR function works by reducing the indicated ISO level of the RAW file by one (DR200%) or two (DR400%) stops. If you set ISO 800 and DR400% and take a picture, the RAW file of the image will be actually recorded with ISO 200—two stops darker than it appears in the live view or in the camera's resulting JPEG. Underexposing an image by one or two stops means that one or two stops of additional bright highlights are protected.

In other words: When the DR function is active, the camera's built-in RAW converter (which is also known as the JPEG engine) pushes the shadows and midtones of the underexposed RAW data one (DR200%) or two (DR400%) stops up to ensure that the live view and the resulting JPEG match the indicated ISO setting. It won't push the brightest highlights, though.

Example: If you set ISO 800 and DR400%, the RAW data will be recorded with ISO 200 (to protect two stops of highlights), but the built-in JPEG engine of the camera will make sure that the shadows and midtones of the live view and the resulting JPEG image are pushed back up two stops to ISO 800 to compensate for the RAW file's underexposure. The brightest highlights of the JPEG will remain at ISO 200, though.

That's why the minimum ISO settings for DR200% and DR400% in cameras with a base ISO of 200 are ISO 400 and ISO 800, respectively. In the same fashion, cameras with a base ISO of 100 require a minimum ISO setting of 200 for DR200% and ISO 400 for DR400%. Finally, the X-T3 features a base ISO level of 160, so DR200% requires at least ISO 320, while DR400% can't operate below ISO 640. Remember that per definition and convention, *ISO settings only apply to the JPEGs* generated in the camera, not to the RAW files. It's perfectly normal for the RAW data to be recorded lower or

higher than the indicated ISO level, because all ISO settings only apply to JPEGs and the live view, not to RAW data.

Understanding this, it becomes clear that in cameras with base ISO 200, extended ISO L (100) is doing just the opposite of the DR function: it records RAW data one stop brighter at ISO 200, while the JPEG engine pulls down (darkens) the live view and the resulting JPEG one stop to simulate and match the indicated ISO 100 setting. Overexposing an image one stop brighter in the RAW than it appears in the live view and JPEG also means that one stop of highlight dynamic range is cut off and lost, so selecting ISO L (100) has the same effect as a DR50% setting would have (if that setting existed).

In cameras with base ISO 100 (like the GFX 50), the equivalent setting for “DR50%” is ISO L (50), and in the X-T3 (with base ISO 160), it’s ISO L (80).

In many practical situations, correctly exposing to the important highlights of a scene results in a live view image that looks very dark in the midtones and shadows, which makes it hard to compose and focus the shot. Using “JPEG settings for RAW shooters” can mitigate this issue, but sometimes it’s just not enough. If that’s the case, using an equivalent ISO/DR setting can help us out.

For example, the following three exposure settings are perfectly equivalent at the RAW level:

- f/8, 1/400s, ISO 200/DR100%
- f/8, 1/400s, ISO 400/DR200%
- f/8, 1/400s, ISO 800/DR400%

The RAW data for these three shots is the same, only the JPEGs (and hence the live view) look quite different from each other: For example, the live view and JPEG of a f/8, 1/400s, ISO 800/DR400% shot looks two stops brighter than the equivalent f/8, 1/400s, ISO 200/DR100% version. However, the RAW data of these two shots is the same.



Fig. 112: In this X-H1 example, I took four images with the same exposure settings: aperture f/8 and shutter speed 1/400s. The only difference were four **equivalent ISO and DR settings** that neutralized each other at the RAW level: The upper-left image shows the JPEG that resulted from ISO L (100) a.k.a. DR50%, while the upper-right image shows ISO 200/DR100%. The lower-left JPEG is the ISO 400/DR200% version, and in the lower right, there's the image taken with ISO 800/DR400%.

The four JPEGs are clearly different with regards to shadow and midtone brightness, because they all have to match their respective indicated ISO settings. Obviously, a JPEG taken at ISO 800, f/8, 1/400s (lower right) must look brighter than one taken at ISO 100, f/8, 1/400s (upper left). However, the underlying RAW data is the same in all four instances.

This gives you additional options: For example, you can *manually* expose your scene to its important highlights at ISO 200/DR100% and then raise ISO one or two stops to 400 or 800, while at the same time changing the DR setting to DR200% or DR400%. *Increasing* RAW and JPEG ISO two stops from 200 to 800 and *decreasing* RAW ISO two stops by selecting DR400% leaves the RAW data unchanged: $+2-2=0$. The only thing that has become brighter is the live view and the JPEG from the camera.

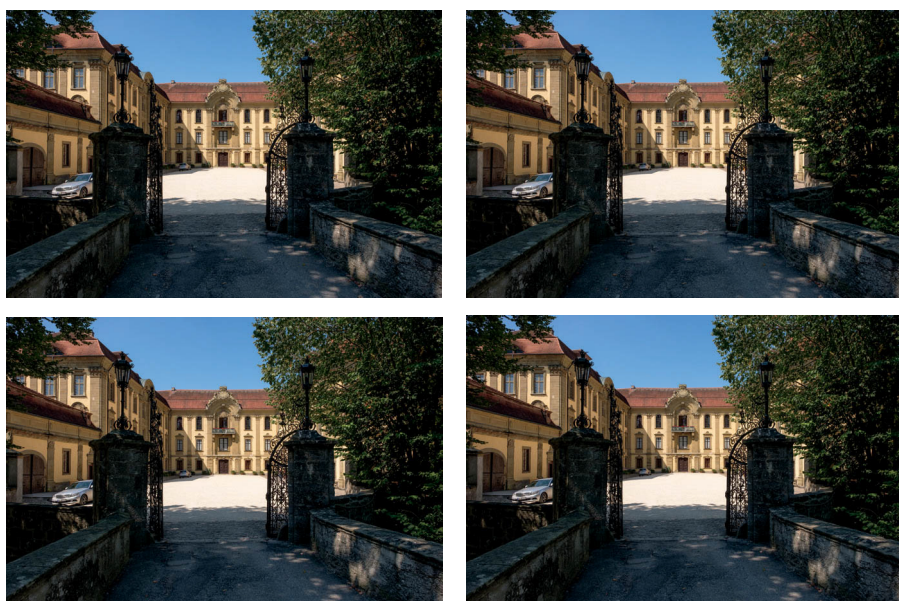


Fig. 113: This example shows the four shots from our previous illustration, all taken with the same exposure settings: aperture f/8 and shutter speed 1/400s. This time, however, I processed the RAW files of the four images in Lightroom Classic CC and applied the same development settings to all of them—with the exception of the exposure slider, which was adjusted to compensate Lightroom's import exposure pull or push that is automatically applied to the RAW data based on the indicated ISO/DR setting.

The Lightroom-processed results from the shots taken with ISO L (100)/DR50% (upper left, Lightroom exposure slider +1 EV), ISO 200/DR100% (upper right, exposure slider 0 EV), ISO 400/DR200% (lower left, exposure slider –1 EV) and ISO 800/DR400% (lower right, exposure slider –2 EV) look perfectly the same. This isn't at all surprising, because the RAW data *is* indeed the same.

This discovery can be of tremendous practical benefit if you intend to make the most of your camera's ISOless sensor and push its dynamic range capabilities to the limits.

The best way to use the DR function for shooting scenes with very high dynamic range is to expose in manual mode **M**. Here's how to proceed:

- Set manual mode **M** and make sure that the exposure preview for manual mode is enabled.
- Deploy "JPEG settings for RAW shooters" by selecting film simulation Eterna (or Pro Neg. Std), Highlight Tone -2, and Shadow Tone -2.
- Set DR100% and manually expose the high-contrast scene to protect important highlights. If available, use the RGB histogram with the live overexposure warning ("blinkies") and set an exposure that is just rich enough that some of the important highlights in your scene begin to blink. Remember that this is about protecting the *important* highlights. Feel free to overexpose parts of your scene that aren't worth saving, like the ball of the sun in a backlit daylight scene.
- Now that your exposure to the scene's important highlights is manually set and locked, the live view may look too dark to comfortably frame the scene. So, let's add the DR function to the mix: First, increase ISO as needed by either one or two full stops (1 or 2 EV). Then neutralize this ISO change by also increasing DR by the same amount (either DR200% or DR400%). For example, you can raise ISO from 200 to 800 (= a two-stop ISO *increase* applied to the RAW, the live view, and the JPEG) while also raising DR from DR100% to DR400% (= a two-stop ISO *decrease* that is applied only to the RAW file, but not to the live view and the JPEG).
- Having completed the previous step, the RAW remains as it was, but the live view looks either one or two stops brighter than before. That's great for demanding, high-contrast scenes, because not only can we perfectly expose to their important highlights, we can also still see what's going on in those really dark parts of the scene.



Fig. 114: Let's revisit this example that I shot with an X-H1 at f/11 and 1/125s. The upper-left image shows the scene as it looks with Provia factory settings and base ISO 200. The upper-right example shows the same image, but now with "JPEG settings for RAW shooters": film simulation Eterna, Shadow Tone -2, and Highlight Tone -2. While these are perfect settings for *exposing* a high-contrast scene toward its important highlights, the live view still looks a tad too dark to comfortably *frame* the scene. Luckily, we now know what to do: We can increase ISO/DR by one or two stops to ISO 400/DR200% (lower-left image) or ISO 800/DR400% (lower-right image) to get a brighter live view (and brighter JPEGs) without affecting the perfect RAW exposure that was determined and locked using the ISO 200/DR100% live view from the upper-left image.

Using manual mode **M** to expose high-contrast scenes is highly recommended because you can easily split the process into two stages: First, you determine and set the correct exposure to protect important highlights of the scene using DR100% and "JPEG settings for RAW shooters." When the exposure is set, you can concentrate on brightening the live view to a more useable level by increasing ISO one or two stops while also raising DR to either DR200% or DR400%.

With the brighter live view, you can easily compose the scene, focus it, and take the shot in the right moment. Not only can you now see what's going on in the shadows and midtones of the scene, the camera's auto white balance will also do a better job when it's not fishing in the dark. This is an accurate, reliable, and straightforward process, and I personally use it all the time with great success.

That said, a few older X models like the classic X100 or the X-A1 and X-M1 don't offer exposure preview in manual mode **M**, meaning you can't use the live view and live histogram in manual mode to determine the correct exposure to the important highlights of a scene. So, here's an alternative procedure to expose and shoot high-contrast scenes in either of the AE modes **P**, **A**, or **S**:

- Set the camera to one of the three AE modes. Select Auto-ISO and make sure that DR100% is set. I also recommend setting either matrix or average metering.
- Use "JPEG settings for RAW shooters" by selecting film simulation Eterna (or Pro Neg. Std), Highlight Tone -2, and Shadow Tone -2.
- Turn the exposure dial in the negative (-) direction to expose your high-contrast scene to protect important highlights. Use the live view and live histogram to determine the proper exposure that doesn't blow critical highlights.
- If the live view appears too dark after the exposure has been set to protect important highlights, you can brighten the image by turning the exposure dial (based on its current position) either three 1/3 EV clicks (= 1 EV) or six 1/3 EV clicks (= 2 EV) in the positive (+) direction, then immediately neutralize your change on the RAW-file level by selecting either DR200% or DR400%.
- If available, you can now use AE-Lock to lock the exposure setting, then take your shot(s).

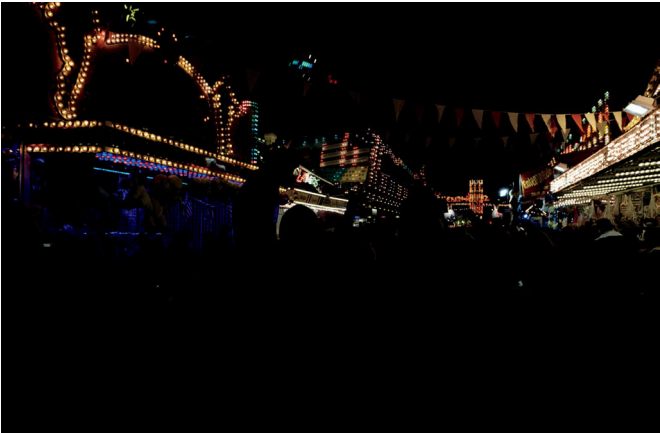


Fig. 115: This X-T1 example illustrates how using the DR function along with “JPEG settings for RAW shooters” can help you see in the darkness caused by scenes with extreme contrast. This exposure was limited by several factors: I couldn’t go slower than 1/60s, because there were moving persons in the scene and I wanted to avoid motion blur. I also couldn’t open up the aperture wider than f/4 due to depth-of-field requirements: the entire group of people was supposed to be in focus. Like all X series cameras, the X-T1 is ISOless, so I set the camera to base ISO 200 to preserve as many of the bright and colorful lights in the background as possible.

The image above shows the original exposure using Classic Chrome and otherwise standard JPEG settings at the camera’s base ISO 200/DR100%, f/4, and 1/60s. While these settings perfectly protect the bright lights in the background, our main subjects are very much invisible. This makes framing the image and focusing on our actual subjects practically impossible. It’s a catch-22: Even though the exposure is spot-on to record as much dynamic range as possible, we still can’t practically use it.

The image in the middle shows how I resolved the problem by using “JPEG settings for RAW shooters” and the DR function. In the case of the X-T1, the settings were Pro Neg. Std, Shadow Tone –2, and Highlight Tone –2. However, these settings alone weren’t sufficient, so I also increased ISO from 200 to 800, and DR from DR100% to DR400%, all while keeping f/4 and 1/60s. These settings didn’t change the RAW data, but they allowed me to finally see what’s going on. I could now compose the shot, and the camera’s face detection was able to detect three faces and automatically focus on the face closest to the center of the frame.

The image below is the final result after processing the RAW file in Adobe Lightroom, again using the Classic Chrome film-simulation preset. I find the amount of dynamic range that can be extracted even from older sensors like the X-Trans CMOS II quite impressive.

As an alternative to raising ISO and DR in tandem (which brightens the live view without affecting the RAW exposure), you can also expose high-contrast scenes in manual mode **M** and then turn off the exposure preview after determining the correct exposure. Here’s how it works:

- Set manual mode **M**, DR100% and turn *on* exposure preview.



Fig. 118: Using virtual high-key in a portrait: This example illustrates a difficult lighting situation with strong contrast and harsh shadows on the face.

The upper-left sample shows a JPEG that was created by exposing for the highlights with the CLASSIC CHROME film simulation and ISO 200. This resulted in a rather dark face with strong contrast and shadows.

The upper-right image shows the same shot two ISO stops brighter, and with extended highlight dynamic range to protect the highlights. This means using ISO 800 and DR400% while maintaining the exposure (aperture and shutter speed) of the upper-left sample. Additionally, I set HIGHLIGHT TONE to -2 to pull back the brightest (skin) tones. As you can see, the eyes are now much brighter and the harsh contrasts are gone.

Too much? Don't worry! Using the camera's built-in RAW converter, you can always create more realistic versions of your high-key shots. In this case (lower-left image), I used PULL -1 (effectively pulling the shot from ISO 800 down to ISO 400) along with DR200% (to compensate for the pull), SHADOW TONE -2 (for more shadow detail), and HIGHLIGHT TONE -1 (to bring back the brightest skin tones).

Alternatively, you can also process the RAW file in any external RAW converter. In the case of the lower-right example, I used Adobe Lightroom.

Another useful application of the DR function is dealing with bright spots in an otherwise regular scene. With a normal exposure, these highlights can easily blow, which is particularly undesirable if they affect a human face.



Fig. 119: This **skin-repair** example was taken in the shadow of a tree, with a few bright sunbeams making their way through the foliage onto our model's face. For the human eye, these bright spots look perfectly harmless. However, highlights like these can be a recipe for disaster for any digital camera if you decide to "correctly" expose the shot toward the darker parts of the face, like I did here.

The example on the left displays the JPEG with DR100%. While the shadow-parts of the skin are correctly exposed, the bright spots are clearly blown: there's no texture.

The image in the middle is the DR200% version, which brings the healing power of one extra stop of highlight dynamic range to the face.

The example on the right was processed with DR400%, which corresponds to two stops of additional highlight dynamic range. The previously "damaged" skin now looks perfectly okay.

DR versus DR-P

TIP 71

In addition to the DR function with its DR-Auto, DR100%, DR200%, and DR400% options, recent X series models like the X-H1 and X-T3 feature a function called DR-P, which stands for Dynamic Range Priority.

TIP 72

Dual Conversion Gain and how to use it

We already know that all cameras featuring the X-Trans CMOS III sensor use a base ISO of 200. Those cameras are the X-Pro2, X-H1, X-T2, X-T20, X-E3, and X100F. However, there's more: these cameras offer what's called "dual conversion gain"—a second (higher) base ISO level. In our case, this level is automatically activated when you set ISO 800 (or higher) at DR100%.

Dual conversion gain (DCG) reconfigures the sensor for low-light use: read noise is further reduced, which means that you can extract additional dynamic range in situations with very little light.

Normally, you wouldn't care about dual conversion gain, because the camera is performing everything automatically. There is no "on/off" switch or menu: simply set a minimum of ISO 800/DR100% (or ISO 1600/DR200%; or ISO 3200/DR400%) and dual conversion gain will be active.

You can make use of this second DCG ISO level in the same way that you use base ISO 200 to extract as much dynamic range from high-contrast scenes as possible. However, in this case, we are talking about situations with very little light; scenes that one would usually expose with really high ISO settings such as 6400, 12800, or even 25600.

Instead of setting these high ISO values, you can just as well set the camera to ISO 800/DR100% (or to equivalent ISO-level settings of ISO 1600/DR200% or ISO 3200/DR400%) and shoot away, while protecting as many high-lights as possible.

Let me give you a practical example: During our Fuji X Secrets Bootcamp workshop in March 2018, we organized an evening get-together in an ancient wine cellar that was only illuminated by a few candles. I shot several candid portraits of the delegates with my X-H1 and an XF16–55mmF2.8 R LM WR lens in manual mode **M** with fixed settings of

ISO 800, f/2.8 (wide-open), and 1/20s (my slowest usable shutter speed for handheld shooting of living subjects). In order to see the image I was composing, I turned *off* the exposure preview in manual mode.



Fig. 121: This **dual conversion gain** example shows a low-light shot as it was taken with my X-H1 at 55mm focal length, f/2.8, 1/20s, and ISO 800/DR100% (the camera's additional "dual gain conversion" base ISO level). The unprocessed result on the left looks really, really dark. The only part that is clearly visible is one of the few candles that were lighting the scene.

On the right, you can see the same image after processing the RAW file in Lightroom Classic CC. Pushing the face of the person up from ISO 800 resulted in brightness equivalents of at least ISO 12800, while the already-bright parts of the candle remained at ISO 800 to protect as much of their texture and tones as possible. It's the usual tone-mapping procedure, and it gives you a glimpse of the dynamic range reserves that are available in Fuji's X cameras. You just have to be bold enough to unleash them.

In cameras with X-Trans CMOS III, dual conversion gain results in a noise advantage of approximately 1/3 EV. This doesn't sound like much (and it really isn't in normal situations), but it can be essential in situations where you have to push shadows up 4 or 5 stops during RAW processing (or need to take images at very high ISO levels like 12800 and above).

Important: *Even though the X-T3 uses a new X-Trans CMOS 4 sensor with base ISO 160, its additional dual conversion gain ISO level is still ISO 800. This means that as far as DCG is concerned, the X-T3 behaves just like its older siblings.*

TIP 73

Creating HDR images

A popular method of capturing high-contrast scenes is HDR photography. HDR [62] means High Dynamic Range: multiple images of the scene are taken at different exposure levels and then merged into a single image with extended dynamic range. The merging process can be facilitated with specialized software, such as Photomatix Pro by HDRsoft.

Typically, HDR requires a minimum of two different exposures of a scene, but some photographers don't stop there. They take five, seven, or even nine different exposures, each separated from the other by (usually) one stop or 1 EV (exposure value).

Here's a procedure that you can use to quickly generate nine different exposures of a scene:

- Put the camera on a tripod or a similar device.
- Connect a remote shutter release or set the self-timer to 2 seconds to avoid camera shake.
- Set the camera to aperture priority **A**.
- Choose a low ISO setting (such as base ISO 200). Don't use extended ISO L, though!
- Deactivate any DR expansion by setting the dynamic range to DR100%.
- Select a suitable aperture for your shot and scene and use manual focus. This ensures that all nine images will be focused the same. If you like, you can also use adapted manual focus lenses.
- Set AE BKT (auto exposure bracketing) to three shots with a variation of ± 1 EV
- Select AVERAGE exposure metering.



Fig. 122: This rather extreme **HDR image** consists of seven RAW shots, each taken with an exposure difference of 2 EV and merged in Adobe Lightroom.

Having prepared the camera for HDR, you can now follow these steps to capture the actual images:

- Set the exposure compensation dial to neutral (0) and press the shutter release. Make sure to either use a remote shutter release or the self-timer. The camera will now record the first three shots of the scene, with exposure levels of 0 EV, -1 EV, and +1 EV.
- Set the exposure compensation dial to -3 EV and press the shutter release. The camera is now recording three more images that deviate -4 EV, -3 EV, and -2 EV from the original exposure.
- Finally, set the exposure compensation dial to +3 EV. After releasing the shutter, you'll get three more exposures, this time with +2 EV, +3 EV, and +4 EV.



Fig. 123: This **handheld HDR** consists of the original “exposed-to-the-highlights” image, plus two additional shots that were exposed 2 EV and 4 EV brighter. Using Lightroom to merge the RAW files into a single HDR-DNG file, the result looks clean and noiseless in the shadows, with plenty of fine texture and no tonal gaps.

TIP 75

Electronic shutter (ES), electronic first curtain shutter (EFCS) and flicker reduction

Most X series cameras feature an electronic shutter (ES). It offers three advantages: it is completely silent, it eliminates vibrations from shutter shock, and it allows shutter speeds as fast as 1/32000s. That’s great in situations where you want to be particularly stealthy, or when you want to use fast lenses (like the XF56mmF1.2 R) with a wide-open aperture in bright light and spare yourself the hassle of attaching an ND filter.

You can set which shutter type the camera is supposed to use in SHOOTIG MENU > (SHOOTING SETTING >) SHUTTER TYPE. There are at least three available options:

- **MS:** The camera is only using the mechanical shutter. This is the default setting and also my recommended standard setting.
- **ES:** This setting switches the camera to the electronic shutter with shutter speeds up to 1/32000s. Extended ISO settings aren't available in ES mode, and you cannot fire a flash when the ES is in use.
- **MS+ES:** In this mode, the camera combines both shutter types. It will automatically use the ES for shutter speeds faster than the maximum mechanical shutter speed. Flash photography is possible, but only within the envelope of the mechanical shutter. ISO may still be limited to the regular non-extended range.

To access shutter speeds beyond the camera's mechanical limit, you can set the shutter-speed dial to **T** and then browse through all available shutter speeds with the command dial in 1/3 EV steps.



Fig. 124: The **electronic shutter** is a practical option for shots taken with fast lenses in bright light, when the maximum mechanical shutter speed simply isn't fast enough to avoid overexposure.

Please note that even at $1/32000$ s, the electronic shutter needs some time to capture all image contents. In most X camera models with ES, it takes the electronic shutter $1/20$ s to record all 24 megapixels of the sensor. This effect, known as Rolling Shutter [63], can lead to weird distortions when you are taking pictures of fast-moving subjects.



Fig. 125: The **distortion effect** of electronic rolling shutters becomes quite visible in scenes with fast-moving subjects like this football.

In addition, image quality will deteriorate when the ES is used in concert with pulsing or flickering artificial light sources. The long readout time and the rolling shutter are also responsible for the restrictions regarding flash photography.

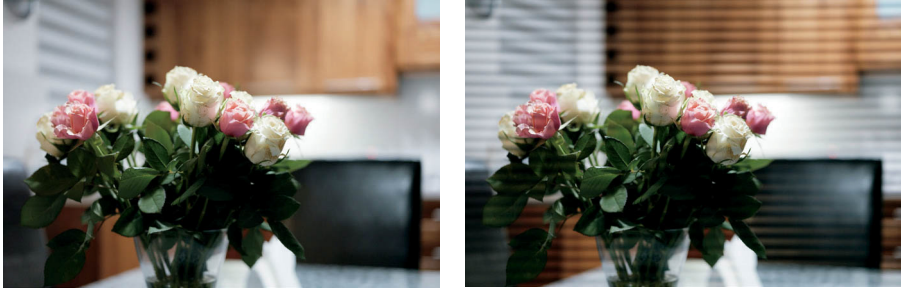


Fig. 126: Pulsing light sources, such as energy-saving lamps and LED lights, go on and off with the same frequency as the electric grid (50 Hz or 60 Hz). While the mechanical shutter can deal with this phenomenon, the electronic rolling shutter cannot. This example shows the same artificially lit scene taken with the mechanical shutter (left) and the electronic shutter (right) of my GFX 50S. The interference of the pulsing light with the rather slow line-by-line sensor readout of the large GFX sensor is hard to ignore.

With the GFX, Fujifilm introduced the option of an **electronic first curtain shutter (EFCS)**, which is also available in the X-H1 and X-T3. The EFCS combines some advantages of the ES with some benefits of the MS: It reduces vibration and eliminates shutter shock by replacing the mechanical first shutter curtain with an electronic version. However, the second shutter curtain remains mechanical, thus avoiding issues caused by electronic rolling shutter. The EFCS also reduces the blackout period in the EVF and emits a softer mechanical shutter noise.

With very fast shutter speeds, using the EFCS can potentially be detrimental to image quality (especially the bokeh). That's why cameras with EFCS offer an EFCS+MS setting that automatically switches back to the MS when the shutter speed exceeds a certain threshold (1/2000s with

TIP 76

CDAF and PDAF: what's the difference?

Both AF methods offer distinct qualities that can be useful during your daily shooting:

- CDAF focuses on surfaces and works best with areas that offer a lot of contrast. A solid white or black wall doesn't work well with CDAF, but a checkered wall works great. It's the same with clothes: unicolor may be tough, but patterned clothes work wonderfully. CDAF operates with a trial-and-error approach: it keeps adjusting the focus until it finds the distance setting with the utmost contrast. CDAF doesn't directly go to the optimal focus setting. This result is heightened autofocus motor activity and visible focus hunting while the AF iterates back and forth until it finds the optimal focus position.



Fig. 127: The original X100 came to market in 2011. It was a CDAF-only camera with a rather slow **contrast detection autofocus** system. However, despite some people claiming otherwise, accurate autofocus was never an issue with this classic camera—as long as the subject didn't move too fast.

- PDAF loves focusing on edges, especially vertical edges (or horizontal ones if you hold the camera upright). Unlike CDAF, PDAF can directly determine the distance to an object, so there's no need for focus hunting. That's why PDAF is considerably faster.
- Both methods depend on sufficient light to work with maximum efficiency. The brighter a scene is and the more contrast it has, the better the AF will work. Bright lenses with large maximum aperture openings are beneficial because they allow the AF to work with more light and less depth of field, which helps increase the precision of the autofocus. It's worth noting that most lenses are less bright near their edges than they are at the center (this effect is called vignetting), so in poor light, the autofocus may work less efficiently with focus frames that are located far off center.

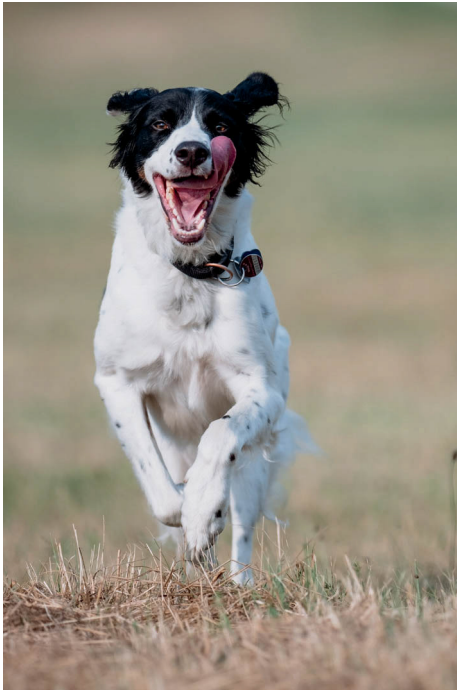


Fig. 128: Tracking fast-moving subjects like this running dog is a job for the **phase detection autofocus (PDAF)**.

TIP 77

AF-S or AF-C?

Your X camera features two basic AF modes:

- **AF-S (AF Single)** is meant for stationary subjects. Once you half-press the shutter button, the camera will focus on the object covered by the active AF frame and lock the distance (as long as you keep the shutter button half-depressed). You can either fully press the shutter button to take the shot, or you can take your finger off the shutter release and try again.
- **AF-C (AF Continuous)** is meant for moving subjects, especially those that move toward or away from the camera. When you half-press the shutter button, the camera starts focusing on the object covered by the active AF frame and continuously adjusts the distance to the moving object while you keep the shutter button half-depressed. In the live view of older or less advanced entry-level models, this may look like the camera is continuously hunting, while the green AF confirmation dot in the bottom-left corner of the screen keeps going on and off. Just make sure that the active AF frame or AF zone always covers the part of the image that is supposed to be in focus.

Every camera experiences a small delay between pressing the shutter and recording the image. This shutter lag can be considered by the predictive PDAF: the camera isn't focusing on the object's current position, but on the position the object is *predicted* to be when the image is captured. Predictive autofocus is also possible with CDAF, though to a lesser degree of performance.

While AF-C focuses using the set working aperture, AF-S can open the aperture beyond working aperture to improve the AF performance in poor light. This also improves the focusing accuracy due to the reduced depth of field caused by the wide-open aperture.



Fig. 129: When shooting with AF-C in poor light, it helps to keep the aperture wide open.

Single Point AF vs. Zone AF vs. Wide/Tracking AF

TIP 78

SHOOTING MENU > AF/MF SETTING > AF MODE lets you choose between SINGLE POINT, ZONE, or WIDE/TRACKING autofocus. Several recent X camera models also offer an ALL option, which lets you seamlessly select one of the three AF modes simply by changing the size of the focus frame or zone.

If your X camera doesn't offer Zone AF or Wide/Tracking AF modes, chances are it's an older model. Don't worry! You can still benefit from most tips in this chapter as long as they apply to Single Point AF.

- **Single Point AF** mode is my recommended AF setting for most applications. In this mode, you can manually select one of many available focus frames (up to 425 in



Fig. 132: To get tiny parts of an image in perfect focus, it's best to choose a **small AF frame size**.

In a similar fashion, you can change the size of AF zones by pressing the focus stick or designated AF button and turning the command dial left or right. You have a choice of three AF zone sizes: in most X cameras it's 3×3 (default), 5×5, or 7×7 out of 91 frames.

Since we can regard AF zones as very large AF frames, the same rules apply: larger zones are more convenient, and they potentially offer a faster AF response; but they are also potentially less accurate than smaller zones.

Keep in mind that the faster PDAF method is only available if the zone doesn't extend beyond the PDAF-enabled point matrix (only the X-T3 and future cameras with an X-Trans CMOS 4 sensor offer PDAF over the entire image area). As soon as an AF zone is configured to include at least one CDAF-only AF point, the focus system will switch to CDAF. You can easily tell the difference between AF points that are PDAF enabled and those that are CDAF only: the

PDAF-enabled points are displayed as larger squares than the surrounding CDAF-only points.

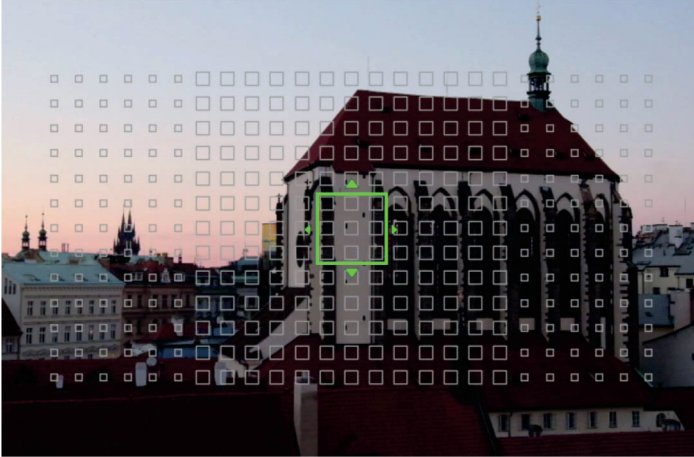


Fig. 133: In many X camera models (this example shows the X-T2), the PDAF-enabled sensor area is indicated by larger squares.

Manual focus and DOF zone focusing

TIP 81

In most X camera models, manual focus (MF) mode offers several focus aids:

- A magnification tool with different magnification levels.
- Focus peaking (Focus Peak Highlight) with two strength levels and optional colors.
- Digital split image (only in cameras with PDAF).
- Digital microprism (X-T3/X-Trans CMOS 4 only).
- An electronic distance scale with depth-of-field indicators.
- Instant AF: autofocus in MF mode, typically triggered by pressing the AF-L button in manual focus mode.



Fig. 135: This shot was manually focused by setting the **hyper-focal distance** for $f/14$ on the camera's electronic focus distance scale (XF27mmF2.8 Pancake).

If you are using an older X model that doesn't offer you a choice between a pixel and a film-format based DOF scale, do not worry: in these cameras, the DOF scale is always pixel based.

TIP 82**Manual focus assistants**

Most X series cameras feature several MF assistants:

- **Focus Peaking** (or Focus Peak Highlight) emphasizes the edges of objects when they are in focus. This method is especially useful in concert with longer focal lengths and bright lenses with a tiny DOF.
- **Digital Split Image** tries to simulate the split image indicator of manual focus SLRs. It works best with vertical lines (or horizontal lines when the camera is held in portrait orientation). It uses the sensor's PDAF-enabled

area, which is why the digital split image is just as large as the area covered by the central PDAF frames.

- **Digital Microprism** is so far only available in the X-T3 and simulates a microprism that used to be popular in the manual-focus SLR days.

To quickly switch between the available MF assistants, you can press and hold the rear command dial for about a second while you are in MF mode.

You can watch a short video [69] demonstrating different manual focus assistants. There's also a video demonstrating the “real thing”: actual analog split image and microprism focusing in an old Minolta SLR [70].

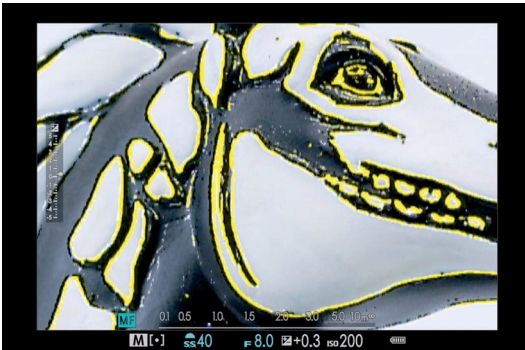


Fig. 136: **Focus peaking** is my favorite among the available manual focus aids. To make things even easier, it can be combined with the magnifier tool. In this X-H1 example, I opted for yellow outlines to indicate the areas of the scene that are in focus.

Using the Focus Check magnifier tool

TIP 83

The magnifier tool is available in most X camera models. It's helpful for checking if the current focus is spot-on. Press the rear command dial (either in AF-S/Single Point AF or in MF mode) to magnify the area that is targeted by the selected focus frame. Of course, this assumes that the rear command dial is operating with its default FOCUS CHECK Fn button assignment.

Pre-AF burns plenty of power because the autofocus in the lens is always working. On the other hand, using it can potentially result in a quicker AF response. When you are shooting action with telephoto lenses, Pre-AF may be helpful—but don't forget to pack a few extra batteries. Normally, I set this option (SHOOTING MENU > AF/MF SETTING > PRE-AF) to OFF.

TIP 87**Using face detection and eye detection**

Face detection is available in most X camera models. It's a combined autofocus and exposure metering mode that can even affect auto white balance. You can activate face detection with SHOOTING MENU > AF/MF SETTING > FACE/EYE DETECTION SETTING and picking one of the four FACE ON options.

Here's what it does:

- The camera scans the scene and detects human faces. It automatically focuses on one of the detected faces when the shutter button is half-pressed. When more than one face is detected, the camera tends to focus on the face that's closest to the center. That face will be highlighted with a green frame. The other detected faces will be highlighted with a white frame.
- Face detection uses a custom version of weighted multi metering that puts an emphasis on the selected face. The goal is to deliver an exposure with correct skin tones. It may also influence the camera's auto white balance.

Face detection is both a blessing and a curse. It's a blessing when it works because it focuses directly on a face and makes sure that it's "correctly" exposed. It's a curse when the detection goes wrong, because it doesn't just mean that the focus might miss; it may also mess up your exposure metering.

The good news is that in many cases, face detection works, even with people who only show their profiles to the camera. The bad news is that face detection may not work well on folks wearing glasses.

Please note that the performance of face detection has been significantly improved in the X-T3 (and other upcoming cameras with X-Processor 4).



Fig. 140: **Face detection** is great for stationary scenes with one or more people looking at (or showing their profile to) the camera.

Here are a few helpful tips regarding face detection:

- If you want to take face detection exposure metering out of the equation (and I highly recommend that you do), you can set the camera to manual exposure mode **M**. While the *metering* will still be affected in this mode, the *exposure* itself will not. Alternatively, you can use the AE-L button to meter and lock the exposure and prohibit face detection from interfering with it while AE-L is ac-

tive. You can still adjust your locked exposure with the exposure compensation dial.

- Face detection works with the full sensor area. This means that AF-C tracking performance of moving objects varies depending on which kind of AF method (PDAF or CDAF) can be used by the camera. In models prior to the generation of the X-T3, face detection isn't the best option when tracking an athlete or a child running toward the camera. With these older cameras, it may be better to use conventional AF-C mode with one of the central AF frames or an appropriate AF zone.
- Spot, center-weighted, and average metering aren't available when face detection is active. The camera is always using a derivate of multi metering.
- When face detection fails to detect a face in the scene, the camera will automatically fall back to the selected regular AF mode: Single Point, Zone, or Wide/Tracking. At the same time, exposure metering reverts to regular multi metering.
- AF-Lock is not available when face detection is active.
- In most cameras, face detection can be assigned to any function (Fn) button. Personally, I tend to assign it to the lower selector button.

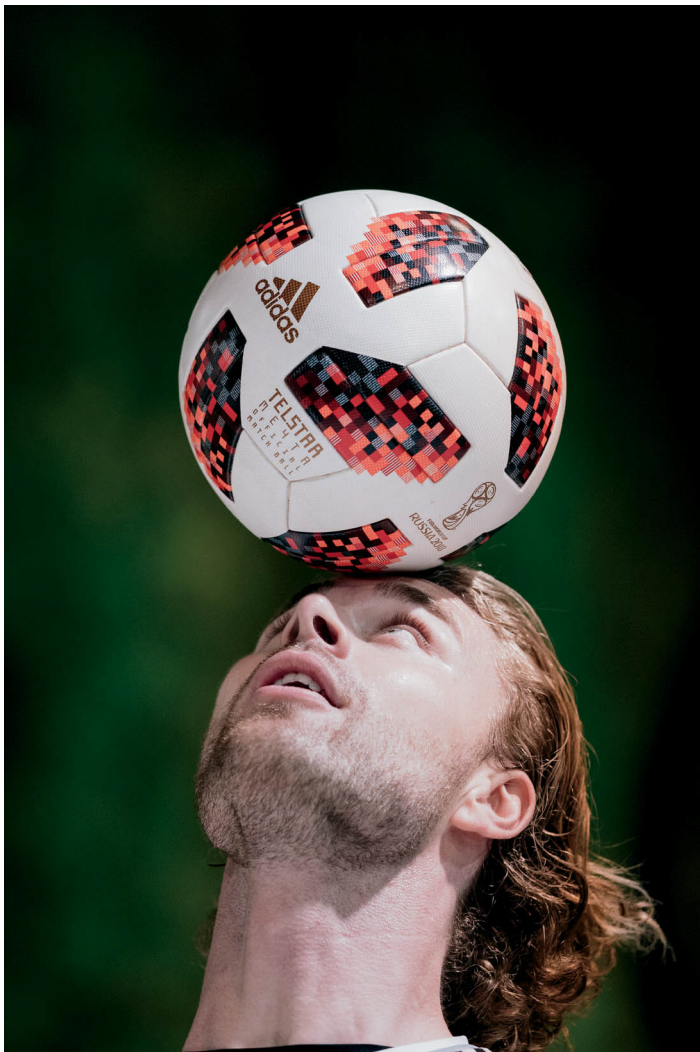


Fig. 141: For persons who are moving around, only the new X-T3 and upcoming models with X-Processor 4 are fast enough to confidently track their face with AF-C and face/eye detection.

Face detection accuracy can be improved with the optional eye detection feature. With the exception of the new X-T3 platform, eye detection is only available in AF-S mode. To activate it, select either FACE ON/LEFT EYE PRIORITY or FACE

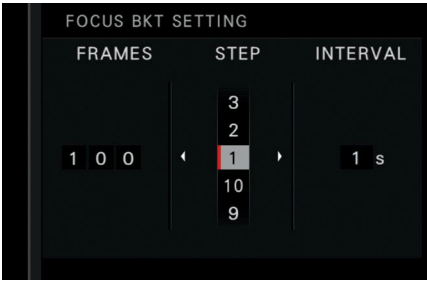


Fig. 147: The **focus bracketing** configuration screen allows you to set the number of frames that the camera should automatically take (FRAMES), the focus difference between individual shots (STEP), and the pause between individual shots (INTERVAL). The latter is useful to have the camera settle down after each shot to avoid shutter-induced vibration. If available, it's also recommended to activate the electronic first curtain shutter (EFCS).

To initiate a focus bracketing run, it's best to select MF and manually focus on the nearest point of your scene that you want to have in perfect focus. It's also recommended to stop down the lens to its "sweet spot." With macro lenses, that's typically two stops down their maximum aperture, while wide angle lenses often deliver peak performance three or four stops down.

Depending on your needs and time restraints, you can experiment with different step settings. To start the sequence, make sure that the camera is in BKT mode (DRIVE menu or dial) and that FOCUS BKT is selected as the BKT MODE, then press the shutter button. The camera will now take the set number of images or stop when it reaches infinity—whatever occurs first.

When the camera has finished recording the source images, you can merge them in Photoshop or specialized focus stacking software.



Fig. 148: This **focus stacking** example consists of 241 individual RAW files that were automatically recorded by my GFX 50S with a GF120mmF4 R LM OIS Macro lens and MCEX-45G WR macro extension tube at f/8. The RAW files were merged into a single DNG file using Helicon Focus. The DNG was then processed in Lightroom Classic CC.

Focusing on moving subjects (1): the “autofocus trick”

TIP 93

Rule of thumb: Use AF-S (Single) for stationary subjects; use AF-C (Continuous) for subjects that move toward or away from the camera. But, as usual, there’s no rule without an exception: meet the so-called “autofocus trick” or “shutter mash” technique:

- Set the camera to AF-S and single shot drive mode (S). Where available, make sure that High-Performance or Boot mode is on.
- Use Single Point AF or Zone AF. Select an AF frame or zone position and size that cover the part of the moving subject you want to be in focus.

- Set a suitable exposure and make sure that the shutter speed is fast enough to avoid unwanted motion blur. Most action shots require shutter speeds of at least 1/1000s.
- Follow the moving subject in the viewfinder, making sure that the selected AF frame or AF zone always covers the part that needs to be in focus. Do *not* half-press the shutter button!
- *Fully* depress the shutter button in one swift motion when you want to take the shot. The camera will need some time to focus, so make sure the focus frame remains positioned on the moving subject while the camera is focusing. As soon as the camera can lock the focus, it will automatically take the shot. Depending on your X camera model, the time between fully depressing the shutter and the camera taking the shot can extend to a good fraction of a second.

The AF trick, also known as shutter mash, is based on the camera's autofocus priority logic. When you release the shutter, the camera *first* attempts to lock the focus, *then* take the shot. Since the delay between having locked the focus and releasing the shutter is very short, the moving subject ends up being in focus most of the time. This means that the AF trick works best with aperture settings that offer sufficient depth of field, and with subjects that don't move too fast toward the camera.

A negative aspect of this method is the delay between fully depressing the shutter button and the camera taking the shot. This makes it challenging to hit decisive moments and requires some amount of foresight from the photographer.



Fig. 149: A running horse captured using the **autofocus trick** or **shutter mash technique**. With older X camera models like the X100, X100S, X-Pro1, X-E1, X-M1, X-A1, or X-A2, this method is the only way to autofocus on subjects that are moving toward the camera. This sample image was taken with an X-E1.



Fig. 151: **Panning** the camera in synch with a racecar at 1/60s: the slow shutter speed resulted in f/18 and more than sufficient DOF using a focal length of 50mm.

TIP 95

Focusing on moving subjects (3): autofocus tracking using Single Point AF, Zone AF, or Wide/Tracking AF

Predictive PDAF (phase detection autofocus) is available in most X cameras. It allows you to track moving subjects in three-dimensional space. Since the camera can calculate the movement of the object, it can automatically pre-focus on its predicted distance and compensate for any inherent shutter lag.

Please note that the X10, XF1, X-S1, X100, X-Pro1, X-E1, X-A1, X-A2, X-A3, GFX 50S, and GFX 50R don't offer PDAF at all. The X20 and X100S do feature on-sensor PDAF, but their AF systems aren't designed to track moving subjects and behave like the CDAF-only models with contrast detection autofocus.

Consequently, this tip is meant for users of the remaining X series models, such as the X-E2(S), X-T1, X-T10, X-Pro2, X-T2, X-T20, X-E3, X-H1, X-T3, XQ1, XQ2, X30, X70, X100T, and X100F. Xacti-made models like the X-A5, X-T100, and XF10 also offer PDAF with subject tracking, but its implementation is so slow and sluggish that many consider it hardly usable.

The X-T3 and future models with an X-Trans CMOS 4 sensor feature predictive PDAF that covers the entire sensor area. Users of these cameras don't have to care about restricting AF frames or zones to the camera's central PDAF area, because the entire sensor is the PDAF area.

Let's start with the **Single Point AF** and **Zone AF** modes:

- Set the focus to AF-C and make sure that High Performance or Boost mode is set.
- Set the camera to burst mode. I recommend a slow setting of 3 fps (cameras with an EXR II processor) or 5 fps (cameras with X-Processor Pro and X-Processor 4) that displays a real-time live view image between shots and supports all AF frames.
- If you are using Single Point AF, select one of the central PDAF-enabled autofocus frames. As of December 2018, only the X-T3 covers the entire sensor area with PDAF.
- If you are using Zone AF, select a zone that doesn't extend beyond the PDAF point matrix. If you use a zone that includes AF points outside this PDAF-enabled area, the camera can only use CDAF. Again, X-T3 users can happily ignore this restriction.
- Position the selected AF frame or AF zone to directly cover the subject or the part of the subject that you want in focus. Half-press the shutter button, and the camera will start tracking the subject covered by the AF frame or AF zone.

- Keep the shutter button half-depressed as you follow the moving subject with the selected AF frame or AF zone.
- Fully depress the shutter when you want to start taking a series of exposures. The actual burst speed (frame rate) depends on how well the camera can track the subject. As the camera is taking pictures, keep the selected AF frame or AF zone on the part of your image that is supposed to be in focus. This may be challenging at first, so practicing is important.



Fig. 152: **AF tracking** with AF-C and burst mode: The predictive autofocus was tracking one of the kids with the selected AF zone while they were running toward the camera. To make this kind of shot work, it's vital to follow the subject with the active AF frame or AF zone, making sure it's always covering the part of the subject that is supposed to be in focus.

In principle, AF-C tracking also works in single shot mode (DRIVE mode **S**, not to be confused with the AF mode **S**). In this case, the camera takes a single frame when the shutter button is fully depressed, then ends the tracking.

As an alternative to Single Point and Zone AF, you can also use **Wide/Tracking AF** mode in concert with AF-C to track a moving subject. This mode enables real 3D tracking, meaning the camera isn't merely tracking a subject's changing distance to the camera (z-axis), but also its left/right (x-axis) and up/down (y-axis) movements inside the image frame.

Here's how it works:

- Set the focus mode to AF-C and make sure that High Performance or Boost mode is active.
- Set the camera to **Wide/Tracking AF** and select a slow burst mode.
- Select one of the available tracking AF points. The point you select will serve as a starting point for your tracking action, so position it in a way that suits your composition.
- To identify your target, make sure that the selected AF point covers the object you want to track and half-press the shutter button. While you keep the shutter button half-pressed, the camera will use pattern recognition to automatically follow the object as it moves around the frame (or as you move the camera around) with a "cloud" of small green AF frames.
- Fully depress the shutter button and keep it pressed to take pictures at the selected burst rate.



Fig. 153: AF-C in concert with **WIDE/TRACKING** and burst mode can track a subject in 3-dimensional space. To accomplish this, the camera is using pattern recognition to follow the designated subject as it moves.

Performance-wise, AF-C Tracking mode has long been a weakness with many X cameras. This changed for the better with the X-E3 and X-H1, as well as firmware upgrades for the X-Pro2, X-T2, and X-T2o that brought these models up to par. While the X-T3 offers the best 3D tracking among all X cameras, the X100F and older models with EXR II processors still suffer from lackluster tracking performance.

The same is true for AF-C tracking with face detection. As of December 2018, only the X-T3 offers great AF-C subject tracking in concert with face and eye detection. Previous X models are still using a weaker face detection algorithm that works with persons who are standing still, but falls apart with fast-moving subjects.



Fig. 154: AF-C in concert with face detection has traditionally been a weakness of X series cameras. This changes with the X-T3, which offers fast face- and eye-detection tracking. This example was shot wide open with the XF200mmF2 R LM OIS WR telephoto lens.



Fig. 156: By selecting FRONT as your ZAS setting, you can force the camera to focus on whatever part of the image inside your selected AF zone happens to be closest to the camera. In the case of the vulture that was flying toward the camera (above), a ZAS FRONT setting allowed me to focus on the bird's head and beak instead of the more prominent wings. However, using the same settings in a fly-by situation (below) only shifted the focus toward the left wing, which was closest to the camera within the 3×3 zone I had selected in my X-H1.

Unlike the X-T2, X-T3, and X-H1, the X-T20, X-E3, and X-Pro2 do *not* let you set these three parameters directly and independently. However, you can set them indirectly by choosing from several presets that cover typical AF-C shooting scenarios. Select SHOOTING MENU > AF/MF SETTING > AF-C CUSTOM SETTINGS, then pick one of the following available parameter sets:

- SET 1: STANDARD SETTING FOR MULTI-PURPOSE is the default setting and is our general AF-C setting. It's a great choice for situations where you don't have a clear understanding of how a specific custom setting could improve the AF-C performance. Its parameter settings are TS 2, STS 0, and ZAS AUTO.
- SET 2: IGNORE OBSTACLES & CONTINUE TO TRACK SUBJECT keeps the focus on a subject even when it's temporarily going out of the frame or is obscured by obstacles. This can be useful for following a specific target with the camera and ensuring that the target isn't lost when it's temporarily obscured by people, trees, or other obstacles that pass through the line of sight. Its parameter settings are TS 3, STS 0, and ZAS CENTER.



Fig. 157:
Set 2 is a good choice when you want to track a specific, steadily moving subject without interference, like this girl riding a scooter through the shot.

- **SET 3: FOR ACCELERATING/DECELERATING SUBJECT** is your typical racetrack mode. It takes changing relative speeds of subjects moving towards the camera into account. Whenever you have targets that rapidly accelerate or decelerate, this mode can be useful, especially in concert with XF lenses featuring high-speed linear autofocus motors. Its parameter settings are TS 2, STS 2, and ZAS AUTO.
- **SET 4: FOR SUDDENLY APPEARING SUBJECT** allows the camera to instantly focus on a subject that enters the focusing area, with priority given to any object (or any part of it) that is closest to the camera. It is ideal for subjects that suddenly appear in the focusing frame. Its parameter settings are TS 0, STS 1, and ZAS FRONT.



Fig. 158: **Set 4** makes sure that the AF-C immediately focuses on what's closest to the camera (as long as it's located anywhere inside the selected AF zone).

- SET 5: FOR ERRATICALLY MOVING & ACCEL./DECEL. SUBJECT is suitable for subjects that are moving at varying speeds in different directions, coming in and out of the focusing area. It is optimized for shooting field sports like soccer or tennis. Its parameter settings are TS 3, STS 2, and ZAS AUTO.
- SET 6: CUSTOM is currently (December 2018) only available in the X-T2, X-H1, and X-T3. It stores your individual setting for the three AF-C subject-tracking parameters TRACKING SENSITIVITY (TS), SPEED TRACKING SENSITIVITY (STS), and ZONE AREA SWITCHING (ZAS). Use this preset to manually create optimized settings for the specific movement characteristics of your subject.

Focus priority vs. release priority

TIP 97

The autofocus in your camera will *always* try to focus on a subject before it takes the shot. In this context, release priority vs. focus priority only refers to how the camera is behaving when the AF *fails* to lock on a target:

- Set SHOOTING MENU > AF/MF SETTING > RELEASE/ FOCUS PRIORITY > AF-S PRIORITY SELECTION > FOCUS to stop the camera from taking a picture when the autofocus (AF-S) cannot lock onto a target (red AF warning).
- Set SHOOTING MENU > AF/MF SETTING > RELEASE/ FOCUS PRIORITY > AF-C PRIORITY SELECTION > FOCUS to make sure that the camera only takes pictures in AF-C mode (particularly in concert with burst mode) when the autofocus can lock onto something.

Basically, selecting focus priority for AF-S and AF-C reduces the number of out-of-focus pictures on your memory card.

By default, the camera is set to release priority, following the motto, “better a misfocused shot than no image at all.”

Since I am no friend of misfocused shots, my cameras are set to focus priority for both AF-S and AF-C.

Please note that when AF+MF is active in AF-S mode, the camera will always use AF-S Release Priority.

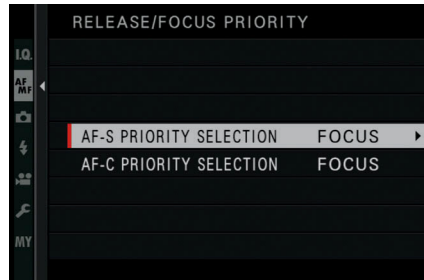


Fig. 159: Most X cameras allow you to select either **focus** or **release priority** for AF-S and AF-C. Personally, I opt for focus priority.

TIP 98

Focusing in good light: What could possibly go wrong?

Many X series cameras find it difficult to determine a reliable and reproduceable focus distance when you are focusing on distant objects, such as a mountain, a building, or a wall. This is particularly common when you are in AF-S mode and one or more of the following conditions are met:

- You are using a wide focal length.
- You are using a slow lens with a small maximum aperture opening (such as f/3.5 or higher).
- You are stopping down the lens in good lighting conditions (such as f/8 for a sunny landscape shot).

A typical example would be a bright and sunny day where you are focusing on a distant subject with nice contrast. You are using a focal length of 16mm, and you are stopping down the lens to f/8 in order to get sufficient depth of field.

What could possibly go wrong? As it turns out, quite a lot. You might notice that repeatedly focusing on the subject

(by repeatedly half-pressing the shutter button) leads to a variety of different focus distances on the camera's distance scale. This is strange. After all, the distance between your camera and subject doesn't change, so you'd expect the autofocus to repeatedly and reliably deliver the same focusing result. However, in a situation like the one that I have described above (AF-S, sunny day, 16mm, f/8, distant subject), that's not necessarily the case.

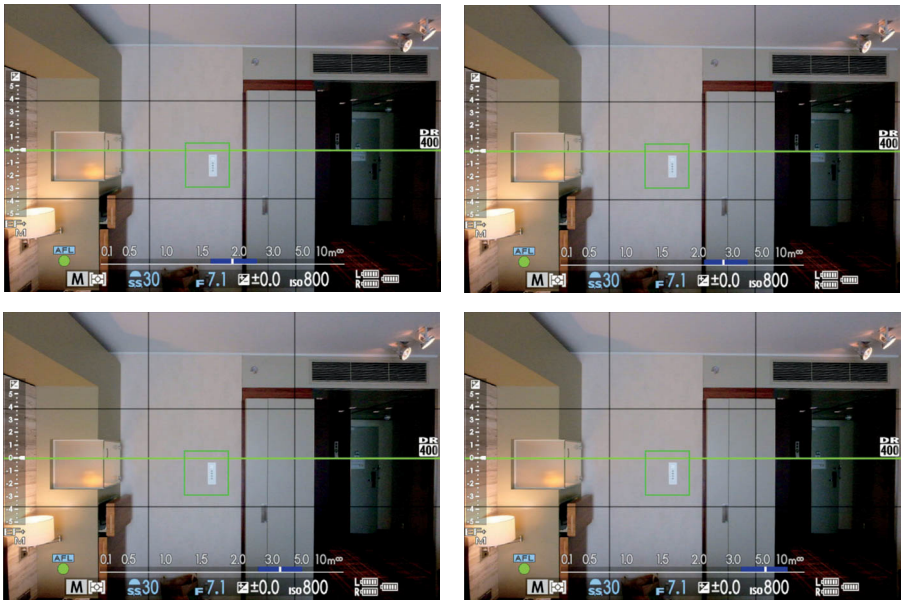


Fig. 160: Using AF-S with a stopped-down wide-angle lens in decent light can lead to unreliable autofocus results. You can test this unpleasant phenomenon by putting the camera on a tripod and repeatedly focusing on the same non-moving target (like a wall). In theory, the autofocus should always return the same focus distance, but as it turns out, it often doesn't. In this example, the wall was actually about 3 meters away from the camera, but repeated refocusing with a 16mm lens delivered random autofocus distances between 2 and 5 meters.

Why? I have a theory: By using a wide focal length in concert with a slower lens (or by stopping down a fast lens in bright light), the resulting focusing aperture delivers so much

The correct **white balance** ensures that neutral (white or gray) areas of an image appear without color tints, regardless of the light conditions. At the same time, the results are usually not supposed to look clinically neutral. Your X camera masters this task quite well, so you can rely on the Auto white balance setting to get it right most of the time.

However, “most of the time” is not “all the time.” There are instances when the white balance is off, or when you *want* it to be off. For example, you may want to emphasize a sunset with a warmer white balance. In such cases, it makes perfect sense to manually set the white balance in advance or after the fact.

X series cameras offer a variety of options to manually set the white balance:

- Several white balance presets for typical situations, such as sunny weather (Fine), cloudy skies (Shade), and tungsten light (Incandescent).
- A Kelvin option to manually set the color temperature.

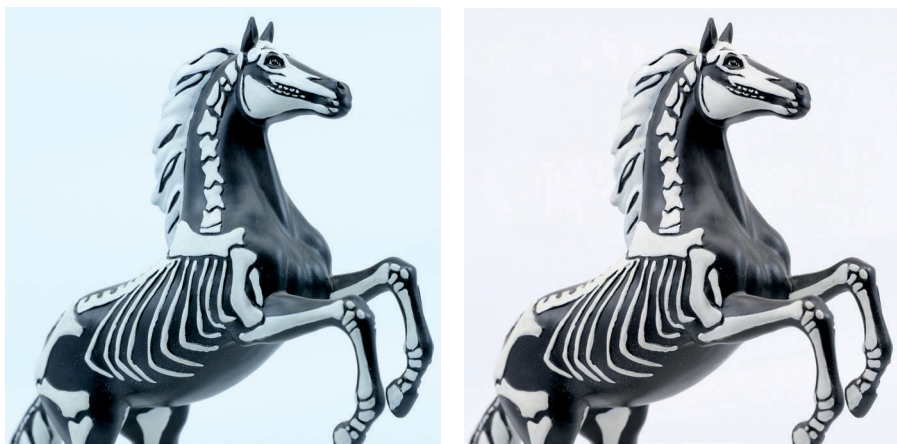


Fig. 162: AUTO white balance isn't always right. However, you can always adjust white balance later with the built-in or an external RAW converter. In this case, a simple **white balance preset** change from AUTO (left) to FLUORESCENT LIGHT-1 (right) did the job.

- Custom white balance that meters a white or neutral surface (like a white wall) under the current light conditions. This way, the camera can adjust the white balance to make the surface appear neutral.

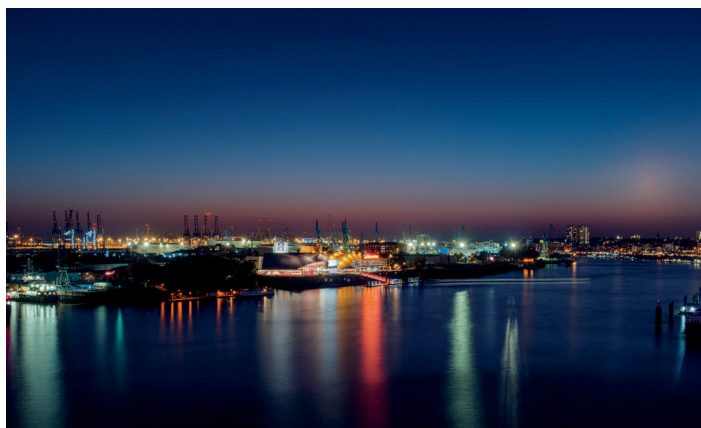
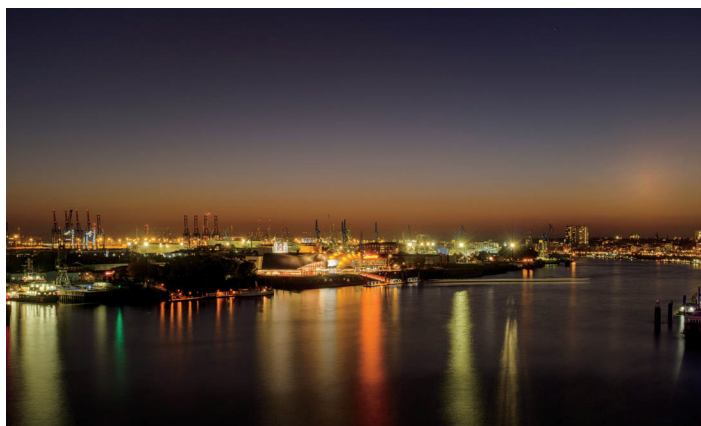


Fig. 163: Two versions of the same shot processed with **different white balance settings**. The image above shows the WB Auto setting without further corrections; the image below shows the same shot after a manual white balance adjustment in Adobe Lightroom. While white balance can also be adjusted with the camera's built-in RAW converter, extensive changes like this one are easier to accomplish with external RAW conversion software.

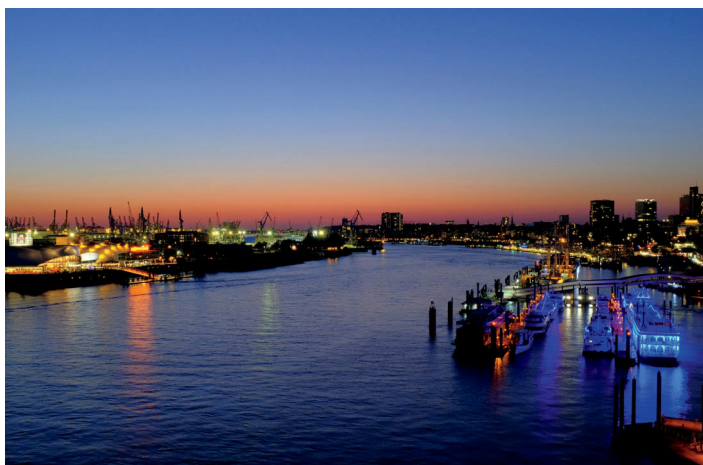
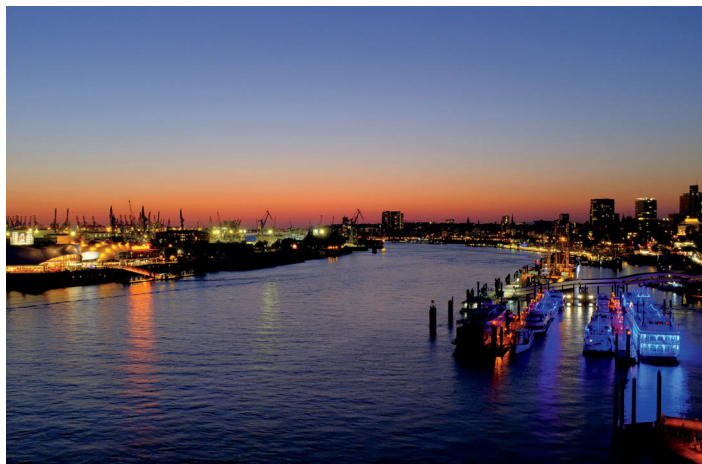


Fig. 166: WB SHIFT in action: The example above shows a straight-out-of-camera image (SOOC JPEG) with the AUTO white balance settings. Below, you can see the same image, again straight out of camera and with AUTO white balance, but with an additional WB SHIFT of BLUE +3 and RED -3 to make it look cooler than the original.

Important: *WB Shift is only available for in-camera JPEGs from the built-in RAW converter. When you process a RAW file externally with Adobe Lightroom or similar software, any WB Shift settings that were active when you took the image will be disregarded.*

White balance and monochrome images

TIP 102

You may think that white balance adjustments don't affect black-and-white images, because monochrome shots only consist of neutral shades of gray. In reality, your white balance settings still affect the *underlying* color information that your monochrome conversion is based on.

Black-and-white photography is color photography with an additional dimension of difficulty. This added dimension is determining how different grayscale levels are assigned to different colors. Since your white balance settings affect the colors of the underlying shot, they also affect the gray-scales of the color-to-monochrome conversion.

Black-and-white images can be created either in-camera (with the MONOCHROME and ACROS film simulations) or externally with RAW conversion software such as Adobe Lightroom, Capture One, or Silkipix. When you set your X series camera to ACROS or MONOCHROME, it is still re-coding RAW *color* images, which are then converted into black-and-white JPEGs.

Knowing this, you can manipulate the look of your black-and-white conversions by changing the white balance during RAW conversion—either in-camera or externally in software like Lightroom. In-camera with the built-in RAW converter, you can use one of the white balance presets, or select a manual Kelvin setting between 2500K and 10000K.

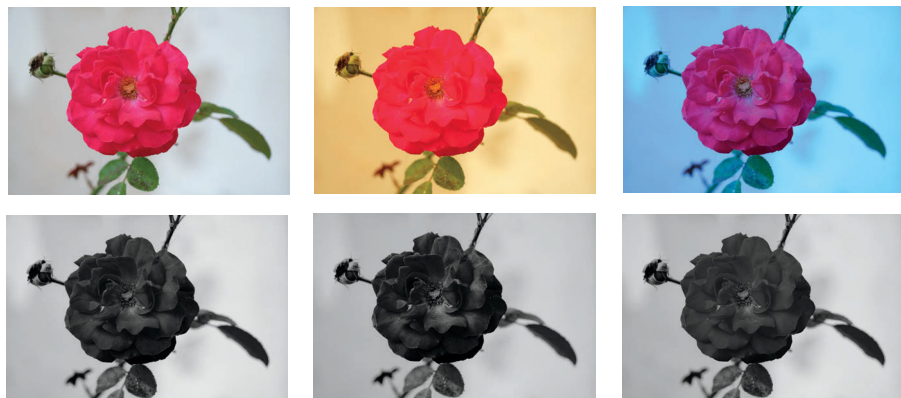


Fig. 167: White balance and monochrome: In the upper row, this illustration shows the same color image with Auto white balance (left), a 2500K setting (center) and a 10000K setting (right). The lower row exhibits monochrome conversions of the above images, all three made with a MONOCHROME+G FILTER film simulation and a SHADOW TONE +4 setting. The different underlying white balance settings have a visible impact on the appearance of the monochrome conversions.

TIP 103**Using film simulations**

The importance of film simulations for the overall look of a JPEG is often underestimated. Film simulations influence color grading, color saturation, dynamic range, and contrast in the resulting JPEGs. Picking a film simulation should always be the first step when adjusting JPEG parameters. As with all JPEG settings, film simulations have no effect on the actual RAW file (the digital negative). They only affect the JPEGs that are generated in the camera (the digital prints). Most current X camera models offer six or seven different color film simulations, eight black-and-white modes, and one sepia option:

- PROVIA is the standard, all-purpose setting. The name reminds us of Fuji's popular Provia slide film.

- ASTIA is another color slide film derivate with softer highlights and pleasing skin tones. It's often used for portraits but can also work with landscape shots that feature vegetation and blue sky.
- VELVIA is a very contrast-heavy, color-saturated derivate of the legendary Fuji Velvia slide film. It's mostly used for landscape and nature shots and is rather unsuitable for portrait work.
- CLASSIC CHROME reminds us of the golden era of *LIFE* magazine color photography. The distinctive look of Classic Chrome is equally suitable for landscapes and portraits.



Fig. 168: The distinctive look of **CLASSIC CHROME** has earned it much popularity in a very short time.



Fig. 175: GRAIN EFFECT adds natural-looking analog grain to all film simulations, providing extra texture and micro contrast for an organic look. These zoomed-in samples show the same image as before in four variations, all processed in-camera with minimal noise reduction: MONOCHROME with GRAIN EFFECT OFF (top left), ACROS with GRAIN EFFECT OFF (top right), MONOCHROME with GRAIN EFFECT WEAK (bottom left), and MONOCHROME with GRAIN EFFECT set to STRONG (bottom right). As you can see, the built-in noise shaping of ACROS holds its own without adding another layer of artificial grain via the GRAIN EFFECT setting.

Adding artificial grain may not be necessary for shots that were taken with ISO settings of 800 or higher. Instead, you can reduce the NOISE REDUCTION setting to -4 to preserve as much noise (and detail) as possible and allow the camera to do its magic.



Fig. 176: **Grain effects** are also available in some external RAW converters and post-processing software. This sample shows a Lightroom-processed image with a subtle grain effect. Artificial grain is primarily about adding texture and micro contrast to an image. In most cases, the grain itself will be invisible at normal viewing distances. Subtle extra grain can also be used to trick hosting services and websites into applying less JPEG compression to out-of-focus areas when you upload images to share online. Less compression means larger files and smoother tonal transitions with less artifacts.

Contrast settings: adjusting highlights and shadows

TIP 105

A useful feature of the X series is its ability to independently set the contrast [84] for dark and bright parts of a JPEG image using the HIGHLIGHT TONE and SHADOW TONE settings. These settings can also be used to extend or reduce a JPEG's dynamic range by lifting dark shadows or lowering bright highlights. To increase the overall contrast of a shot, you can increase both parameters in tandem by choosing a

setting on the plus side. To reduce the overall contrast, pick a negative setting for both parameters.



Fig. 177: Comparing **Shadow Tone** settings: The image on the left shows a SHADOW TONE +2 version; the image on the right shows the same RAW file processed with SHADOW TONE -2. Shadows and dark midtones are lifted by the reduction of the JPEG’s shadow contrast, while the highlights remain untouched.

It’s worth mentioning that increased contrast also enhances the impression of image sharpness and color saturation. This demonstrates that JPEG parameters always work in concert with each other.



Fig. 178: Comparing **Highlight Tone** settings: The image on the left shows the HIGHLIGHT TONE -2 version of a shot; the image on the right shows the same RAW file processed with HIGHLIGHT TONE +2. Increasing the highlight contrast leaves the shadows and darker midtones untouched.

Skin tones and noise reduction: smooth or with texture?

TIP 106

The smoothness of surfaces (such as skin tones) at higher ISO settings is best controlled by reducing the NOISE REDUCTION setting. To reveal more detail and achieve less skin smoothening with in-camera JPEGs, you can decrease the noise reduction to -2 or lower.

If this still doesn't meet your demands, you can switch to an external RAW converter to turn RAW files into JPEGs or TIFFs. Current versions of RAW File Converter EX, Silky-pix, Adobe Lightroom and Capture One offer copies of the camera's internal film simulation modes. This means you can replicate the famous Fuji Colors and enjoy more control over many processing parameters.

Please note that RAW files recorded with extended DR settings (DR200%, DR400%) may require additional manual processing in external RAW converters if you want them to match the look of your camera's built-in film simulations. You'll have to tone-map the image and manually recover blown highlights. In Lightroom and Adobe Camera Raw, you can combine the sliders for exposure, highlights, shadows, whites, and blacks to get the job done.



Fig. 179: In models with X-Processor Pro and X-Processor 4, the built-in film simulations and their copies in Adobe Lightroom look almost identical. This example shows a Provia JPEG from an X-Pro2 (left) and its Lightroom counterpart (right).

SHADOW TONE -2, and ETERNA or PRO NEG. STD film simulation.

- You could create profiles for black-and-white or infrared shooting. For example, a black-and-white profile could contain one of the eight B&W film simulations, minimal noise reduction, and additional highlight and shadow contrast.



Fig. 185: Selecting C7 in the Quick menu of my X-H1. The C7 custom setting is traditionally the spot where I keep my “RAW Shooter” settings. To help you remember what each of the (up to) seven custom settings does, you can assign them memorable labels such as “RAW Shooter.”

TIP 112

Working with the built-in RAW converter

The RAW converter in your X series camera serves two main purposes:

- You can create different versions of a shot; for example, a colorful Velvia version and a gritty black-and-white version of the same image. Not sure what’s best or what you want? Quickly create multiple versions with different film simulations and varying JPEG parameters, then sort them out later at home on your calibrated computer screen.
- You can improve your JPEGs after the fact. Since it’s hard (if not impossible) to guess and set the perfect JPEG settings for each shot in advance, it’s more convenient to ad-

just these parameters later when you have time to look at your results. You can easily change parameters like white balance, color saturation, contrast settings, sharpness, or noise reduction. You can also adjust the exposure and try different film simulations.



Fig. 186: Using the **built-in RAW converter** to change the look of a shot: The left image shows the scene as it was recorded with the camera's default settings. On the right, you can see the same shot processed with ACROS+Red Filter and maximum contrast (SHADOW TONE +4 and HIGHLIGHT TONE +4).

Here are a few things you can accomplish with the built-in RAW converter:

- Use PUSH/PULL processing to brighten (push) underexposed shots or darken (pull) overexposed images.
- Use the contrast settings (SHADOW TONE and HIGHLIGHT TONE) to selectively adjust the contrast of dark or bright parts of your image. It's perfectly adequate to



Fig. 189: **X RAW STUDIO** offers a straight-forward workflow. You begin with selecting a RAW image from your computer's hard drive. In this case, I chose a shot of the Taj Mahal that I took with my X-T2 and an XF18–55mm kit zoom. The image is automatically processed and displayed with the camera settings that were active when I took the shot (top image). In this case, I used the camera's factory defaults with PROVIA.

The center image is the same RAW file after processing it with different settings. After changing the film simulation to CLASSIC CHROME, I lowered the exposure by applying a PULL of -1.33 EV, raised HIGHLIGHT TONE to $+4$ for brighter highlights, reduced NOISE REDUCTION to -4 to reveal maximum detail, and applied SHARPENING $+3$, because I was unlucky enough to bring a soft XF18–55mm lens copy with me to India. After clicking on the Convert button, the app saved the new and improved JPEG on my Mac, using the same directory as the underlying RAW file.

The image below is a second processing variant of the same shot, this time using MONOCHROME+R FILTER, PULL -1.33 EV, HIGHLIGHT TONE $+4$, SHADOW TONE $+1$, NOISE REDUCTION -4 , and SHARPENING $+3$. I also changed the white balance to 4500K and applied a WB shift of R: -5 and B: $+7$ for a little bit more drama.

Comparing external RAW converters

TIP 114

So far, we have talked a lot about the built-in RAW converter. It's a great tool to create JPEGs. It's also easy to use, because it utilizes the same functions and parameters that are available in the shooting menu. But what about diehard RAW shooters who don't care much about in-camera JPEGs, Fuji colors, or the built-in RAW converter? Those guys (I tend to be one of them from time to time) require an external RAW converter to process their RAW files.

In this tip, I'll compare how popular external RAW processors handle specific features of your X series camera:

- **RAW File Converter EX** comes free with your camera. This software is currently based on version 8 of the Japanese **SilkyPix** [92] RAW processor that is also commercially available in version 9. If you want to use all the features



Fig. 192: **Capture One Pro** is a comprehensive RAW converter particularly popular among professionals and PhaseOne medium-format photographers. You can activate the software as a free Capture One Express for Fujifilm version, as Capture One Pro for Fujifilm, or as the regular Capture One Pro version that works with RAW files from 500+ cameras, including Fujifilm. You can also choose between subscriptions and perpetual licenses [97].

- A great RAW processor for macOS users is **Iridient Developer** from Iridient Digital [98]. Even more popular among Fujifilm users is **Iridient X-Transformer** for macOS and Windows, which can be launched from a plug-in in Adobe Lightroom. It converts Fujifilm RAF files into pre-demosaiced DNG files that can be perfectly processed in Lightroom, thus combining the strengths and benefits of Iridient Developer and Lightroom.
- **Photo Ninja** from PictureCode [99] is another interesting option. Like Iridient Developer, it can extract a great amount of sharpness and detail from Fuji's X-Trans RAWs. It also contains a module for adaptive tone-mapping, offers competent noise reduction, and features a special algorithm to restore blown highlights.

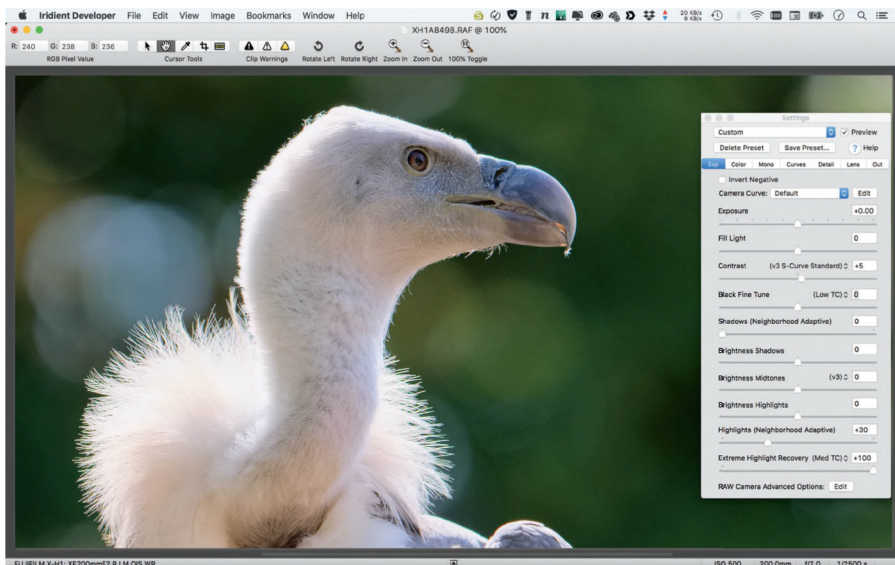


Fig. 193: **Irident Developer** is a macOS-based RAW converter that is known for delivering great results with X-Trans RAWs. This led to a spin-off converter named Irident X-Transformer for Windows and macOS, which works particularly well as a companion software to Adobe Lightroom.

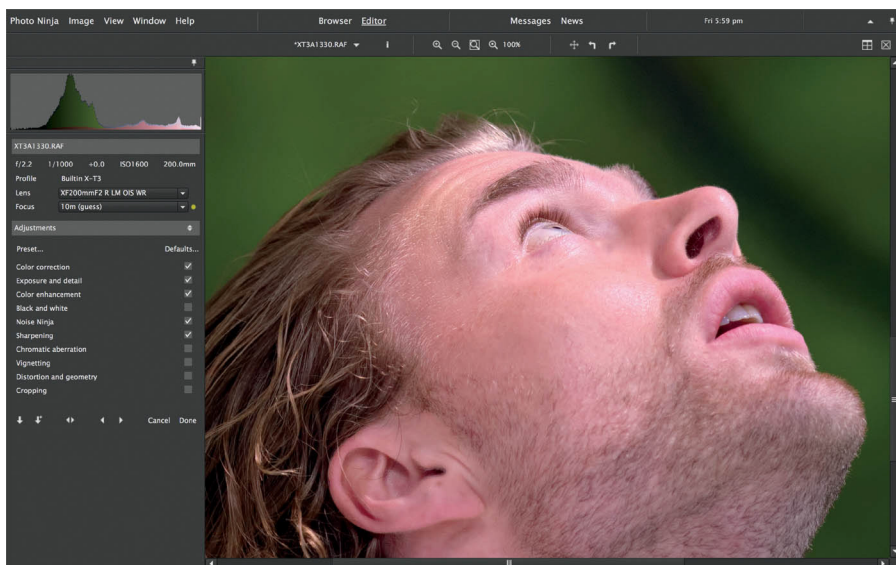


Fig. 194: **Photo Ninja** is a no-nonsense RAW converter for macOS and Windows that works well with X-Trans files. While its graphical user interface is hopelessly outdated, the modules for tone-mapping, highlight recovery, and noise reduction (Noise Ninja) are very powerful.

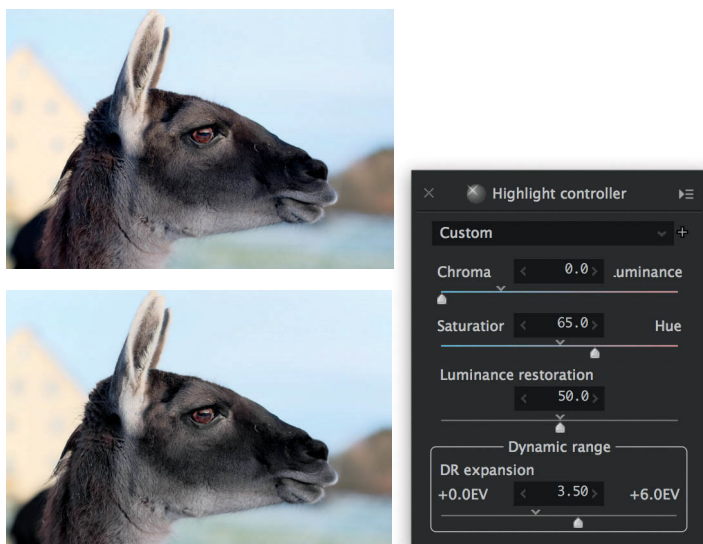


Fig. 195: The unique pastel highlights' look of a straight-out-of-camera DR400% JPEG (top) isn't easy to replicate with external RAW converters. With RAW File Converter EX and Silkipix, you can get close (bottom) by tweaking the highlight control's default settings (right).

- **Lightroom** and **Adobe Camera Raw** are also smart enough to recognize RAWs with extended DR settings, and they automatically push the exposure up 1 or 2 EVs when the RAWs are opened in the software. However, recovering the highlights isn't an automated process; it's the user's job. This can become challenging because Lightroom's exposure-related sliders work in a different way than Fuji's internal tone-mapping.
- **Capture One Pro** works like Lightroom and applies a push of 1 or 2 EV to RAWs that were recorded with a DR200% or DR400% setting. There's also a slider to recover highlights that may have disappeared during this push, but the results look different from Fuji's own DR tone-mapping. However, DR200% and DR400% settings in RAW files from cameras with X-Processor Pro or X-Processor 4 are

fully emulated if you are using one of the official Fujifilm film simulation profiles in Capture One. The results look similar to the original DR200% and DR400% JPEGs from the camera.

- **Iridient Developer** operates like Lightroom and Capture One, automatically pushing RAW files that were recorded with a DR200% or DR400% setting. There's also a High-light Recovery slider to restore highlights that may have vanished, and here's the good news: the results very much resemble the look from the camera's internal RAW converter. Well done! **Iridient X-Transformer** doesn't create JPEGs and relies on Lightroom to recover highlights. Lightroom treats DR200% and DR400% X-Transformer DNGs just like DR200% and DR400% RAF files.
- **Photo Ninja** uses its own powerful adaptive tone-mapping module, and hence doesn't really bother emulating Fuji's simple tone-mapping. There are several sliders to adjust a RAW file's exposure during processing.

DIGITAL LENS CORRECTIONS

Digital lens corrections affect three areas: devignetting, distortion correction, and the removal of chromatic aberrations (CAs). The information to perform such corrections is stored in the metadata of each RAW file. Every RAW converter can potentially read and use this metadata to apply appropriate image corrections. However, not all converters are able to do so.

- The **built-in RAW converter** supports all types of lens correction, including the camera's Lens Modulation Optimizer (LMO), which isn't available in external RAW converters.
- **Silkypix** and **RAW File Converter EX** can read and process the RAW metadata for distortion correction, devignetting, and CAs. All corrections are automatically applied and can't be controlled by the user.

- **Lightroom** and **Adobe Camera Raw** can also process lens-correction metadata and automatically apply the respective corrections in the background. It's currently not possible to control or stop the application of these lens corrections. That said, Lightroom offers *additional* correction profiles for the lenses of X100 series cameras *on top* of the metadata-based digital lens corrections. With these additional profiles, distortion and vignetting can be further corrected or even over-corrected.
- **Capture One Pro** can also process lens-correction metadata. Unlike Lightroom and Silkipix, it allows users to control the intensity of the corrections or switch them off altogether. There's also an option to reduce diffraction blur.
- **Iridient Developer** can use lens-correction metadata, too. Like Capture One, it also provides control over the extent of the corrections. In a similar fashion, **Iridient X-Transformer** offers checkboxes to switch off any of the three metadata-based lens-correction parameters. This means that X-Transformer, when used as a Lightroom plug-in, can serve as a way around Lightroom's current inability to disregard RAW metadata-based lens corrections.
- **Photo Ninja** ignores all lens-correction metadata. Instead, the software asks the user to provide suitable profiles or to manually correct distortion, vignetting, and CAs.

Automatic lens metadata corrections can look a bit different depending on the RAW converter because each converter tends to interpret the data differently.

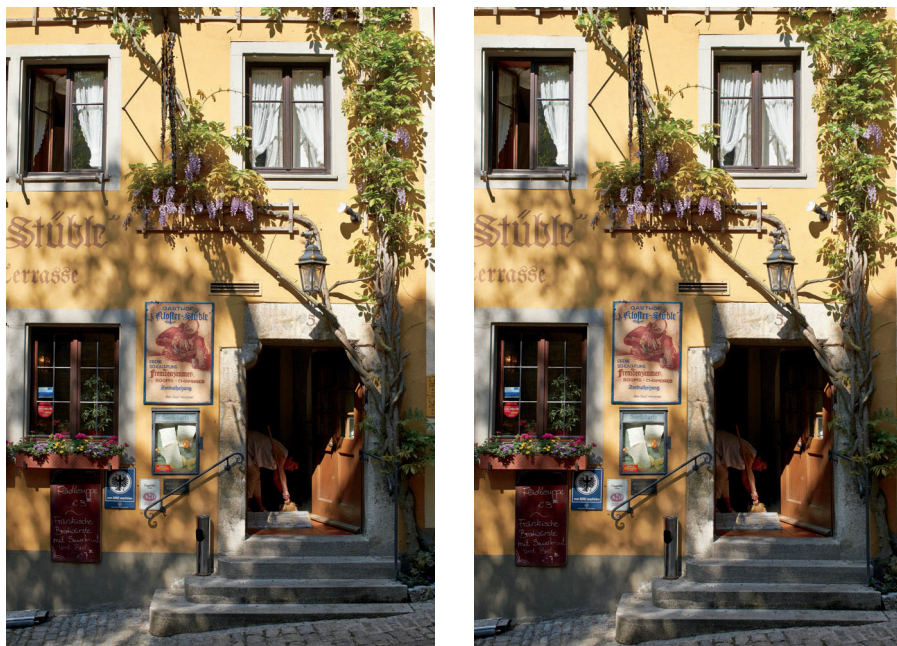


Fig. 196: **Digital lens correction:** This shot was taken with a Zeiss Touit 1.8/32 lens. The left image shows the shot without digital distortion correction. On the right, you can see how Capture One Pro applied the digital distortion correction to straighten the lines.

Sharpening RAWs with Adobe Lightroom

TIP 115

Sharpening X-Trans RAW files in Adobe Lightroom is a controversial topic on the internet, especially when it comes to landscape shots with grass and foliage.

As a general rule, you should always sharpen an image near the end of your editing process. Clarity, contrast, and color settings all impact how crisp or soft an image looks, so make sure that those parameters are set before you finalize the sharpening.

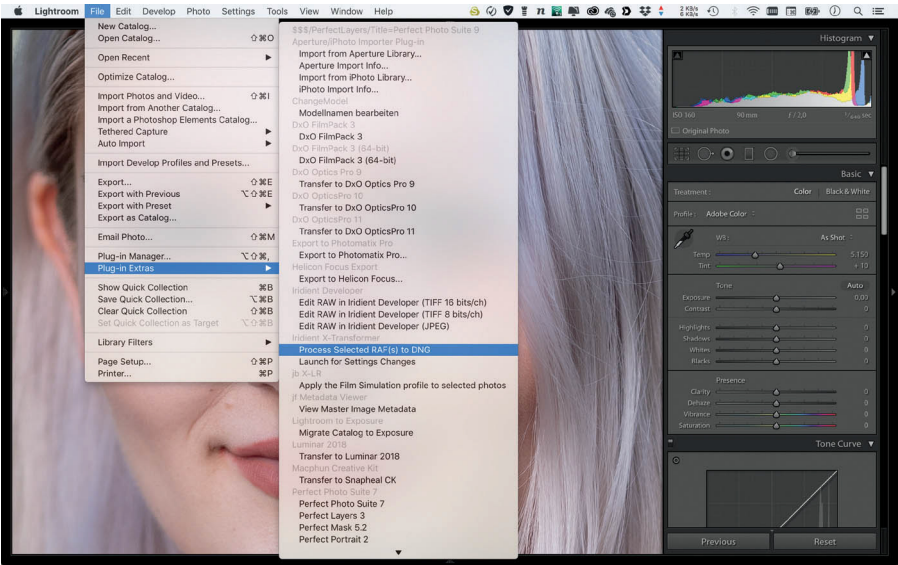


Fig. 200: Transforming RAFs to X-Transformer DNGs is easy, thanks to the plug-in structure of the app. After selecting the RAF files that you want to transform, all you have to do is execute PROCESS SELECTED RAF(S) TO DNG. Lightroom will then pass the selected RAF(s) to X-Transformer, which turns them into pre-demosaiced DNGs and hands the results back to Lightroom where they are automatically linked to the original RAF files.

Using X-Transformer as a pre-processing stage can be helpful in situations where you want to maximize your camera's dynamic range by pulling up shadows and midtones by several(!) stops. X-Transformer's benefits in this regard are most visible with RAWs from older 12-bit cameras like the X-E1 and X-Pro1, and with shots that were taken with the electronic shutter (ES).

To maximize dynamic range, your camera's sensor needs to be ISOless. But that's just half of the story. It's also important to use a RAW converter that correctly handles pushing up RAW files by several stops. As we now know, Lightroom delivers better results when it is pushing X-Transformer DNGs than original RAFs.

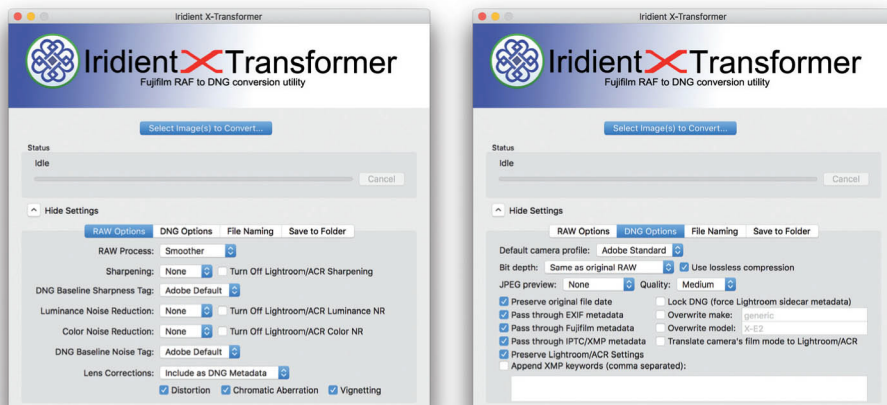


Fig. 201: To make sure that X-Transformer DNGs can be processed in Lightroom with the same settings of their original RAF versions, it's essential to **configure X-Transformer** appropriately. The screenshot on the left shows my suggested *RAW Options* settings. On the right, you can see my preferred *DNG Options*. With these settings, all adjustments that you have already applied to the original RAF in Lightroom will be copied and applied to the X-Transformer DNG.

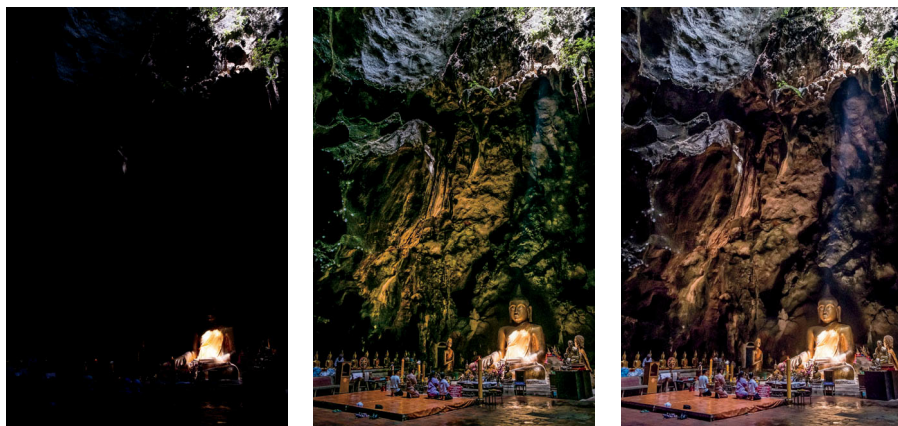


Fig. 202: This X-E1 example illustrates how X-Transformer helps **improve Lightroom's dynamic range** capability. On the left is the original exposure to the highlights at base ISO 200. In the middle, you can see the Lightroom-processed RAF with a strong push of the shadows and midtones. The image on the right shows the same Lightroom processing, but now of the DNG from X-Transformer. The green tint and blocked shadows of the RAF version have disappeared.

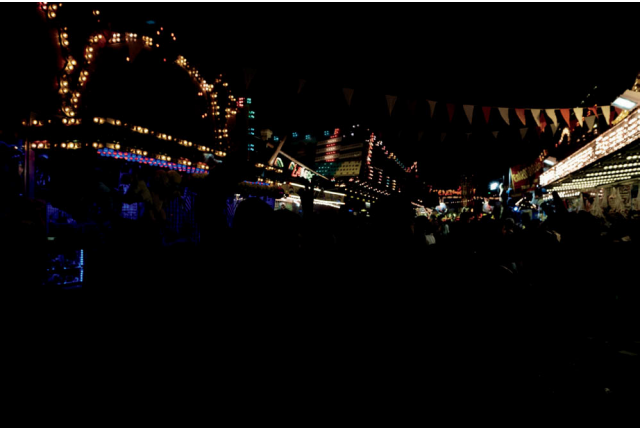


Fig. 203: (Left) Here's another pretty **extreme dynamic range** example, this time from an X-T1 (14-bit sensor) and with a push of approximately +5 EV. The top image shows the original exposure at base ISO 200. The image in the middle is the Lightroom-processed version of the RAF, and at the bottom you can see the X-Transformer DNG with the same Lightroom development settings. Again, the DNG from X-Transformer delivers better tonality in the dark areas.



Fig. 204: X-Transformer DNGs are also beneficial for **pushing RAW files that were taken with the electronic shutter**. This example was shot with an X-T10, and the RAWs were processed in Lightroom.

Top left: mechanical shutter ISO 6400 RAF file; top center: mechanical shutter ISO 200 RAF file pushed 5 EV; top right: mechanical shutter ISO 200 X-Transformer DNG file pushed 5 EV.

Bottom left: electronic shutter ISO 6400 RAF file; bottom center: electronic shutter ISO 200 RAF file pushed 5 EV; bottom right: electronic shutter ISO 200 X-Transformer DNG file pushed 5 EV.

The pushed RAF that was taken with the electronic shutter (bottom center) clearly can't match its pushed X-Transformer DNG cousin (bottom right). It's also inferior to Lightroom's version of the pushed mechanical shutter RAF (top center). So, let's not blame the camera or the electronic shutter; It's the RAW converter! In this case, it's Lightroom's inability to competently push the original RAF up 5 EV. Take the detour via X-Transformer and your results will very much improve.



Fig. 205: In this final example we examine a mechanical shutter shot taken with an X-H1—another 14-bit camera, but with a more current X-Trans CMOS III sensor. As usual, the top image shows the original exposure, this time at ISO 800, which is the camera's dual conversion gain level. In the middle, we see the ISO 800 RAF file after being pushed approximately +4 EV in Lightroom. The image below is the same shot with our usual X-Transformer detour, pushing the X-Transformer DNG file with exactly the same Lightroom settings as the original RAF file. Once again, we can see a slight improvement in coloration and shadow rendering.

Please note that the detour via X-Transformer isn't recommended as a general rule for *all* your images. Instead, it's meant as a better alternative for those rare occasions when you literally have to push your X series camera to its dynamic range limits—especially with shots that were taken with the electronic shutter or with older 12-bit cameras.

Another aspect of using X-Transformer is its demosaicing algorithm, which is considered superior to Lightroom's own processing. By feeding Lightroom with a pre-processed DNG from X-Transformer, you can combine Lightroom's feature set with X-Transformer's demosaicing and get the best of both worlds. I'm always using X-Transformer's *Smoother* demosaicing option to avoid artifacts.

Iridient X-Transformer also offers its own sharpening algorithm that is supposed to deliver more details results with less artifacts. Here's the catch: You can't apply Masking to X-Transformer's sharpening, so the process will always apply to the entire image, including areas that don't require any sharpening. To replace Lightroom's sharpening with X-Transformer's alternative, you have to use a different set-up:

TIP 121

Front- versus rear-curtain flash synchronization

Flash photographs are double exposures consisting of surrounding light and flash light. When you shoot the surrounding light with a slow shutter speed, there is the question of when the flash (with its much faster speed) should fire. Normally, the flash is fired along with the shutter opening its FRONT (or 1st) curtain at the *beginning* of an exposure. However, selecting the REAR (or 2nd) curtain makes the flash fire at the *end* of the exposure when the rear shutter curtain closes.

Naturally, moving objects change their position during the exposure of a shot. Synchronizing the flash with the rear curtain ensures that moving objects are frozen where they are located at the end of the exposure as opposed to at the beginning. This often results in the moving object appearing more natural in the image.

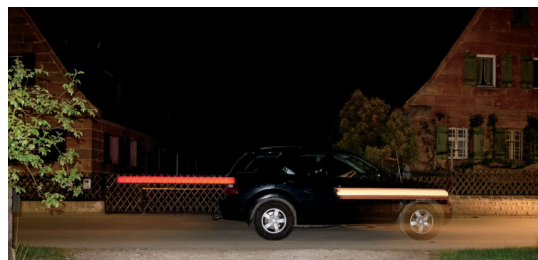
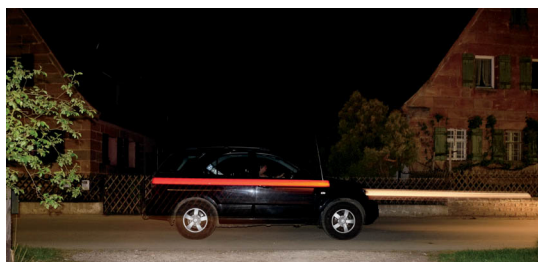


Fig. 216:

Front- versus rear-curtain

sync: This example shows the same scene photographed with front-curtain sync (above) and rear-curtain sync (below). The shot above shows how the flash freezes the moving vehicle at the beginning of the exposure, while the shot below shows it being frozen at the end of the exposure. The rear-curtain version looks more natural and avoids the false impression of the car moving backward. This is also a good example to examine the nature of flash photographs as double exposures. You can see how the slow shutter speed captures the moving vehicle as a blurry trail of light, while the fast flash instantly freezes parts of it.

Flash synchronization: where's the limit?

TIP 122

The maximum flash sync [106] speed of most X series cameras with interchangeable lenses (and hence focal plane shutters) is 1/180s. The X-Pro2, X-T2, X-T3, and X-H1 offer 1/250s, and the large shutter of the GFX syncs at 1/125s or slower. Thanks to their leaf shutters, fixed-lens cameras like the X100 series can officially sync flash as fast as 1/2000s.

- In exposure modes **P** and **A**, the camera will never offer a shutter speed faster than the official maximum sync speed. If this is too slow for the current light conditions, the surrounding-light component will be overexposed. In this case, the shutter speed will be displayed in red. To avoid overexposure, stop down the lens, reduce ISO (but never below base ISO), or use a neutral density (ND) filter [107] in front of the lens.
- In exposure modes **S** and **M**, you can select shutter speeds faster than the maximum sync speed. Your camera will honor these settings in flash mode, but there is a price to pay: the resulting images will display some partial shadowing of the flash. It's often possible to use shutter speeds that are a little bit faster than the official maximum sync speed without visible negative effects—it depends on the type of flash you are using. Its power setting plays a role, as well. Proceed at your own risk!



Fig. 217: Many photographers wish to use a **flash sync speed** faster than the maximum sync speed of their camera. That said, it's also possible to deliberately use very slow synch speeds to create a blurry background behind a more contoured flash-lit foreground. This was taken with an X-T2 and an EF-X500.

- High-speed synchronization (HSS, also known as FP mode) up to $1/4000$ s or $1/8000$ s is officially supported by the X-T1 and cameras with X-Processor Pro and X-Processor 4, but not available with many Fuji-TTL-compatible flashguns. As of December 2018, the only HSS-compatible flash from Fujifilm was the EF-X500. Luckily, several Fuji-TTL-compatible third-party flashguns and systems (Godox, Metz M400, etc.) support HSS, as well.
- HSS/FP consumes more flash power, so you may need a more powerful flashlight to compensate HSS-related losses. Depending on the brand and type of your flash, the effective power reduction that occurs at the transition point between normal sync and high-speed sync can vary between $2/3$ EV (Godox AD200 or AD600) and almost 2 EV (some speedlights).



Fig. 218: This manually controlled HSS shot was taken with an X-H1 at a shutter speed of 1/500s, using a Godox AD600B [108] with a gridded 120cm Phot-R Octabox [109] and a Godox Xpro-F [110] radio controller.

X cameras with a **leaf shutter** (like the X70 or X100 series) don't offer HSS due to their inherently faster flash sync speeds. For example, the official flash sync speed of the X100 series is 1/2000s, but you can go faster as long as your flash can keep up with the increasingly small firing window.

Using wireless flash (TTL and manual) with leaf-shutter cameras at fast shutter speeds doesn't result in an HSS-related power reduction, but it can impose other sync restrictions, because the transmitter on the camera needs time to communicate with the off-camera flash. This latency can reduce the maximum effective sync speed of your setup. In my experience, light-based communication (such as the Fujifilm EF-X500 or Metz M400) results in less latency than radio-based communication (like the Godox 2.4 GHz system).

With leaf-shutter cameras, I recommend 1/500s as a safe maximum sync speed for off-camera radio flash units operating at or near full power. With less output power, faster shutter speeds of up to 1/1000s are also possible.



Fig. 219: This wireless flash shot was taken with an X100F at a shutter speed of 1/800s using a Godox X1T-F radio transmitter and a Godox TT600 [111] flash mounted in a square softbox.

TIP 123**Red-eye removal: a two-step affair**

If the flash and your subject share almost the same optical axis (a frequent occurrence with the built-in flash or a clip-on flash), this can lead to the red-eye effect [112]: an unpleasant red reflection in the eyes of humans or animals.

- If you pull up SHOOTING MENU > FLASH SETTING > RED EYE REMOVAL and then select either FLASH or FLASH+REMOVAL, the camera will emit a pre-flash prior to each shot that forces your subject's pupils to contract, thus reducing or eliminating the red-eye effect.

- In addition to the pre-flash, there's *another* red-eye removal tool available: selecting REMOVAL (or FLASH+REMOVAL) in the FLASH SETTING > RED EYE REMOVAL menu will detect and remove unpleasant red-eye effects in a JPEG after the fact. This function is also available in PLAYBACK MENU > RED EYE REMOVAL in case you decide to use it later. If you want to keep a copy of the unretouched JPEG, select SET UP > SAVE DATA SET-UP > SAVE ORG IMAGE > ON. The RAW file isn't affected by this variant of red-eye removal.



Fig. 220: The **red-eye removal** function emits a pre-flash that is bright enough to prompt your subject's pupils to contract.

Using TTL-Lock

TIP 124

TTL-Lock works like AE-Lock: Where AE-Lock locks the exposure of the surrounding-light component, TTL-Lock locks the exposure of the flash-light component. To use TTL-Lock, you have to first assign it to one of your camera's Fn buttons.

TTL-Lock can work in one of two ways:

- Keep and lock the exposure of the most recent flash exposure when you press the TTL-Lock button (FLASH SETTING > TTL-LOCK MODE > LOCK WITH LAST FLASH).



Fig. 226: If you are looking for a fully compatible shoe-mount flash that is more affordable and less bulky than the Fujifilm EF-X500, the Fujifilm edition of the **Metz M400** might be just right for you.

The M400 is based on a “fly-by-wire” user interface that doesn’t feature dials with fixed markings. Instead, there are four generic control buttons and an LCD display that can be read day and night. Thanks to this flexible user interface, the M400’s firmware can be fully compatible with any camera. Also, there are never any discrepancies between flash settings made in the camera and those made directly on the flash unit. Most flash functions can be conveniently accessed and changed on the flash configuration page and in the menus of your camera.

In addition to this, Metz keeps improving its flash firmware and provides free updates that can be applied by the user via the flash unit’s built-in USB interface. This ensures compatibility with upcoming Fujifilm cameras and future feature changes.



Fig. 227: Despite its compact size, the **Metz M400** packs enough punch to be used with small light modifiers. In this example, I put it in a 40×40cm softbox and triggered it remotely with an EF-X500 on my X100F. Thanks to this camera's leaf shutter, I could sync the Metz flash wirelessly at 1/500s without HSS (and hence without any HSS-related power loss).

Serious bargain: the Godox X system

TIP 128

If you are looking for an affordable radio flash solution that meets professional standards and is not only compatible with the Fujifilm X series, but also with cameras from Canon, Nikon, Sony, Olympus, Panasonic, and Pentax, it's hard to ignore the Godox company from Shenzhen, China. You may already know some Godox products under one of several rebrands, such as Adorama's Flashpoint, Neewer, MoLight, Pixapro, StrobePro, or Quadralite.

Apart from its affordability and compatibility across all major camera brands and their corresponding flash standards, the main appeal of the Godox X system is its scalability. For example, you can start out with a Fuji-compatible

X1T-F radio transmitter [115] along with 3 wireless TT600 speedlights [116], 3 compact light stands with tilting speed-light brackets, and 3 gridded softboxes—all for less than US \$450. That's about the price of a single, bare-bones Fujifilm EF-X500 speedlight without any accessories.



Fig. 228: This **wireless flash shot** was taken with an X100F at a shutter speed of 1/250s, using a Godox X1T-F radio transmitter and a bare-bones Godox TT600 speedlight (handheld by a friend without any modifiers).

If you crave for more power and flexibility, you can obtain one or more copies of the highly versatile, portable Godox AD200 pocket flash [117] with 200 Ws output power. It comes with two different flash heads (a Fresnel and a bulb head), and it can be further expanded with a round flash head [118] or an LED head [119]. There's also a decent choice of custom-fit accessories [120] that you can mount either directly or on a lightweight extension head [121]. Alternatively, you can put the AD200 in a Bowens-type speedlight bracket [122] or combine two AD200 units in an AD-S2 bracket [123] for a more powerful, yet portable, 400 Ws studio flash.



Fig. 229: The Godox AD200 is one the most innovative flash units on the market today. For approximately US \$300, you get a portable 200 Ws flash with a Li-Ion battery and Fresnel and bare-bulb heads (1) along with a battery charger and lampstand mount, all in a protective carrying case. You can expand the AD200 with a round flash head (2) and a set of fitting magnetic light modifiers (3). There's also an LED head option (4) and a barn-door kit with color gels (5) that fits on the Fresnel and LED heads. You can combine two AD200 units to a 400 Ws outfit with a Bowens and Speedring mount (6) or reduce lightstand weight with a flash-head extension cable (7). You can also directly mount a variety of portable Godox light modifiers on the bare-bulb head [124] or put the AD200 in an S-type bracket for compatibility with hundreds of Bowens and Speedring accessories.

The sheer number of Godox products and accessories can easily be overwhelming. Luckily, there's help on the internet. For example, Robert Hall has assembled a great Godox X system introductory guide [125] with videos, and Flashhavoc has an informative 3-part article [126] with a complete Godox overview.



Fig. 230: I took this **simple but effective portrait** outdoors using a single Godox AD200 with an AD-S7 multi-softbox that was located right above the camera using a hand-held boom. I placed my model in front of an old wooden barn for a dark and textured background. The sun served as my backlight, so I didn't need a second flash. I used the GFX 50S with a GF32–64mmF4 lens at 32mm and f/14, 1/125s, ISO 100.

Generic third-party flash units**TIP 129**

Basically, you can use any modern flashgun from any vendor with your X camera, as long as you are prepared to set its power manually. You can connect third-party flash units directly to the camera's hot shoe or use a cable or a wireless (radio) triggering device.

The camera's TTL modes aren't available when you are using generic third-party flashes because the camera isn't *metering* the flash light, it's only *triggering* the flash. There's also no HSS support.

This makes using generic flash equipment possible but inconvenient. Luckily, major flash brands like Broncolor, Profoto, and Elinchrom are now supporting Fujifilm with dedicated transmitters for the Fujifilm X series. They also support HSS.



Fig. 231: Manually controlled **studio flash shot** using an X-Pro1 and an XF18–55mm zoom lens.

Important: Attaching Canon-compatible TTL flash equipment to the hot shoe could result in the camera overheating

exceptions are cases when you are using a special optical adapter that changes the focal length of the adapted lens, such as a Metabones Speed Booster for the X-mount (focal length reduction), or a Laowa Magic Format Converter for the G-mount (focal length increase). Entering the correct focal length is especially important if you use a camera with IBIS, like the X-H1.

Please note that the menu locations mentioned above refer to cameras with X-Processor Pro and X-Processor 4. Older/other X camera models with interchangeable lenses still offer the same features for adapted lenses, but you may have to find them at different menu locations.

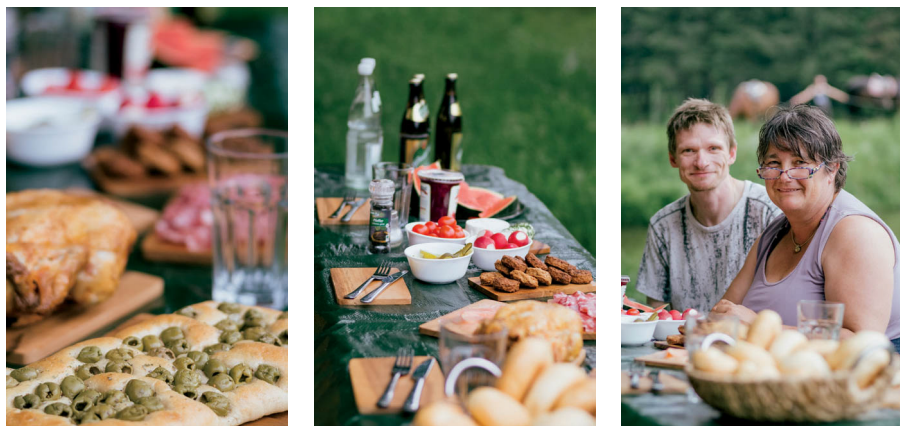


Fig. 237: Third-party lenses with “character” can help you achieve images with a distinctive look and bokeh. For this series, I attached a Voigtländer Heliar 75mmF1.8 M-mount lens to my X-E1.

TIP 133**Exposing with mechanically adapted lenses**

Mechanically adapted lenses (dumb adapters) can be used in exposure modes **A** (aperture priority) and **M** (manual mode). There are also a few notable differences between exposing with native lenses and adapted lenses:

- Native lenses close to working aperture when the shutter is half-pressed or when the shot is taken. Mechanically adapted lenses always operate with the aperture set by the user. As soon as you stop down an adapted lens, less light reaches the sensor and the camera's exposure metering. Stopping down adapted lenses increases the depth of field in the viewfinder.
- Since less light reaches the sensor when the lens is stopped down, the camera must increase the live view image amplification to display an accurate WYSIWYG simulation of the scene. This decreases the quality of the live view image and can also negatively affect the live view's frame rate.
- Since the camera thinks there's no lens attached at all, the aperture is always displayed as f_0 in the viewfinder (and $f/1$ in the EXIF data). There's no way for the camera to know which aperture has been set on a mechanically adapted lens.
- Shooting in poor light with mechanically adapted lenses can be tricky when you stop down the aperture. It's possible to reach the live view's amplification limit. Once this limit is reached, the live view and live histogram cannot display the actual brightness of the scene, so it appears darker than the image that will be exposed. However, exposure metering will still work correctly, and the camera will display the correct shutter speed.
- Since the electronic live view cannot control the aperture of a mechanically adapted lens, it takes longer for the camera to adjust to abrupt brightness changes. You can test this yourself by quickly panning the camera from a bright scene to a dark scene and vice versa. With adapted lenses, the camera may need a few seconds for the live view to adapt to the changing brightness levels.



Fig. 238: With “dumb” mechanical adapters, **exposing with adapted lenses** is limited to modes **A** and **M**, and metering always takes place at the set working aperture. No matter which aperture you set, EXIF data will always show f/1. For this street portrait, I attached a Helios 44M-4 lens to my X-E2 using a Novoflex M42 adapter.

TIP 134**Focusing with mechanically adapted lenses**

Mechanically adapted lenses can only be focused manually. Here are a few tips to make things easier for you:

- Set your camera to manual focus. This makes sure that MF assistants such as Focus Check, focus peaking, and digital split image are available.
- The electronic distance and depth-of-field (DOF) scale of your camera is useless in concert with mechanically adapted lenses. Instead, you must rely on analog scales and markers that may be engraved in the barrel of your

adapted lens. Remember that the DOF scale on your lens is probably less conservative than what you're used to from the electronic scale in your camera. The analog scale doesn't guarantee pixel-sharp results at 100% image magnification. Instead, it will more likely resemble the FILM FORMAT BASIS option of the electronic DOF scale.

- The most important tool for focusing with adapted lenses is the magnifier tool. You can usually activate it by pressing the rear command dial (if you didn't change its default Fn button assignment). Turn the rear command dial to cycle between the available magnifications. Don't forget: instead of focusing and recomposing, it's better to select a focus frame position that covers the part of the image you want to be in focus.
- Use focus peaking or digital split image. You can cycle between these MF assistants and the standard view by pressing and holding the rear command dial. The magnifier tool can be combined with focus peaking and digital split image. However, in concert with digital split image, only one magnification level is available.



Fig. 239: **Focusing mechanically adapted lenses** can be tricky. My preferred method for pinpoint manual focus is focus peaking in concert with the magnifier tool. This example was shot with a Helios 44M-4 lens that was adapted to my X-E1 using a Lens Turbo II focal reducer.

- The magnifier tool and MF assistants work best at wide-open aperture, when the DOF is as small as possible. However, some lenses exhibit focus shift, meaning the focus plane shifts when the lens is stopped down. The increased DOF from stopping down the lens may not be sufficient to compensate for the focus shift, so your carefully focused shot will end up out of focus when the aperture is closed. If you are using a lens with pronounced focus shift, it's better to focus with the actual working aperture instead of the wide-open aperture. Please note that focus shift isn't a matter of price—even a few high-end lenses from Leica and Zeiss exhibit it quite prominently.

Fujifilm M-mount and H-mount adapters**TIP 135**

Fuji's own M-mount adapter is a little bit different from conventional adapters:

- The adapter features electronic XF lens contacts to identify itself to the camera. However, there's no transmission of any lens data since the adapter doesn't know which M-type lens has been attached or what distance and aperture has been set. Sadly, the electronic contacts also make the inner adapter tube thinner than normal, so not all M-type lenses are physically compatible with it. To be certain, you can download a list of compatible and incompatible lenses [135]. Fuji also encloses a template with its M adapter that you can use to find out if your M lens measures up with the adapter.
- Pressing the function button on the adapter directly opens the camera's adapter menu.
- The camera's adapter menu offers a few additional functions when a Fuji M-mount adapter is attached. In addition to entering the focal length, you can also enter correction values for lens distortion, color shading, and vignetting. Those corrections only affect the JPEGs during RAW conversion with the built-in or external RAW converters. As usual, the corrections are burned into the RAW file metadata where they can be interpreted by RAW conversion software. However, color-shade data is currently only processed by the camera's built-in converter. For each adapted lens, you must find out the right correction values for yourself before you can enter them. There aren't any reference lists you can use that I know of.

the current 24 MP and 26 MP APS-C sensors, the demands are even higher.

However, many older lenses offer something else: character. Because maximum sharpness and resolution weren't as important back then as they are today, the designers of legacy lenses could put their priorities elsewhere: for example, by designing lenses that provide outstanding bokeh [139].



Fig. 242: Good or interesting legacy lenses don't have to be expensive: this shot was taken with a Russian **Helios 44M-4**, a 58mmF2 lens with an M42 screw-mount. You can often find this lens online for less than 25 dollars. For this example, I connected the lens with a Metabones Speed Booster Ultra focal reducer to my X-E2S.

Adapting full-frame (35mm format) lenses to the GFX can lead to similar issues. Luckily, most full-frame lenses are capable to illuminate the large sensor area of the GFX, however at the cost of more vignetting and possibly increased softness near the edges. Of course, you can always crop the image later, or you can set the GFX to 35mm crop mode right away. In crop mode, the GFX will only expose the full-frame

portion of its larger sensor and behave like a 24×36mm camera. The live view, RAW files, and JPEGs will adjust accordingly, so you'll get smaller RAWs and JPEGs, too.



Fig. 243: Adapting “full-frame” lenses is popular among GFX users, because most legacy lenses (especially those with a focal length of 50mm and more) can illuminate the larger 44×33mm sensor without much vignetting. For this example, I attached a Zeiss T* Sonnar 2.8/180 MM via a mechanical Yashica/Contax-to-G-mount adapter and shot with the full GFX sensor area. Optionally, you can also use the GFX in crop mode, which covers the center 24×36mm section of the sensor and makes the GFX behave like a full-frame camera.

Speed Booster: miracle or trick?

TIP 137

Speed Booster and Speed Booster Ultra from Metabones are special adapters for X-mount cameras. They convert the focal lengths of full-frame lenses (35mm format) to their APS-C equivalents. This means that the adapted lens covers the same angle of view on your X-mount camera as it would on a full-frame camera.

Take my *Zeiss Sonnar T* 2.8/180 MM* as an example. It's a classic telephoto lens with a Contax/Yashica full-frame mount. Adapting this lens to any X-mount camera *without* Speed Booster causes the results to look like images taken with a 270mmF4.2 lens on a full-frame camera. That's because there is a crop factor of 1.5 between full-frame and APS-C.



Fig. 244: Metabones Speed Booster Ultra with Contax mount.

Of course, many users of full-frame lenses would like to use them on their APS-C camera, yet keep the angle of view and depth of field intact. Speed Booster can do that for you because it reduces the focal length of the adapted lens by a factor of 0.71. With Speed Booster, my 2.8/180mm full-frame Sonnar turns into a 2/128mm APS-C lens. Enter 128mm as the focal length in the MOUNT ADAPTOR SETTING > LENS REGISTRATION menu of your camera.

Is there a price to pay? Well, yes, since Speed Booster isn't cheap. With regards to image quality, the MTF [140] of the new lens is actually improved, but there's a chance of vignetting when Speed Booster is used to adapt fast lenses. That said, the newer Speed Booster Ultra improves vignetting issues that were problematic with the original Speed Booster. In any case, it's better than knock-off products such as Lens Turbo II.



Fig. 245: This example was taken with the Contax version of Speed Booster and a Zeiss Sonnar T* 2.8/180 MM on an X-E1.

Speed Booster increases the speed (or maximum aperture) of a lens by about one stop, so you can use faster shutter speeds or lower ISO settings. For example, let's assume you need ISO 800 to shoot a scene with your full-frame DSLR at $f/2.8$ (wide open) with a 180mm lens and $1/1000s$. On the X-mount, Speed Booster turns this lens into a 128mmF2 lens

lenses, but you can also find an adapter to connect Contax 645 medium-format lenses to the GFX [142]. A smart adapter for current Nikon DSLR lenses might also be on the horizon.

An ideal smart adapter should meet the following criteria:

- Full electronic aperture control.
- Autofocus support (PDAF/CDAF, AF-S, AF-C, face detection, video, etc.).
- Support for built-in optical image stabilizers (OIS) in adapted lenses.
- Support for IBIS (X-H1, GFX 100) with adapted lenses that don't have built-in OIS.
- EXIF data transmission and recording (focal length, aperture, adapted lens model, serial number, etc.).
- Digital lens correction data transmission and conversion (chromatic aberrations, distortion, vignetting).
- Compatible with most or all lenses of the adapted system, including popular third-party offerings like Sigma or Tamron EF lenses.
- Frequent firmware updates to improve and maintain compatibility. New firmware updates should be easy to install from macOS and Windows computers. Alternatively, there should be support for adapter firmware upgrades via the lens firmware upgrade procedure of X series cameras.

Smart adapters are available from vendors like Fringer, Steelsring, Kipon, Viltrox, Techart, or Fotodiox. Kipon and Viltrox also offer EF-to-FX adapters with built-in focal length reducers (like the Speed Booster) to project the full image circle of the adapted full-frame lens on the smaller APS-C sensor of the X-mount camera.

2.8 WIRELESS REMOTE CONTROL AND TETHERING

Fuji's own Camera Remote app works with wireless iOS and Android devices, and it allows you to remotely control your camera by providing a live view image and a touch-screen interface to set the focus point, change exposure parameters, and release the shutter.

Using the Camera Remote app

TIP 139

Camera Remote allows you to control Wi-Fi enabled X cameras from an Android or iOS device running Fuji's Cam Remote app. To use Camera Remote, you must first download and install the free Cam Remote app on your smartphone or tablet. You can find download links, instructions, and additional information online [143].

Important: *Make sure you use the **Cam Remote App** and not the older **Camera App**.*

Here's how Camera Remote works with iOS devices (it shouldn't be much different for Android users):

- Select SHOOTING MENU > (SHOOTING SETTING >) WIRELESS COMMUNICATION on your camera. It now enters wireless mode and emits a Wi-Fi signal.
- Hook up your smartphone's or tablet's Wi-Fi with the camera's Wi-Fi network. Each camera comes with a unique network name that you can customize in SET UP > CONNECTION SETTING > WIRELESS SETTINGS > GENERAL SETTINGS > NAME.
- Open the Cam Remote app and select Remote Control. The mobile device will now assume control over the camera and display a live view image along with options

to adjust shutter speed, aperture or exposure compensation. There's also a virtual shutter button and a small shooting menu that allows you to adjust parameters like ISO, film simulation, white balance, macro, flash mode, or self-timer.

- To autofocus on a specific part of the live view image, double-tap on it with your finger. Focus will be confirmed with a green rectangle. If no focus lock can be established, the rectangle will appear in red.
- Adjust your exposure parameters as required. The brightness of the live view will change accordingly. Please note that there's no live histogram.

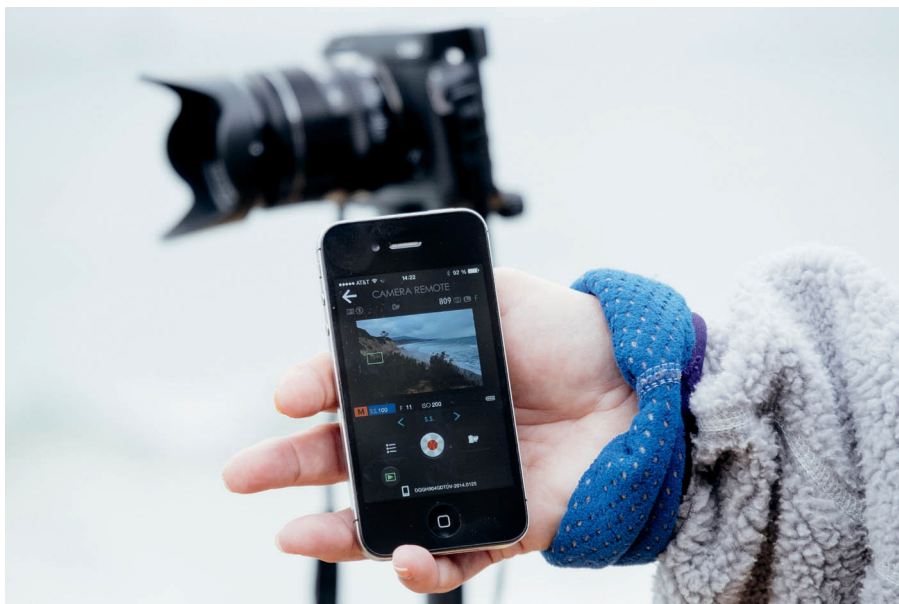


Fig. 248: **Camera Remote** offers a simple interface to control your camera with a smartphone or tablet. To autofocus, double-tap on a specific part of the WYSIWYG live view and wait for the green confirmation rectangle to appear. Sadly, there is no live histogram, and you can't magnify the live view. There is a rudimentary shooting menu, a virtual shutter button, and a playback button that allows you to review images and transfer JPEGs to your mobile device.

Here are a few things you might want to know about Camera Remote:

- Fuji's Camera Remote app allows you to adjust exposure parameters (aperture, shutter speed, ISO, exposure compensation), but you can't remotely change the camera's exposure mode. This means that you must manually set the camera to either **P**, **A**, **S**, or **M** mode *before* you select WIRELESS COMMUNICATION in the camera menu. To change the exposure mode during remote shooting, you must first disconnect Camera Remote, make the desired changes in the camera, and then start over with a new connection.
- There's no electronic level indicator and no live histogram in the Camera Remote live view on your mobile device.
- You can change several shooting parameters from within the Camera Remote app (ISO, film simulation, white balance preset, macro, flash mode, self-timer), but other parameters (such as dynamic range or Auto-ISO minimum shutter speed) must be preset in the camera before entering wireless communication mode.
- There is no bulb functionality in Camera Remote, so your maximum exposure time is limited to the extent of the T setting. If you need more, better use a conventional (tethered or wireless) remote shutter release.
- Some cameras also allow you to shoot HD video (but not 4K) with Camera Remote.

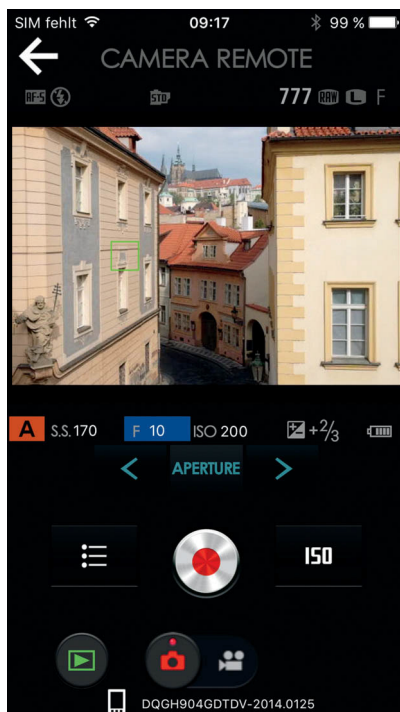


Fig. 249: Changing exposure parameters affects the **WYSIWYG live view**. The live view in Camera Remote always reflects the currently selected film simulation and JPEG parameters. If the camera offers this feature in its own live view, there is also a preview of manually selected DR settings (DR200%, DR400%).

A few more tips and hints:

- I use Camera Remote mostly in manual exposure mode **M**; I feel that this is the most convenient and efficient way to adjust shooting parameters. Changing a parameter (shutter speed, aperture, ISO) immediately adjusts the live view brightness.
- iOS users may be annoyed by the need to frequently reconnect the smartphone to the camera's Wi-Fi network, since the connection must be dropped and reestablished for every mode or parameter change made in the camera. This can be particularly cumbersome at home, where the iOS device is automatically reconnecting with your home

network as soon as the camera has been disconnected. This has become easier with newer Bluetooth-enabled X cameras, because the app can automatically initiate a Wi-Fi connection between the smartphone and a Bluetooth-paired camera as needed.

- Some users may suffer from connection losses caused by interfering networks that are transmitting on the same Wi-Fi channel as the camera. Sadly, there is currently no way to change the camera's transmission channel.
- To transfer JPEGs from the camera to your mobile device with full resolution, make sure to select SET UP > CONNECTION SETTING > WIRELESS SETTINGS > RESIZE IMAGE FOR SMARTPHONE > OFF. Otherwise, the transferred images will be downsized to 3 megapixels.
- Manual DR expansion settings (DR200%, DR400%) are reflected in the Camera Remote live view (as long as your camera supports DR expansion simulation in its own live view). The same applies to JPEG parameters such as contrast (HIGHLIGHT TONE, SHADOW TONE) or white balance settings. In manual mode **M**, the Camera Remote live view will also respect any settings made in SET UP > SCREEN SET-UP > PREVIEW EXP./WB IN MANUAL MODE.

Besides remote controlling [144] the camera, the Camera Remote app offers additional functions that allow you to transfer JPEGs from the camera to your mobile device (one by one [145] or in groups [146]) and to copy GPS location data [147] from your smartphone or tablet to the camera.

If you are using an X series camera with built-in Bluetooth, location data and the current time can automatically be synchronized from your smartphone. Bluetooth-enabled cameras can also benefit from a simple remote shutter release function [148], and there's the possibility to automatically obtain and install camera firmware updates [149]. To use Bluetooth with Camera Remote, make sure to pair the camera with your smartphone or tablet [150].

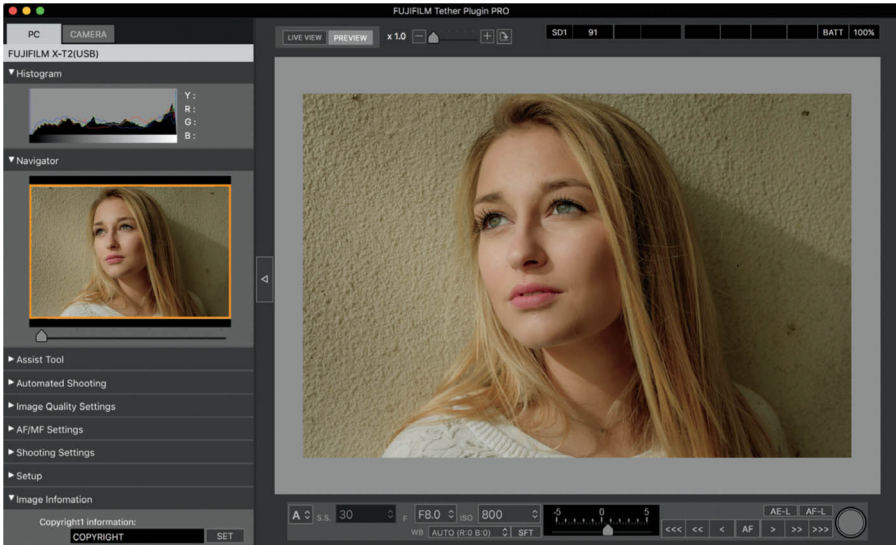


Fig. 251: The **Tether Shooting Plug-in Pro** for Adobe Lightroom includes a live view image and comprehensive control over the camera. Features include color histograms, focus stacking, expanded bracketing and the possibility to enter copyright information. You can also save and load full camera configurations.

I do not recommend buying **HS-V5** for Windows. It's an outdated software with a terrible user interface and limited functionality in concert with more recent X camera models [155].

Fujifilm X Acquire [156] is a simple freebie app for macOS and Windows that saves images to a hot folder from where other apps can obtain them. It also allows you to backup and restore full camera settings on your Mac or PC.

The **Fujifilm Tether Shooting Plug-in** [157] and **Tether Shooting Plug-in Pro** [158] are plug-ins for Adobe Lightroom/ACR. The Pro version offers shooting with a remote live view and remote control over most of the camera's settings.

In addition to that, **Capture One Pro** [159] now also adds direct tethering support thanks to the partnership between Fujifilm and PhaseOne that was revealed at Photokina 2018.

2.9 ANYTHING ELSE?

Hopefully, this book could answer many of your questions that went beyond the manual of your camera. However, this isn't the end: you can read my X-Pert Corner blog, participate in Fuji X forums, or join one of my Fuji X Secrets workshops.

Forums, blogs, magazines, and workshops	TIP 142
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- High-resolution versions of many images in this book are available on Flickr [160].
- At Fuji X Secrets [161], you will find articles and reviews covering specific features, new firmware, and new products for the X series.
- My free X-Pert Corner blog [162] covers a variety of topics about the Fujifilm X series. You will find everything from service articles that go beyond this book to “First Look” previews of cameras and lenses.
- There are several online forums that focus on Fujifilm's X series: The Original Fuji X Forum [163]; The Ultimate Fuji X Forum [164]; and the Fuji X Series Forum [165].
- I am a regular contributor of gear-related articles in *FUJI-LOVE* [166], a great monthly magazine for all things Fuji X.
- Books, blogs, and forums are great, but what about a more personal touch? My site, Fuji X Secrets [167], offers a series of advanced workshops for Fuji X series users. My workshops cover topics that are similar to those in this book, but on a more in-depth and comprehensive level, including practical demonstrations and plenty of sample images. We work in small groups, and our delegates set the agenda. It's everything you always wanted to know about X but were afraid to ask.

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