

Programmable Customizable Autofocus and Optical Image Stabilization

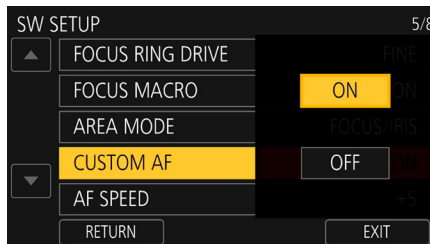
The new AG-UX90 and AG-UX180 camcorders include the ability to program and customize how the autofocus and image stabilization systems respond. This gives you the ability to tailor the autofocus and/or the image stabilization to be most effective for your particular needs, or for any given shot. This paper will explore the customization options and show you what is possible, and make some recommendations on what settings may be useful for different shooting scenarios.

Autofocus

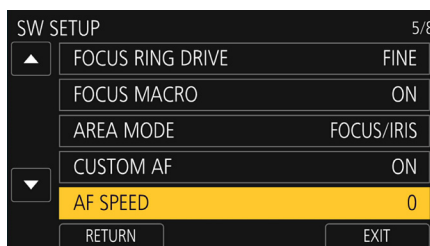
As part of their Leica-certified Dicomar lenses, these cameras have integrated autofocus capability. The autofocus system has been substantially upgraded with the inclusion of a micro-drive focus unit, which allows for tighter tolerances, finer movements, and faster response than prior camcorders could do. The combination of ultra high definition resolution and a large 1” sensor require fast response and high precision; not only does the new micro-drive focus unit accomplish that, but Panasonic went even further by allowing you to customize the speed and sensitivity of the autofocus system.

The camera default autofocus system provides suitable performance for a wide variety of typical shooting needs. However, while the default settings may serve well for general purposes, you can definitely significantly improve the focus performance for specific shooting scenarios.

The programmable autofocus system consists of four menu item settings:



First, there's an overall on/off setting for the Custom Autofocus system. If you set "CUSTOM AF" to OFF, then the default autofocus system will be used. If you want to take advantage of your customized settings, you need to set this to ON.



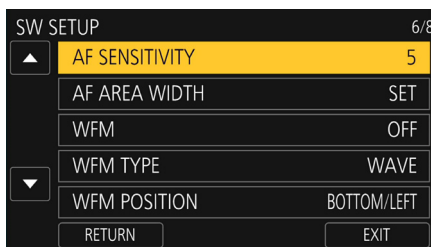
Once you've enabled the CUSTOM AF option, the first customizable parameter is AF SPEED. This governs how quickly (or slowly) the autofocus motor works. The range is from -5 to +5, with 0 as the default setting.

Initially you may think that you'd always want this set to the absolute fastest setting (+5) and, in fact, there are certainly times when +5 works out best. However, do be aware that the faster the focus motor drives the lens elements, the more noise you may hear (especially if you're using the onboard microphone to record sound). The default setting of 0 is a reasonable speed that is still very quiet. The fastest speed (+5) is very quick, and results in a faint increase in

motor noise. If you're using a shotgun or lavalier microphone on your subject, you'll probably never hear the difference in motor noise at all.

Setting a slower speed may be desirable as an artistic statement, or when the anticipated range of focus isn't expected to change much (such as a sit-down interview); with a slower focus speed you may find that there are less incidents of "focus hunting" and gentler transitions between focus points.

Setting a faster speed definitely helps get better focus performance in unpredictable environments (news/live events) or when needing to track a subject who's rapidly changing distance from the camera; for example, when filming a professional football game or a kid's soccer game you'll find that the focus tracking is much improved when the focus motor is permitted to move at top speed.



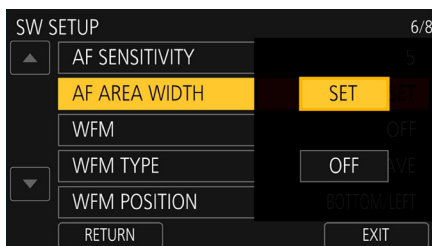
The second major parameter that you can customize is the AF SENSITIVITY. This parameter governs the autofocus system's responsiveness to initiating a refocus procedure (i.e., it controls how "sensitive" the autofocus system is towards thinking it needs to refocus the image). The range of settings are from 0 to 10, and the default setting is at 5.

To understand the idea behind the AF SENSITIVITY setting, imagine that you are filming a sit-down interview, and your subject is sitting in a rocking chair and gently rocking back and forth just a few inches. Each rock forward brings them a couple of inches closer to the camera, each rock backwards takes them a couple of inches further away from the camera. Now, in a scenario like that, you're probably going to be just fine using manual focus and splitting the difference, as the subject is not likely to drift out of focus to any substantial degree at either their closest or furthest points; however, if left on autofocus, this could create a scenario where the camera is constantly feeling like it needs to refocus, and could result in significant amounts of "focus hunting" which could ruin your footage. In a scenario like this, if you had decided you wanted to use autofocus, you could set the AF SENSITIVITY lower; by doing so, the focus system will delay its instinct to respond immediately. In effect, the lower you set this parameter, the longer the camera will delay before taking action. It may recognize that the image should be refocused, but it won't act instantly, it will "take a breath" (as it were) before responding. If the sensitivity were set low enough, it's entirely possible that the subject will move back into focus before the autofocus system even attempts to refocus, and therefore it could potentially defuse any potential "focus hunting" that otherwise would have taken place.

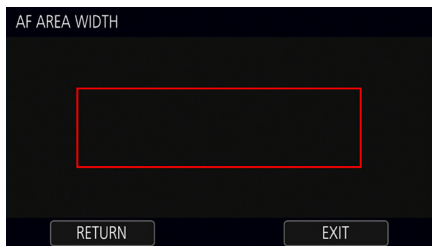
Another example of when low sensitivity might be desirable would be when a one-person crew is conducting a stand-up presentation or interview. Perhaps the camera is positioned 15 or 20 feet away from the reporter and their interview subject, and the reporter chose autofocus because they knew the camera would be unattended. In this scenario, you would generally want the autofocus to be quite "sticky" on the subject, and not easily distracted or diverted. If a pass-

erby were to walk between the camera and the reporter, a normal autofocus system would probably become distracted by the intervening person and want to focus on them, leaving the reporter and their subject out of focus when the intervening person leaves the camera's frame; the camera would then have to focus on the reporter and subject again. But with the custom autofocus, the camera could be set on very low sensitivity (AF SENSITIVITY of 0, for example); in this case the camera would ignore the intervening person for a while, leaving the focus "stuck" on the reporter. If the intervening person clears the frame quickly, the camera will very likely still be focused on the reporter and won't have to refocus at all.

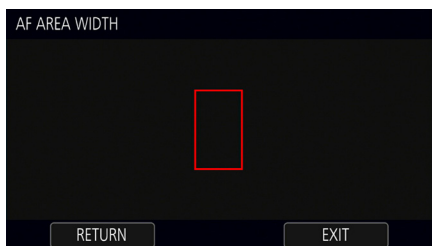
On the other hand, there are shooting scenarios where instantaneous response is desirable, if not mandatory. If the task involves tracking a moving subject, you would definitely want to increase the sensitivity. Imagine filming a football game from the end zone, where a wide receiver is running straight towards you at top speed. They may be covering 40 yards in five seconds or less! You would want the camera to be as sensitive as possible, refocusing the moment it feels it's lost sharp focus, and you'd want the focus motors operating as fast as possible, to track such a fast-moving object. Any time you're filming fast-moving objects that are changing the distance between themselves and the camera (such as horse racing, car racing, track & field events, etc.) you would probably be served best by making the camera as fast and sensitive as possible. Just do be aware that when the sensitivity and speed are at their fastest, that's when the camera is most likely to make quick/small focus moves which might result in a little bit of "twitchiness" to the focus; the focus is most stable when the sensitivity and speed are slowest, and it's most responsive when those settings are at their fastest.



Finally, there is a fourth parameter you can control regarding the focus system, and that's the size of the area in the frame that the autofocus system will evaluate for focus purposes. You can use the AF AREA WIDTH menu item to set how wide, or how narrow, the area it will evaluate will be.



When set to its widest, the camera will take into account most of the width of the frame, and about 1/3 the height of the frame. If you were filming a football team, this focus area might be suitable for capturing the full line of players, and the focus system would choose the best focus setting that kept the focus sharpest throughout the entire red frame.



Alternatively, you can set the frame to be narrower, even to a very narrow degree. The image to the left shows the focus frame at its most narrow. In this setting, the camera will ignore everything outside the red frame, and will only determine focus on what is within that red frame; this small size might be useful to isolate one player out of the whole line of players, and keep that player in sharp focus regardless of where the other players may move.

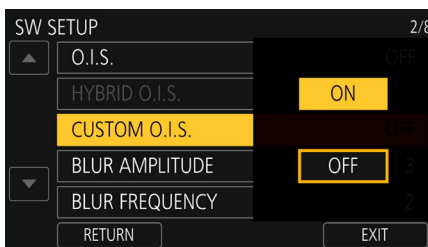
Optical Image Stabilization

The cameras have a comprehensive optical image stabilization system, utilizing an extremely high-precision image stabilization unit incorporated into the lens. The finer the resolution of the image, the tighter the tolerances must be in order to suitably stabilize the picture, and the UX180 and UX90 have a newly-designed high-resolution stabilization system specifically engineered to cope with the demands of stabilizing ultra high definition images.

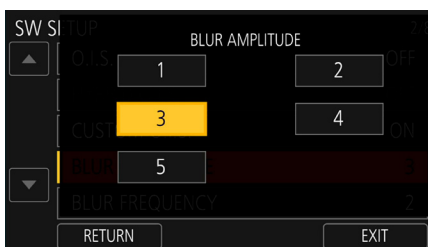
Like the autofocus system, the optical image stabilization system is customizable; you can program it to perform better under certain circumstances. When you know what type of motion you can expect (a stable tripod shot, stationary handheld, walking/running handheld, etc) you can optimize the performance of the image stabilization to deliver the best results under each condition.

The optical image stabilization system can be enabled or disabled either in the camera's menus, or by using the O.I.S. button on the side of the camera. Additionally, when not shooting 4K or UHD, you can enable the Hybrid O.I.S. system, which adds digital stabilization to the optical image stabilizer and makes it even more effective. The programmable Custom O.I.S. applies to the optical image stabilizer, whether or not you've added the Hybrid O.I.S. system. The rest of this document assumes that you have enabled the O.I.S. system before proceeding.

The programmable image stabilization consists of three menu items:



First, there's an overall on/off setting for the Custom O.I.S. system. If you set "CUSTOM O.I.S." to OFF, then the default optical image stabilization parameters will be used. If you want to take advantage of your customized settings, you need to set this to ON.

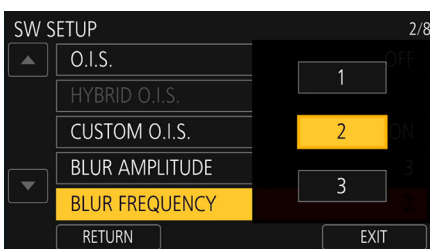


There are two major parameters you can set for the custom O.I.S. system, BLUR AMPLITUDE and BLUR FREQUENCY. Blur amplitude refers to how large the motion is that the O.I.S. system will be working with; the bigger the movement, the more "ample" it is. The blur amplitude has five options; the smaller the number you set it to, the smaller the movements that the O.I.S. system will attempt to compensate for. A setting of "1" directs the O.I.S. system to expend all its energy on canceling out only the smallest movements. This setting would be best for a stationary shot where the camera isn't expected to move at all. Generally, if you had the camera mounted on a tripod, the camera wouldn't be expected to move unless it was subject to perhaps some low level of vibration or being inadvertently bumped or, in the case of being mounted on a wooden platform, there might be some very minor motion caused by people walking across the platform. In those cases, setting the blur amplitude to "1" directs the camera to be hyper-responsive to tiny motions.

The larger you set the blur amplitude, the larger the motions the camera is expected to be able to attempt to compensate for. For example, if you were holding the camera as steady as you possibly could during a handheld interview, perhaps a setting of “2” would be appropriate. Obviously no person can hold the camera as steady as a tripod could, so you might expect there would be some minor wobble or slight hand shake, and with a setting of “2” the camera would be able to cope with the slightly larger movements as compared to the tripod-steady setting of “1”. If you expect to encounter larger movements, you should set the blur amplitude higher. If instead of tightly holding the camera for an interview you were generally walking and aiming the camera at various subjects, you might need setting “3” for that. If you’re encountering larger movements (like running with the camera, or trying to film from the deck of a rocking boat) you should set it all the way up to “5”.

On a setting of “5”, the camera will try to compensate for a full range of movement, from tiny movements all the way up to large moves, but it will be less effective at compensating the tiny movements than it would have been on a lower setting like “1” or “2”. On the lower settings, the camera focuses more of its energy into compensating for the minor movements, and is more effective at canceling them out. As such, if you’re expecting a relatively stable camera position, you should set the blur amplitude smaller and it will deliver the most stable results. Setting it to a larger number should only be done when you reasonably expect that you will be encountering larger movements with the camera; a setting of “5” would not work well when the camera is on a tripod, for example. The default position is “3” as a general-purpose middle-ground setting.

Please understand that there are limits to any image stabilization system, and no O.I.S. is going to be able to compensate for all camera shaking that could occur. It is unreasonable to expect that the camera could completely stabilize handheld running footage, for example. These recommendations are not guarantees that your footage will be rock-solid and stable; they are only recommendations for settings that may allow the camera its best opportunity at stabilizing footage shot under those particular conditions.



The second major parameter you can adjust in the O.I.S. system is the BLUR FREQUENCY. The frequency refers to how frequently the camera can expect to encounter unwanted motions that it should attempt to stabilize. Unlike BLUR AMPLITUDE, this setting isn’t directly proportional to its effect; instead, there are three different “personalities” you can ask the camera to adopt.

Setting “1” is suitable for a locked-down shot when the camera is mounted on a tripod and it is expected that the camera won’t be panning or tilting. At a setting of “1”, the camera actively and aggressively combats any shake of any magnitude or frequency; it assumes that the camera will always be stable and steady and that therefore any camera motion is unwanted motion. It attempts to correct over a wide range of frequencies, whether it’s being tasked with subtle vibration or with something more onerous, such as someone accidentally bumping into the tripod and jolting the camera. Obviously there are limits to how much motion it can compensate for, but it aggressively tries to compensate for as much as it can.

Setting “2” is a more general-purpose setting. It is designed to combat medium to high-frequency motions, and is probably the best setting for when using the camera handheld. This is the default setting.

Setting “3” is optimized to eliminate tiny motions (vibration or subtle handheld shake) while minimizing its attention to larger motions. It will aggressively attack small motions, but only mildly attempt to stabilize larger motions. This would be a good setting for when the camera is on a tripod (or even handheld) and you expect to do a lot of panning or tilting; the camera will aggressively respond to minor jitters but shouldn’t interfere with the panning or tilting moves when using setting 3.

Summary

Customizing the autofocus or image stabilization systems can lead to sharper, clearer, more stable footage in a wide variety of shooting circumstances. Panasonic’s innovation of putting these parameters in the user’s control lets you tailor the camera to deliver better performance for the type of shots you expect to encounter.