Grass Valley

WHITEPAPER

Mastering Light, One F-stop at a Time:

Introducing 1/2 ND Filters in the LDX 100 Series

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Whether you're capturing live sports under shifting skies or filming a concert with constantly changing lighting, one truth remains: lighting is rarely consistent. Yet delivering a clean, beautifully exposed image demands absolute precision — moment by moment, frame by frame.

At their core, cameras are tools for shaping light. Every photon that enters the lens is transformed into image data by the *imager* — a precisely engineered component inside the camera that converts light into picture. Our in-house developed Xenios imagers are designed to handle extreme lighting conditions with over 15 f-stops of dynamic range and exceptional detail. This enables outstanding HDR performance, including more than two f-stops (or 400%) of headroom in HLG mode.

But even with all that range, there's a sweet spot — an optimal exposure window — where imagers deliver their very best: deep blacks, rich highlights, and maximum dynamic fidelity.

Lens Iris: Precision Light Control with Creative Impact

The lens iris is your first point of control when shaping the light that reaches the camera's imager. With a broad adjustment range across multiple f-stops, it gives you the power to fine-tune exposure on the fly. But it does more than just control brightness — it also defines the creative look of your image. A wide-open iris creates beautiful background blur with shallow depth of field, while a smaller iris keeps the entire scene in sharp focus.

However, in many live production environments, maintaining a consistent depth of field is critical — and lenses do not perform equally across the full iris range. That's why limiting the iris range or even locking the iris at its optical sweet spot is often the smart move.

To manage exposure without compromising image aesthetics or lens performance, you need more than just iris control. This is where ND filters and precise camera gain settings come into play — giving you the flexibility to dial in perfect exposure while keeping your creative vision intact.

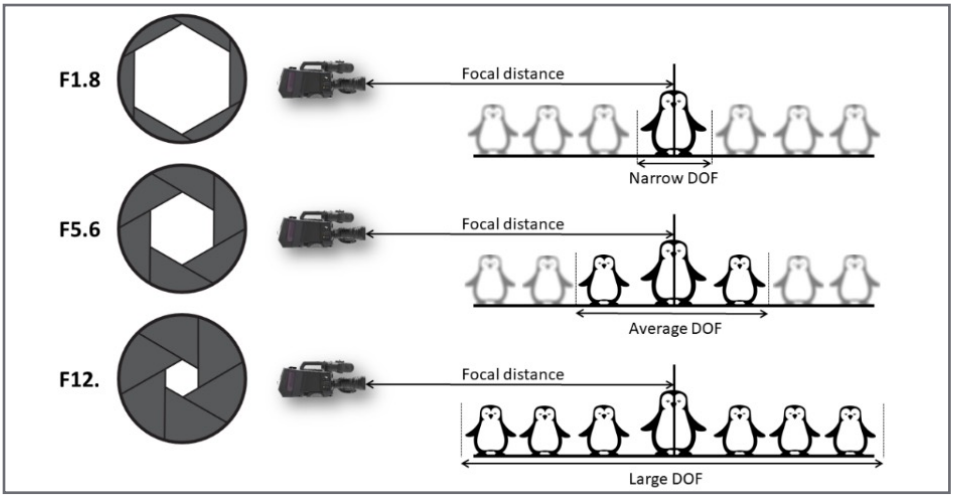

Figure 1 – Depth of field depending on lens iris.

Camera Gain: Fine-tuning Sensitivity with Precision

Gain is a powerful tool in managing exposure, but like any tool, it comes with trade-offs. Negative gain reduces the sensitivity — where every -6 dB equals one f-stop—but it also reduces the available dynamic range. On the other hand, positive gain boosts sensitivity but increases image noise and reduces the signal-to-noise ratio.

Thanks to the 400% headroom available in HLG HDR mode, our LDX 100 Series camera system supports up to -12 dB of gain without any loss in image quality — and even -18 dB can deliver acceptable results in many situations. On the positive side, gain should be used sparingly, though in most real-world conditions +6 dB remains within acceptable limits.

This offers a highly effective electronic gain range: up to 12 dB with no compromises, and up to 24 dB with only minimal trade-offs. When combined with careful iris control, it allows the imager to operate within its optimal performance window — where detail, contrast, and dynamic range are at their peak.

But when ambient light levels climb, gain and iris adjustments alone may not be enough to maintain proper exposure. That's when an additional layer of control becomes essential, and that's where ND filters come in. They provide a precise, non-destructive way to manage exposure, preserving image quality without compromising your creative intent.

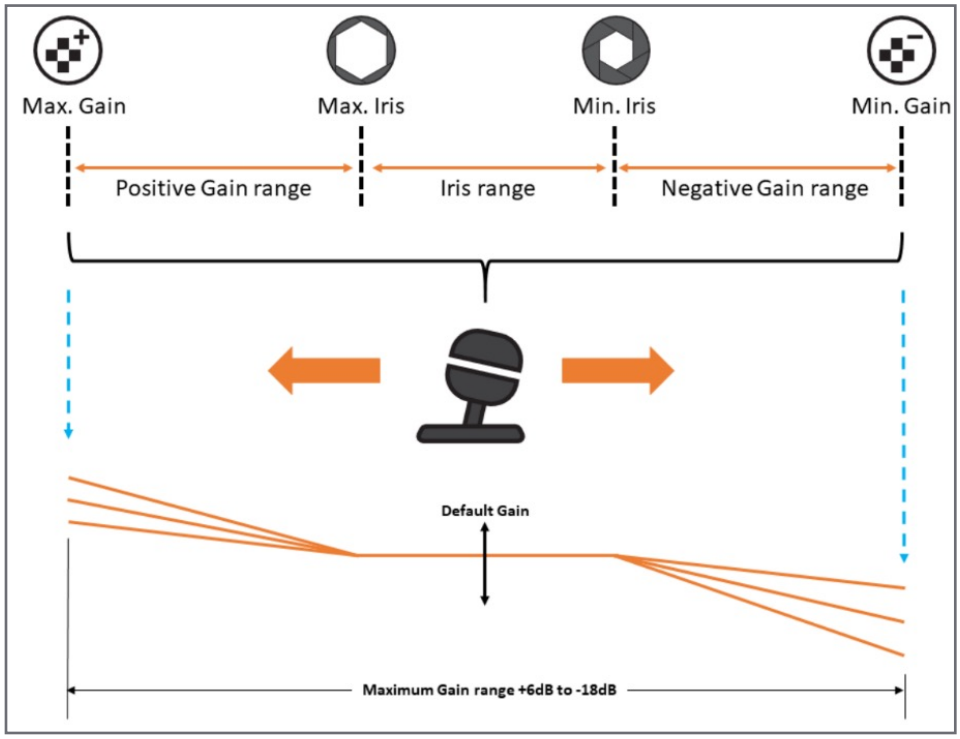

Figure 2 – LDX 100 Series extended iris control.

ND Filters: the Camera's Sunglasses

ND stands for Neutral Density. Think of ND filters as sunglasses for your camera — they reduce the amount of light hitting the imager without affecting color balance. That "neutral" part is critical: all wavelengths are attenuated equally, so reds stay red, blues stay blue, and your creative intent stays intact.

Why not just reduce gain or adjust exposure fully digitally? Because once highlights are overexposed, the detail is gone. You can't recover blown-out areas in post. ND filters limit the light before it reaches the imager, preserving highlight information and ensuring clean, artifact-free results — especially in bright environments.

The Problem: Big Steps, Limited Precision

Traditionally, most cameras offer ND in two full f-stop intervals: Clear, 1/4 ND, 1/16 ND, 1/64 ND — equating to 2, 4, and 6 f-stop reductions. It's a well-established system, but the gaps are large.

Say lighting conditions shift slightly — you don't need a full 2-stop reduction, just one. With only coarse ND steps, your only workaround is changing the lens iris or using gain adjustment, usually in the negative direction. And while -6 dB (one f-stop) helps to find a setting between two ND filters, it consumes half your available adjustment range and headroom. That limits your flexibility when conditions change again. In high-stakes environments, that's far from ideal.

The Solution: a 1/2ND Filter for Greater Control

To offer finer exposure control, we've introduced a new 1/2 ND filter in our latest cameras — equivalent to a one f-stop reduction. This allows you to bridge the gap between standard ND steps with precision and flexibility.

With this new configuration, you get a complete, fine-tuned system of one f-stop increments:

Clear

1 F-stop = 1/2 ND

2 F-stop = 1/4 ND

3 F-stop = 1/8 ND (1/2 ND + 1/4 ND)

4 F-stop = 1/16 ND

5 F-stop = 1/32 ND (1/2 ND + 1/16 ND)

6 F-stop = 1/64 ND

7 F-stop = 1/128 ND (1/2 ND + 1/64 ND)

Note: The operator only needs to select the desired ND filter level between ND 1/2 and ND 1/128 (Fig.3). The control software automatically applies the correct combination of the two ND filters to achieve the selected attenuation level.

This setup gives you smooth transitions in one-stop increments, enabling more refined control over exposure. That means fewer compromises and more time spent operating within the imager's optimal performance range — regardless of how unpredictable your lighting conditions may be.

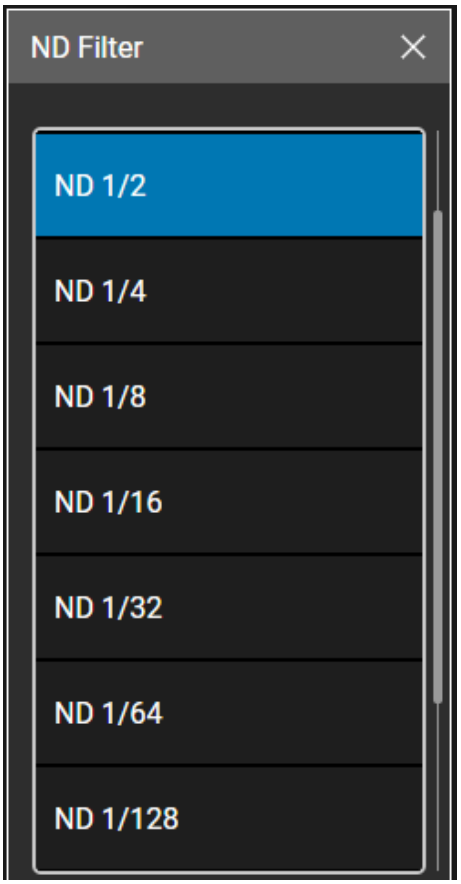

Figure 3 – Extended ND filter selection at the CGA.

For Operators and Shaders: Subtle Control, Superior Results

This isn't just a technical enhancement — it's a practical, real-world enabler.

As an operator or shader, you're constantly juggling highlight protection, exposure balance and signal integrity. With one f-stop ND steps now available, you can make accurate, confident adjustments using only ND filters and minimal gain. That preserves full tonal range and minimizes noise and compression artifacts.

You'll also make faster, smarter decisions under pressure. No more second-guessing whether a two-stop change is too aggressive. You now have the tools to stay in control — whether you're tracking a fast-moving subject in bright sunlight or dialing in a look on a dimly lit stage.

Designed for the Demands of Live Production

At Grass Valley®, we don't just add features — we enhance workflows. The introduction of the 1/2 ND filter, combined with extended iris control, is a direct response to feedback from the field: from operators seeking greater precision and from engineers who understand the real-world challenges of modern live production.

This combination gives you the freedom to position the lens iris exactly where it's needed — whether for depth of field, optical performance, or creative intent — while still maintaining full control over camera output across a wide range of lighting conditions.

This is more than just optical filtering. It's about mastering light, optimizing image quality, and equipping professionals with the precision and flexibility to adapt instantly — without compromise.

Because at the end of the day, great images are built one f-stop at a time.