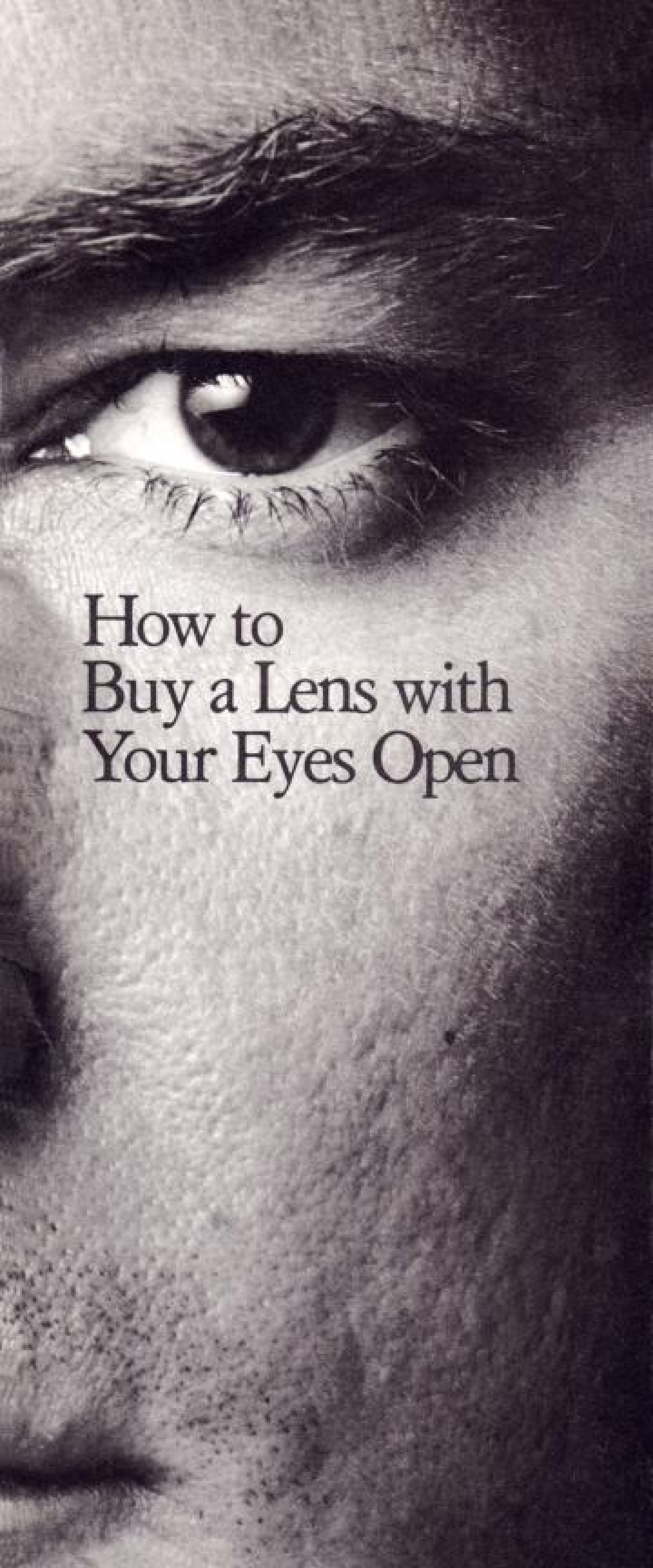

How to Buy a Lens with Your Eyes Open

The fact that you're reading this pamphlet suggests you're interested in buying a lens; maybe not now, but sometime in the near future. Common sense tells you that because lenses vary in price, they must also vary in quality. And all lenses vary in features. Worse, you probably have the sneaking suspicion that although expensive lenses tend to be of high quality, not all high quality lenses are expensive. They problem is, you can read ten different brochures, ads, and test reports and get ten different impressions of what lens has it all: price, performance, and versatility.

As a leading manufacturer of 35mm single lens reflex camera lenses, with over 20 years experience, we'd like to present you with some eye-opening information about a better way to find such lenses. Of course, our reasons for doing so aren't totally unselfish. We think the more you know about buying lenses, the greater the chance you'll buy one of ours.

Oh Say Can You See

OPTICAL QUALITY IS ONE OF YOUR PRIME CONCERNS when buying a lens. But ironically, it's hard to determine the optical quality of a lens before you buy it. You certainly can't tell by putting one on your camera body and looking through it. Neither your eye nor the focusing screen have the resolving power of even the most "average" of lenses. At best, the human eye can resolve only ten lines per millimeter. A good camera lens will average 50 lines per millimeter on film.

Putting your potential purchase on an optical bench is neither practical nor necessary, because your most reliable indicator is right before your eyes: the quality and precision of the lens' construction. Without high quality construction, a lens isn't likely to perform to your expectations, either optically or mechanically.

The Inside Story

ALTHOUGH THE PURPOSE OF THIS PAMPHLET IS TO tell you what to look for when buying a lens, there are things you *can't* see that will have a significant effect on its long term performance and reliability. Any manufacturer can claim his lenses are ''the ultimate in quality and precision.'' If the claims are true, here's what you should expect for your money:

Multicoated Lens Elements

Multicoating does more than just reduce flare and ghosting. It increases light transmission and contrast while allowing more consistent spectral transmittance. (This keeps one lens from being noticeably ''warmer'' or ''cooler'' than another; an important consideration when using more than one lens with color transparency films.)

Before being coated, the lens elements should be heated to 280° - 300° Celsius. The coatings should then be applied in a vacuum chamber as the lens elements are rotated in a planetary motion. These procedures will assure optimum uniformity and durability.

A Strong Yet Lightweight Lens Barrel

The lens barrel is, in effect, the skeleton that holds the lens elements, focusing helicals, zooming cams, and centration retainers in place. It must be capable of being machined to tolerances as close as ± 0.01mm while maintaining its round shape. It must be able to withstand the small but steady friction of years of zooming and focusing, as well as the corrosive effects of heat, cold, dust, and humidity. But it must also be lightweight to maintain a comfortable balance with today's compact camera bodies.

Almost all lens barrels are therefore made of an aluminum alloy. The best use a seamless aerospace quality aluminum, alloyed with chromium, manganese, and magnesium, hardened for at least two hours at 280°C.

For an attractive yet durable finish, the barrel should be anodized both inside and out. (Paint simply covers the metal. An anodized finish is more corrosion and abrasion resistant because it's bonded to the metal's molecular structure.) As an added touch, the manufacturer may *diamond-turn* the finish; a process in which approximately 50 microscopically thin ''turns'', or lines, are cut per each millimeter, giving the barrel a satin-like luster.

Tight Centration Tolerances

A lens with poorly centered elements will have reduced resolution due to axial coma and astigmatism. Optical designs can call for centration tolerances of ± 0.015mm or tighter, but unfortunately, not all lenses achieve this in assembly.

Tight centration is particularly important in zoom lenses. The various lens groups move back and forth over much greater distances than in fixed focal length designs and are therefore more apt to decenter if not properly supported.

To save money, some lens makers use a single zoom support mechanism; a step that's likely to cause ''tilt'' when the lens is at its maximum extension. ''Tilt'' is when the image plane is literally tilted away from being coincident with the film plane. Single support mechanisms can also cause ''chatter'': rough, wobbly zooming caused by unequal distribution of internal forces.

High quality zooms use a dual support mechanism pioneered by Ednalite Corporation for use in high technology aerial zooms. Ednalite centration retainers have two pairs of support arms in 180° opposition to keep the lens elements balanced and perpendicular to the film plane, regardless of position. This also results in smoother and more reliable zooming and focusing.

Low Friction Diaphragm Assembly

Most single lens reflex camera lenses are designed with an automatic diaphragm. The diaphragm stays at maximum aperture for ease of viewing and focusing, closes down the instant before you take the picture, and reopens immediately afterwards.

Obviously, if you're using an autowinder or motor drive, the diaphragm must open and close at the same rate as the motor-driven shutter; sometimes up to five frames-per-second. High rates of friction can prevent the diaphragm from closing down completely, particularly during fast shooting at smaller apertures. The result is overexposure; or worse, the jamming of your camera's diaphragm actuating mechanism.

A high quality lens maker may use up to 200 ball bearings in the lens' diaphragm actuating assembly to reduce friction. This allows actuation times of 25-28 milliseconds, consistent with camera and motor drive demands.

Rounded, Symmetrical Diaphragm Blades

The more diaphragm blades a lens has, the closer the shape of the aperture comes to being a perfect circle and the greater the control over off-axis aberrations. Six bladed iris diaphragms are considered optimum for single-lens reflex camera lenses. They allow a hexagonal aperture and small stops such as f/22 for greater depth-of-field.

Durable, Precision Lens Mount

Lenses made for a specific camera brand should have specifications and tolerances comparable to the camera maker's mount. High quality manufacturers will use materials such as hard chrome plated brass or stainless steel, machined to a tolerance of ± 0.02mm, and fastened with at least three screws for stability.

Premium All-Weather Lubricants

There are two ways to achieve smooth focusing and zooming. The inexpensive way is to manufacture a lens with low metal-to-metal tolerances and "take up the slack" with grease. But greases have a tendency to liquify and spread at high temperatures or to harden at low temperatures. If you happen to be shooting in Death Valley, such a lens would soon become greasy, rough focusing, and wobbly. If you were shooting at your favorite winter resort, such a lens would become stiff and hard to focus.

A better, but more expensive, approach is to machine multistart helical threads and zooming cams with extremely high tolerances; as high as ± 0.005mm. With such high tolerances, the manufacturer can use "dry" lubricants such as Losimol, composed of synthetic oil, mineral oil, and lithium soap. "Dry" lubricants can be used over a temperature range of approximately -30° to 80°C (-22° to 176°F) — a range that can exceed the coefficents of expansion and contraction of the aluminum lens barrel mechanisms themselves.

Tight Quality Control

Probably most important, the manufacturer must take the necessary steps to ensure that his lenses are *assembled* to a uniformly high standard of quality. Lens making is an unforgiving process. A lens assembled in haste is seldom assembled well.

Each lens element should be ultrasonically cleaned and centered in a dust free environment. Afterwards, every lens should be tested for resolution (done with a test pattern projected through the lens), collimation (focusing accuracy), and iris timing, then given a final inspection for freedom from dust and cosmetic defects such as scratches and discolorations. Manufacturers who are truly concerned with quality will again test and inspect a representative sampling of each shipment before it reaches your camera dealer.

Total Control

A company that has total control over optical and mechanical design, selection of glasses, grinding, coating, machining, assembly, and testing, can have much greater control over its lens quality than one that simply has its brand name put on lenses it buys from various manufacturers. Its engineers can optimize their optical and mechanical designs to match the capabilities of their equipment and instruments. This enhances production and the overall quality level of their product. The end result is that you can get a better lens at a lower price.

How to Be Your Own Q.A. Inspector

EVEN THOUGH YOU CAN'T SEE EVERYTHING A manufacturer puts into (or leaves out of) his lenses, there *are* ways to assure yourself that just because you pay a lower price doesn't mean you have to settle for less quality. Here's what to look for:

1. Look for a smooth, flawless finish on the lens barrel, coatings, and mount. The engravings should be clear, cleanly cut, and paint filled. The focusing grip should be seamless vinyl, and should feel rugged and secure.

2. Remove the front and rear lens caps and look into the front of the lens. It should look like a dark tunnel, with virtually no shiny surfaces, globs of lubricant, dirt, or frosted lens element edges. The diaphragm blades should be clean and symmetrical, even at the smallest aperture. Wherever possible, the lens barrel and key moving parts should have anti-reflection grooves to reduce internal reflections.

3. Before mounting the lens on your camera, look at the lens mount and coupling mechanisms. Both should appear at least as sturdy as those on your camera.

4. The lens should mount easily and securely, without binding or wobbling; as if it were made for your camera. Focusing (and zooming, if it's a zoom lens) should also be silky smooth. On the other hand, a "one touch" zoom should have just enough friction to prevent the zoom/focus ring from sliding out of position when the lens is pointed downward.

5. If you own an autowinder or motor drive, or if you plan to buy one in the future, test the lens on a motor-driven camera. If the lens is well-made, it should have no problems keeping up with the shutter, even at small apertures. (Smaller apertures require the diaphragm blades to move further.)

6. Look at the warranty and take careful note of how long it lasts and what it covers. Almost all warranties. last a minimum of one year, but some last as long as five. This gives you a good idea of the confidence the maker has in his product over the long haul.

7. Finally, look for the manufacturer's name on the lens. Some lens suppliers omit this because they would prefer you didn't know who they buy their lenses from.

Consider the Possibilities

BUYING A LENS IS A LONG TERM INVESTMENT. Properly maintained, a well-designed and constructed lens will last a lifetime.

But a lens is more than just aluminum, brass, glass, and steel. It's a creative tool; the "eyes" with which your camera sees the world and its limitless photographic possibilities. When comparing lenses, you should therefore carefully consider which one provides features that will best serve your needs; not just now, but in the years to come.

Look for the little things. For example, if you buy a filter or a pocket calculator, it comes with a case. Why not a lens, which costs much more? All lenses, but particularly tele-zooms, can benefit from a well-designed lens hood. Some manufacturers include one at no cost.

If you can't decide between two similar fixed focal length lenses, consider that an extra f-stop or two in lens speed can mean easier focusing and faster shutter speeds when you're shooting in low light.

If you can't decide between a fixed focal length lens and a zoom because you're worried that the zoom may be too expensive, too slow, too heavy, or not sharp enough, stop worrying. Modern zoom lenses, when well designed and manufactured, are lighter, less bulky, and less expensive than the combination of fixed focal length lenses they would replace. They rival the optical quality and speed of fixed focal length lenses, and beat them hands down when it comes to overall versatility.

There are two basic types of zooms: parfocal ("true") zooms, and varifocal zooms. A parfocal, once focused, stays in focus as you zoom.* A varifocal stays in focus only at infinity, and must otherwise be slightly refocused as you zoom.

Almost all telephoto zooms are of the parfocal type. This is not the case with wide-to-telephoto zooms. Because of the large degree of change in the angle of coverage, aberrations such as astigmatism, focus shift, distortion, coma, and field curvature are much harder to correct. Parfocal wide-to-telephoto zooms can require large and expensive lens elements, even for moderately fast maximum apertures such as f3.5. Designs using 14 lens elements in 8 groups with 4 interdependent zooming, focusing, and compensating

**Experienced photographers "fine tune" the focus of parfocal zooms to assure critical sharpness just before shooting.*

movements, some linear and some rotational, are common. Such designs require tight decentration tolerances that test the capabilities of even the most sophisticated manufacturing facilities.

Add to this the photographer's preference for macro focusing, a fast maximum aperture, compact size, and high optical quality at a moderate price, and the manufacturer is faced with a production nightmare. To achieve a moderate price, some compromises must be made; generally in size, maximum aperture, and close focusing abilities.

Quality conscious manufacturers have therefore turned to varifocal wide-to-telephoto zooms, resulting in lenses that are smaller, lighter, and less expensive. Although the lens must be refocused when zoomed, the manufacturer can make this extra step faster and easier by reducing the angle of rotation on the focusing ring to approximately 90° (¼ turn).

Rather than using a *cammed iris*, the manufacturer can instead let the apertures "float". A cammed iris reduces the apertures at the shorter focal lengths to match the slower apertures at the longer focal lengths. The apertures stay the same throughout the range, but you lose overall lens speed. By letting the apertures "float" you get faster apertures in the wide angle range to allow easier focusing and shooting in low light. You may lose an f-stop at the longest focal length, but this is automatically compensated for by auto-exposure SLRs.

In short, by choosing a varifocal lens and foregoing two relatively minor conveniences, you get the major advantages of zooming, as well as high optical quality, a more simple and reliable design, greater lens speed, compactness, and macro focusing at a moderate price.

Whether a wide-to-normal, wide-to-telephoto, or short-to-long telephoto, all zooms allow you the convenience of being able to change image size without changing lenses or your distance from the subject. Macro focusing zooms are even more convenient, allowing you to focus from infinity to ¼ life-size or greater. With *continuous* macro focusing zooms there are no switches or levers to move and the subject stays in focus as you zoom from infinity to maximum magnification.

When comparing macro focusing zooms, remember also to compare their working distances (the distance from the front of the lens to the subject). Given two lenses that both focus to ¼ life-size, the one with the greater working distance will allow you more flexibility in lighting and photographing elusive subjects.

The inherent versatility of zooms can be increased with related accessories, such as matched tele-converters, reversing rings, and closeup lenses. Most 2X converters were designed to convert a 50mm lens into a 100mm medium telephoto. They do this only moderately well, with similar lackluster performance on longer focal length lenses. In contrast, a matched teleconverter is designed to complement the optical properties of a particular lens or range of focal lengths, with no significant loss of image quality. At some finite focusing distances, image quality can even be improved.

A 2X matched teleconverter will double the focal length of your prime lens as well as its maximum reproduction ratio. For example, an 80-200mm f4.0 zoom that focuses down to ¼ life-size would become a 160-400mm f8.0 that focuses down to ½ life-size. Unfortunately, an f8.0 lens is difficult to focus in all but the brightest light. You may also have to use a tripod to prevent blurred pictures caused by camera shake at slow shutter speeds.

Some manufacturers are therefore also offering a more practical alternative: the 1.5X matched teleconverter. You gain a 50% increase in both focal length and maximum reproduction ratio with only one f-stop loss in light transmission. Your 80-200mm f4.0 can then be transformed into a 120-300mm f5.6 that will not be significantly longer, slower, or more expensive than a comparable 300mm fixed focal length lens, *but a lot more versatile.*

Teleconverters can cause vignetting (dark corners) with wide angle and wide-to-telephoto zooms when used in the wide-to-normal range. You can, however, extend the capabilities of wide-to-tele zooms by using close-up lenses. With a close-up lens set of + 1, + 2, and + 4 diopters, you can produce any magnifying strength from + 1 to + 6 diopters. This allows magnifications up to ½ life-size with practically no loss in light transmission or camera automation.

You haven't yet exhausted the possibilities. Almost all lenses of moderate filter size (49-55mm) can be mounted onto your camera in reverse with a reverse adapter ring. A 24mm lens that only focuses down to 1:10 when mounted normally, can produce an image up to three times life-size (3:1) when reversed. Depending on its optical design, a parfocal or varifocal zoom can produce magnifications from ½ to two times life-size.

Of course, with the lens reversed you'll have to manually stop it down to the taking aperture. If your camera has a behind-the-lens meter (most do), you won't have to perform any arduous exposure calculations. In fact, if you own an automatic aperture preferred camera, it will automatically set the correct shutter speed, just as it would with the lens mounted normally.

Enlightenment

AS YOU CAN SEE, THERE *IS* A BETTER WAY TO BUY A lens than blindly relying on myth, hype, rumor, or advice. It's actually rather simple, once you know what to look for and how to find it.

By the way, if you're wondering how well Kiron lenses rate according to the above standards, we have a confession to make. They're ours. But we're not asking you to take our word for it. All we ask is that you compare any one of our lenses with *any* other lens you may be considering, regardless of name, cost, reputation, or features. After taking a good long look at our price, quality, and versatility you'll see the answer is right before your eyes: Kiron.

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PART NO. 30000001

SEPTEMBER 1980