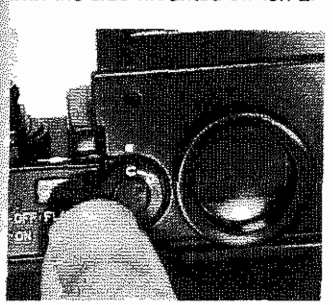
required length of time and then easing pressure so the shutter will close at the end of the extended speed.

Now you switch your meter from viewing the match needles in the viewfinder to centering the needle atop the booster. The top window lights automatically and the interior window light is extinguished when the booster is switched to the lower range. The eyepiece shutter must be closed during metering to prevent extraneous light from entering the eyepiece and possibly causing erroneous readings. Obviously, the camera should now be used on a tripod or stand. Readings are made at actual shooting aperture, so the lens must be closed down properly using the Canon's depth-of-field preview lever. However, you can still view and focus through the eyepiece at full aperture up to exposure once you have set the booster for the proper shutter speed.

Canon claims a four-hour life for the 6-volt, #544 silver-oxide battery. It is most essential to remember to shut the booster off with the side-mounted switch af-



Before using extended range of booster, you must close eyepiece blind with C-O knob to prevent extraneous light from entering during reading.

ter use, not so much to prevent drain from the CdS circuit as to prevent drain from one of the meter-needle illumination lamps.

For prolonged use or in extreme cold, the manufacturer recommends a separate 12-volt battery case similar to that for the Servo EE; however, we did not extend our tests that far.

Using two recently calibrated low-light meters, we were able to check the accuracy of the booster down to its limit of 60 sec. at f/1.2 with an ASA 25 film. We were pleased to find that readings between all three were well within ⅓ f/stop of each other, quite an achievement at such low-light levels. Pictures shot under such conditions were acceptable, but we felt that any variations in departure from correct exposure would be caused more by the film's reciprocity failure than by the meter, and we should caution users to check reciprocity failure tables for their films and make the necessary compensations if they are called for.

Another caution in low light: Meter reaction, particularly when the CdS cells have been exposed to higher levels of illumination, will take some time to provide accurate readings. At the very lowest levels of exposure, it may take as long as 30 sec. for the meter needle to cease moving.

What subjects can be used for such low-light readings? Close-ups and photomicrographic work, certainly. Outdoor exposures at night are also possible. But obviously, the booster is not an accessory which will be required by the average photographer for normal picture taking.

With the increased metering ranges now being built into automatic SLR's using the Silicon Blue Cells (such as Canon's EF reviewed here in May), the abilities of the booster, which does add some 12¾ oz. (350 g) in weight and 3 5/16 x 2 1/16 x 2 11/16 in. (87 x 52 x 69mm) in size to the F-1, seem less impressive. However, the booster does provide even greater low-light ability by at least one f/stop and gives you built-in meter illumination which the new silicon-cell-meter cameras do not offer.

ZUIKO 75-150MM F/4 FOR THE OLYMPUS OM-1

MANUFACTURER'S SPECIFICATIONS: 75-150mm f/4 Zuiko Auto-Zoom for Olympus OM-1 cameras. FEATURES: Apertures to f/22, focusing to 5 ft. 3 in. (1.6m), accepts 49mm accessories. PRICE: $349.95.

In examining the 75-150mm f/4 Zuiko zoom, the first question that occurs to many people is: "Why make a lens of this speed and focal length?" While it's true that an 85mm portrait lens plus a standard 135mm short tele will cover this modest 2:1 range fairly effectively, a 75-150 of moderate aperture has the following advantages: it's relatively compact and handleable, it is comparatively easy, optically, to design a fine-performing, medium-aperture zoom in this range, and it does cover the "longer than normal, shorter than 200mm" range with a blanket. And while this lens is a "two touch" optic with separate zooming and focusing controls, it's also one of the lightest—15 oz. (426g)—slimmest—about 2½ in. (64mm) in diameter—zooms we've ever seen. Since it extends only 4½ in. (114mm) from the camera body at infinity, it's understandably devoid of a tripod socket.

The zoom's scales are legible in white-on-black (except for a green-on-black focal length scale and an orange-on-black footage scale), and the aperture ring has click stops at all whole-stop intervals. While other Zuikos have their aperture rings situated near the front of the lens, the zoom's 3/16-in.-wide (5mm) f/stop collar is situated near the rear of the lens, just in front of the mounting ring. Rounding out the controls are a heavily-knurled, rubberized 7/16-in.-wide (11mm) zooming ring, a 13/16-in.-wide (21mm) focusing ring which takes the lens to minimum focusing distance in a smooth 160° (approx.) turn, and a sliding sunshade which adds another 3/4 in. (19mm) to the lens in extended position. All controls operate with commendable smoothness and precision.

The focusing image provided by the Zuiko zoom is something of an enigma. Brightness there is in abundance, except for the OM-1's central microprism which resembles a "pepper and salt" grid instead of an image-fracturing focusing aid. We conclude that the angles of the tiny prisms comprising this grid were calculated to optimize focusing with wider-aperture lenses, and the f/4 zoom's focusing precision suffers a bit. Fortunately, the surrounding fine-line-Fresnel area offers a finely-detailed (if not overly contrasty) alternative for obtaining the precise focus.

On the optical bench, the 15-element, 11-group Zuiko zoom proved to be a good performer for a lens of its type. At 75mm flare was low, focus shift was small, and the slight red fringing visible on axis was judged very good for a zoom. Off axis, color fringing was brighter, but smaller in size, and astigmatism was not noticeable for practical purposes. Flare was rather small as was decentering, though imaging was somewhat soft. All in all, a better-than-average zoom.

At 150mm, axial color increased and the image had no strong core. But flare, quite visible wide open, improved as the lens was stopped down, and color fringing was not as pronounced. At f/11 the lens can be said to be diffraction-limited. Lateral color was visible, but within tolerances, and astigmatism was

Would you like to test your own lens? Get MODERN's Lens Test Kit, $3.95. Write to Lens Test Kit, MODERN PHOTOGRAPHY, 2160 Patterson Street, Cincinnati, Ohio 45214.

Resolution Power

75-150mm f/4 Zuiko Zoom at 75mm No. 105241 At 1:46 Magnification

f/no.	Center Lines/mm		Corner Lines/mm	
4	Exc.	58	V/Good	32
5.6	Exc.	58	Exc.	41
8	Exc.	65	V/Good	41
11	Exc.	65	Exc.	46
16	Exc.	56	Exc.	46
22	V/Good	46	Exc.	41

Actual Focal Length: 76.7—154.4mm Zoom Ratio: 2.01:1

At 100mm At 1:48 Magnification

f/no.	Center Lines/mm		Corner Lines/mm	
4	Exc.	54	Exc.	34
5.6	Exc.	60	Exc.	38
8	Exc.	60	V/Good	38
11	Exc.	60	Exc.	43
16	Exc.	60	Exc.	43
22	V/Good	48	V/Good	38

At 150mm At 1:48 Magnification

f/no.	Center Lines/mm		Corner Lines/mm	
4	Exc.	48	Good	30
5.6	Exc.	54	Good	30
8	Exc.	60	V/Good	38
11	Exc.	60	Exc.	43
16	Exc.	54	V/Good	38
22	V/Good	48	V/Good	38

Image Contrast

75-150mm f/4 Zuiko Zoom at 75mm No. 122950

f/no.	Center Percentage		Corner Percentage	
4	Medium	49	Low	12
5.6	High	76	Low	16
8	High	66	Low	26
11	High	64	Medium	40
16	High	76	High	49
22	Medium	51	Medium	37

At 100mm

f/no.	Center Percentage		Corner Percentage	
4	Medium	40	Low	12
5.6	Medium	48	Low	17
8	Medium	57	Low	24
11	High	63	Medium	37
16	High	58	High	45
22	Medium	54	High	43

At 150mm

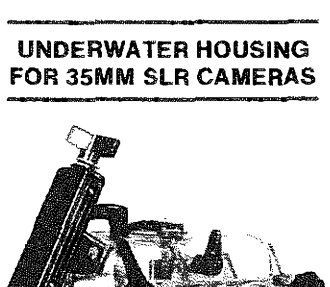
f/no.	Center Percentage		Corner Percentage	
4	Low	32	Low	12
5.6	Low	41	Low	12
8	Low	51	Low	18
11	High	57	Low	26
16	High	57	Low	29
22	Medium	49	Low	29

fairly well corrected. Coma was also nicely corrected, but the image lacked a strong central core. Decentering was obvious on the optical bench, but within tolerances for a zoom lens.

The transparencies we shot with the Zuiko zoom were more than satisfactory on the whole. At 75mm, on-axis color was low and flare quite pronounced, though sharpness remained high. The flare situation improved markedly on stopping down, however, and slides shot at f/8 and smaller were crisp and flare-free. While lateral color was quite large, skew-ray flare was commendably small, and astigmatism was not visible at any aperture. Despite a slight overall softness, contrast and resolution remained high. Test Kodachrome transparencies shot at 150mm were very similar to those shot at 75mm, with a moderate increase in flare caused by spherical aberration and coma. We were pleased with the quality of out-of-focus images which lacked double-line patterns, and sharpness was uniformly very good at the point of focus.

After all is said and done, few medium-focal-length zooms exceed the Zuiko's overall performance, and not one presently available is as compact.

UNDERWATER HOUSING FOR 35MM SLR CAMERAS



MANUFACTURER'S SPECIFICATIONS: Ikelite SLR Underwater Camera Housings for Nikon, Canon, Nikkormat, Pentax, Mamiya/Sekor, Konica Autoreflex, Minolta, Yashica, Ricoh and other cameras. FEATURES: Shutter-speed, aperture, focusing controls, provision for flash connection, interchangeable lens ports, internal 22½ volt BC power pack for external flash units. PRICE: $149.95.

While MODERN*'s technical staff does number among its members an experienced diver and underwater photographer, for an even more knowledgeable expert in the field we asked renowned diver-photographer Flip Schulke to aid us in testing the Ikelite housing (to which we will add our own postscript):*

There has been a great demand for underwater housings for 35mm SLR cameras which could be purchased at a reasonable price. In the past, SLR underwater cases have either been constructed by hand from Plexiglas, a time-consuming and costly procedure, or from cast aluminum molded housings. The drawbacks to these metal Rolls Royces of underwater housings are high cost and lack of adaptability to the numerous 35mm SLR cameras on the market. I own aluminum molded housings for my motorized Nikon F, but I am finding that, for many reasons, the Ikelite housing is becoming my favorite underwater photographic tool.

Before I go into the actual use of the Ikelite SLR housing underwater, I should like to digress a minute to explain one major advantage of the Nikon F, Nikon F2, and Canon F-1 in underwater photography. Each of these three camera models have removable prism viewfinders. Both Canon and Nikon have available interchangeable prism sportsfinders which Canon calls a "Speedfinder." The advantages of these enlarged viewfinders in underwater photography are twofold. First, since they have been designed for viewing, with your eye two to three inches away from the camera, they enable the diver to see the full picture frame, even when he's wearing his mask. Viewing through a normal prism with any 35mm SLR produces some picture cutoff. Your eye just can't get close enough to the normal viewfinder because of the face mask. Secondly, the sportsfinder prisms present a much larger image so the diving photographer can see greater detail in the viewing picture. Although the view is not quite as large as the images from 2¼ x 2¼ cameras underwater, the 35mm Canon and Nikon sportsfinders come quite close.

The Ikelite housings are all molded from GE's polycarbonate "Lexan," the same transparent plastic material being used in space helmets, and face protectors. It's a very strong, high impact plastic, vastly superior in strength to Plexiglas. A clear plastic underwater housing has a distinct advantage: the diver can see inside. This simplifies camera setting controls and makes the detection of leaks very easy. (A piece of sand under the rubber "O" ring can cause a case to leak.) Molded plastic housings do not suffer from moisture, condensation and the corrosion problems common to cast-aluminum housings. Condensation can be a real problem when diving in cold water because the camera lens inside of the housing can fog up.

The Ikelite housing has a handle on the right side of the case, set at a 45° angle. This isn't too hard when carrying the housing on the surface, but underwater, where the housing is "weightless" it enables the diver-photographer to operate the camera with only one hand. This particular housing is more comfortable for taking either vertical or horizontal shots. An underwater exposure meter can be attached to the handle.

For flash, a stainless-steel metal bar can be fastened onto the base of the housing; a flashbulb arm, a flashcube arm, or a strobe can be attached to it. The bar has a standard tripod-socket size female screw quite handy for macro photography underwater.

The housing comes with a flashbulb and flashcube 22½-volt BC power pack enclosed in the case, with external terminals for flash arms. Electronic flash can be utilized with the housing through a front-mounting Ikelite system. (This does not allow the strobe to be unplugged from the housing underwater.) For an additional charge, the standard underwater Strobe E.O. female connector can be installed by the factory or by the diver-photographer. This E.O. connector enables one to unplug the strobe underwater. This is an advantage if you are using more than one camera underwater at the same time because you can use one strobe with many cameras.

Apertures and speeds are set by exterior controls, enabling the diver to see the f/stops and speeds directly through the case itself. A gear drive system provides precise focus control with all lenses. You fasten a rubber-cushioned clamp to your lens focusing ring. This clamp engages with a gear-driven sleeve inside the lens port which you turn with an outside knob located on the right-hand side of the underwater housing.

Your camera fastens to a holding tray inside the housing with a tripod screw. This assembly drops into the housing. The two sections of the housing are sealed by an "O" ring, and held together by four "quick-release" stainless-steel lid snaps.

The housing is 4½ lb. (2kg) above water, but is negative or positive in buoyancy underwater, depending on the specific camera utilized and the addition of flash and strobe equipment.

My own Nikon F housing, even with sportsfinder, 20mm lens and underwater meter attached, was slightly positive. Since I don't like an underwater housing to float upwards when I'm trying to steady it, I've added some lead to make it "negative" underwater.

The housings operate safely to depths of 175 ft. (53m), well within the *safe* range of normal diving using compressed air.

The window of an underwater housing through which the camera lens sees is called the port. The front section of the port is made of Plexiglas in Ikelite housings because it is far superior in optical qualities to Lexan. Four interchangeable lens ports are available, all secured by two quick-release locks. The port supplied with the housing accepts 35 and 50mm lenses.

For wide-angle lenses such as 28mm, 24mm, 20mm, 18mm and 17mm, the Ikelite SLR offers as an accessory a dome-port fitted with a concentric Plexiglas "dome." This dome-port used in conjunction with a +3 diopter close-up lens corrects for pincushion distortion, restores normal lens-edge sharpness, and also restores the surface angle-of-coverage of a wide-angle lens. I feel that the dome is a must for corrected wide-angle underwater photography.

Two other ports are offered for the SLR housing. A macro port enables the diver to use the microfocusing lens or a short telephoto lens. An extension port can be used for long lenses or a macro-focusing lens with an extension tube. Both of these ports are designed for the photographer who likes to photograph fish, coral, medium and extreme close-ups underwater.

The housing does have some drawbacks. The speed and f/stop controls work by friction, so it's necessary to look at the numbers through the plastic. This necessitates an underwater flashlight if you are deep (it's dark) or you are out at night. The Ikelite system works, but requires some practice since it is slower than the direct reading controls on many of the more expensive cast-aluminum housings. But Ikelite has recently offered an aperture scale to fit over the regular scale on Nikon cameras. The numbers are large and easy to read through the housing.

Plastic *does* scratch, and you must be more careful handling the case, especially in rough seas in a small boat.

In addition to Schulke's work with the Ikelite housings, MODERN *has used one with a Konica Autoreflex T2 and 55mm f/3.5 Auto Macro Hexanon down to 60 ft. (18m) to photograph reef fish, sponges and coral. Despite our inability to see the entire picture frame, we were able to view sufficiently well to get our subject within the picture area and also to focus quite accurately on the microprism screen. The automatic-exposure system of the Konica worked quite well for us underwater. After setting our shutter speed we were able to see the aperture scale to the right of the picture area when using a mask which fit close to our face.*

We also used a Vivitar Model 202 electronic flash in an Ikelite underwater housing ($59.95) connected to the Konica for many of our shots. This combination too worked successfully. Any failures were more the fault of the photographer than the well-thought-out system.—THE END