If you find this manual useful, how about a donation of $3 to: M. Butkus, 29 Lake Ave., High Bridge, NJ 08829-1701 and send your E-mail address too so I can thank you. Most other places would charge you $7.50 for a electronic copy or $18.00 for a hard to read Xerox copy. These donations allow me to continue to buy new manuals and maintain these pages. It'll make you feel better, won't it?

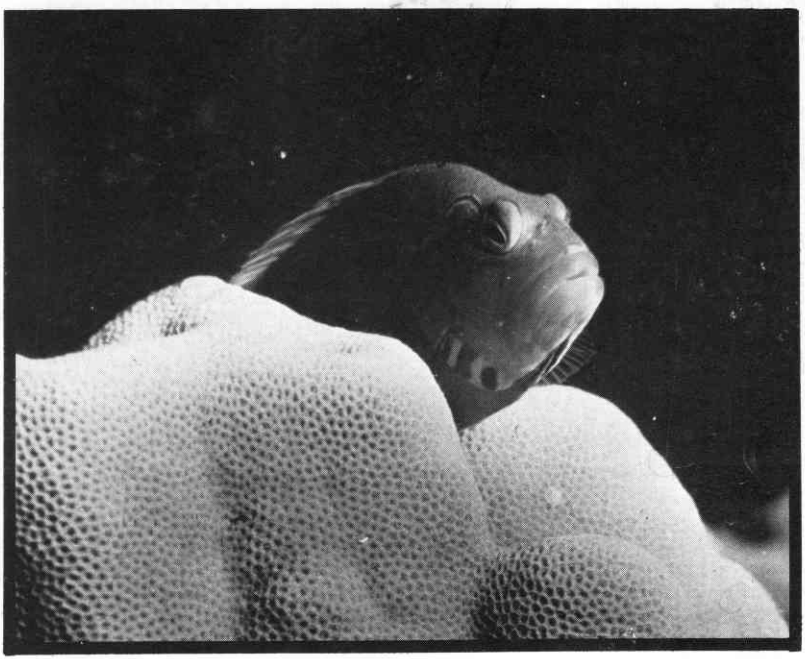
If you use Pay Pal, use the link below. Use the above address for a check, M.O. or cash. Use the E-mail of butkusmi@ptd.net for PayPal.

back to my “Orphancameras” manuals /flash and light meter site

Only one “donation” needed per manual, not per multiple section of a manual !
The large manuals are split only for easy download size.

NIKONOS PHOTOGRAPHY – the CAMERA and SYSTEM

By Fred M. Roberts



- The System
- Flash
- Close-Up
- Trouble Shooting

NIKONOS PHOTOGRAPHY - the CAMERA and SYSTEM

by Fred M. Roberts

- CONTENTS -

LIST of FIGURES

- LIST of TABLES -

FIGURE 1-1

FIGURE 1-2

FIGURE 1-3

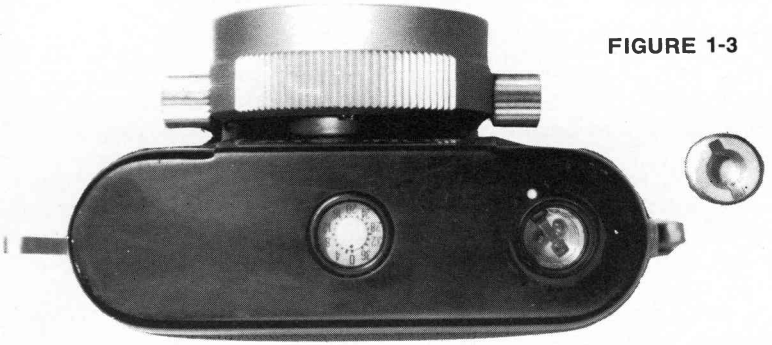


FIGURE 1-3. BOTTOM VIEW OF THE NIKONOS CAMERA. The Camera is shown with the combination tripod socket thread and flash connector port plug removed. The white dot visible near the port is the location for the key of the flash connector (refer to FIGURE 3-1). The lens is shown with its key engaged indicating proper location of the lens to film plane.

The lens may be mounted with either the focus scale on the top (facing the camera) or the aperture scale. However, the designers intended the focus scale to be on the top, putting the focus knob on the left side of the camera (camera facing subject) and the aperture on the right side. It is important to be consistent or you may move the wrong control in a hurried moment. The body flash port plug should be operated with the edge of a coin to avoid damage to the soft metal plug slot.

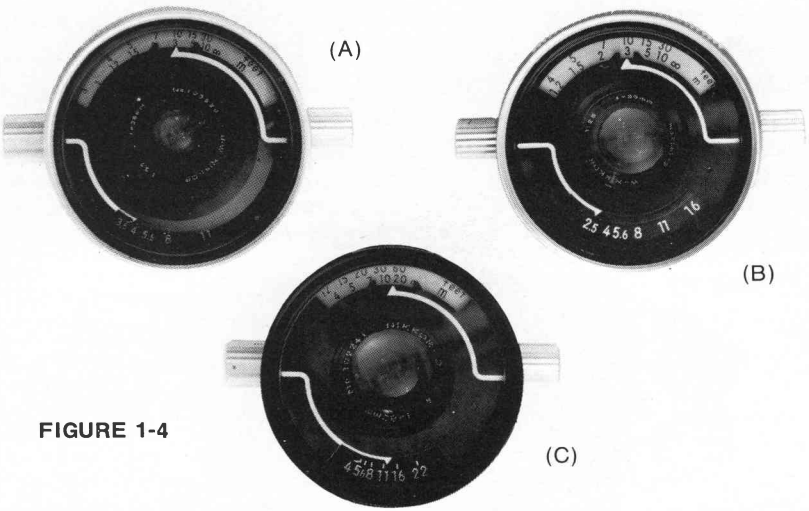


FIGURE 1-4

FIGURE 1-4. STANDARD NIKONOS LENSES. (A) The underwater 28mm f/3.5 lens; (B) The universal (above or below the water) 35mm f/2.5 lens and (C) The universal 80mm f/4 lens. The underwater 15mm f/2.8 lens and its special optical viewfinder are shown on page A-7 of the Appendix. Last minute information on the 15mm lens was limited, therefore, it was added at the end of the text.

INTRODUCTION TO THE NIKONOS 35mm CAMERA

The Nikonos camera is an integrated environment proof assembly of waterproof body and shutter with special sealed system lens. The ease of use and portability of the 35mm camera are retained by the Nikonos, plus the advantage of a self-contained submarine camera without external case.

The camera is designed to withstand water depths to 160 feet, offers full use of all controls and settings while submerged and is synchronized for either focal plane flash bulbs (FP) or electronic flash (1/60th second or slower).

The Nikonos is a viewfinder type camera not a SLR (single lens reflex). and depends on an external open frame sportfinder or an optical built-in finder for the 35mm lens. A 35mm wide angle lens is standard equipment.

Shutter speeds are easily set at anytime, above or below water, and these speeds range from "B", bulb setting, 1/30th, 1/60th, 1/125th, 1/250th, and 1/500th second. The same shutter speed control also carries an "R" or film rewind position, *Figure 1-13,* which frees the film take-up spool so that the retractable rewind lever can return the film to the cassette.

PREPARING THE CAMERA FOR FILM LOAD OR UNLOAD

Refer to *Figures 1-1* and *1-2.* The Nikonos is unlike a normal 35mm camera when film is to be loaded. A standard camera generally requires only a back or bottom panel removal to expose the cassette cavity and the wind spool. The Nikonos requires a lens removal first, then a body separation.

REMOVAL OF THE LENS

The first order of business when the camera is to be loaded or unloaded with film, is to remove the lens. This can be done easily by pulling the whole lens outward, away from the body, until the two small pins visible at the rear of the lens mount clear the notch visible at the top and bottom of the outer camera body shell. Refer to *Figure 1-5.*

FIGURE 1-5

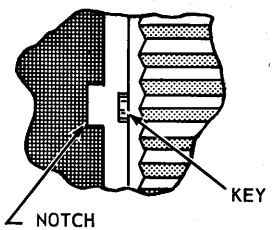
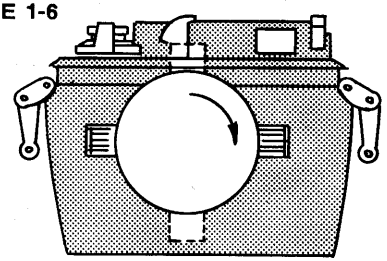


FIGURE 1-6



Turn the whole lens in a clockwise direction until the aperture and focus control knobs of the lens are vertical instead of horizontal, *Figure 1-6.* Now pull the lens clear of the body in an even gentle way to prevent damage to the "O" ring body seal.

SEPARATION OF THE INNER & OUTER CAMERA BODY

Set aside the lens, carefully, and examine the camera body assembly. Refer to *Figures 1-1* and *1-2.* Lift the cam on each side of the body and place the projecting levers under the inner body lugs, *Figure 1-7,* Apply downward force to each cam at the same time to lift the inner body clear of the outer body, exposing the main body seal "O" ring. Pull the cam arms out of engagement and out of your way, they carefully lift the inner body clear of the outer case, *Figure 1-8.*

FIGURE 1-7

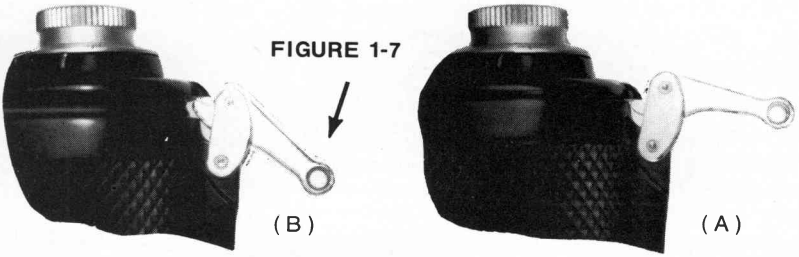


FIGURE 1-7. BODY SEPARATION. Remove the lens. (A) Place separation cam under inner body lugs. (B) Swing both cams toward the outer case to lift the inner case free of the outer case.

FIGURE 1-8

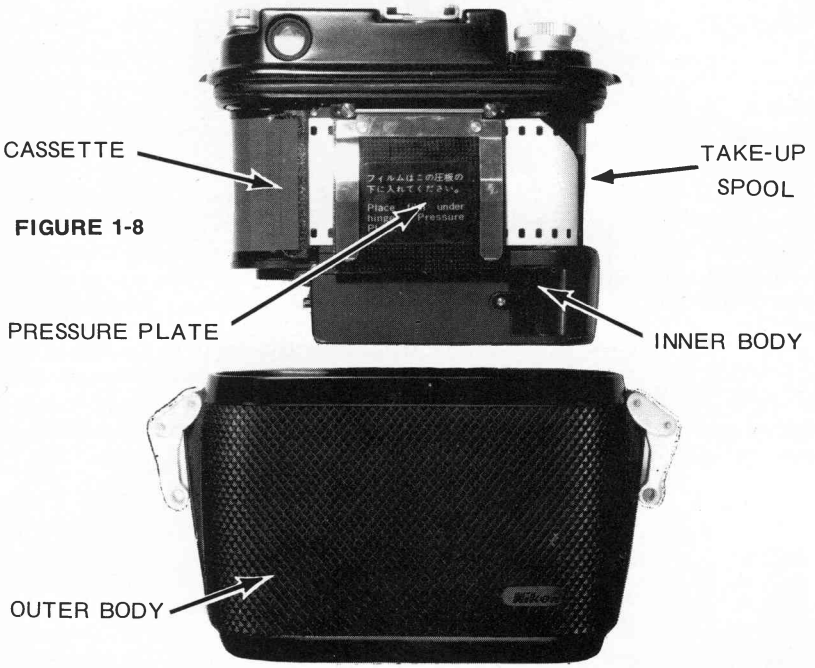


FIGURE 1-8. INNER AND OUTER CASE DESIGN OF THE NIKONOS. View shows the film cassette in place, with the film threaded under the pressure plate and into the take-up spool. When returning the inner case into the outer, avoid catching the pressure plate springs on the edge.

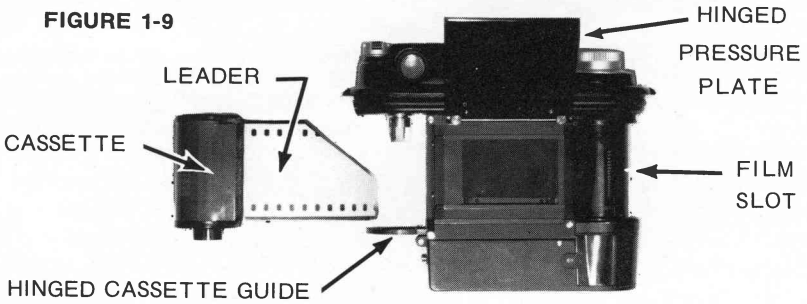
INSPECTION

Examine the two "O" ring seals now exposed during disassembly, the "O" ring sealing the lens to the outer body and the body seal between the inner and outer body. These should be lubricated periodically with the grease provided with the camera, petroleum jelly, barium "O" ring grease or as a very last resort silicon grease. Silicon grease is very hard to remove from areas where grease is undesirable, such as the glass port of the lens or the rear lens element. Wipe-off excess grease as it may be accidentally carried where it does not belong by your fingers. It is best to lubricate your seals at the time the parts are put back together, but do be sure you clean the seals and keep them clean while the camera is apart.

LOADING THE FILM

Open your film box and remove the cassette from its protective cover or metal can. Place the cassette into the inner body as shown in *Figure 1-9*, folding the hinged cassette guide out of the way while inserting the cassette rewind spool into the rewind fork.

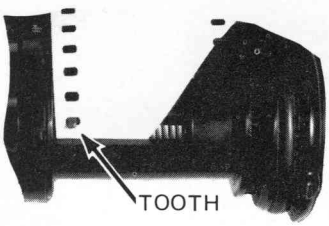
FIGURE 1-9



Carefully allow the hinged cassette guide to encircle the projecting spool while keeping the film leader from between the cassette and the inner body. The hinged pressure plate on the Nikonos II should be open while loading film.

Dress the film leader across the rectangular film mask at the rear of the inner body and insert the end of the leader into the slot in the camera take-up spool. Push the leader in as far as it will go, short of the end making a full loop in the spool and exiting the same slot. Stop with one film sprocket hole engaged with the single projecting tooth of the take-up spool.

FIGURE 1-10



Carefully hold the cassette in proper position, *Figure 1-10* and set the shutter release lever lock on "safe", the position that would keep the shutter cock and release lever in place when cocked. Move the shutter release-cocking lever slowly to wind-up the excess leader. When the leader is well engaged and the film comes directly from the cassette, stop moving the lever.

Check the pressure plate surface for dirt, scratches or nicks. If you must remove material, use the skin of your finger or thumb tip as the abrasive and smooth or clean in the same direction as the film travels. Be sure your thumb or finger is clean - no salt water or dirt should be present.

If you use a cloth be sure it is soft and dirt free, and that you still move in the same direction as the film travels so that scratches are smoothed in the direction they will least damage the film. Close the pressure plate after also removing any dirt that has collected on the film leader under the film leader under the pressure plate and near the exit of the cassette.

Remove dust and dirt from the body seal and lubricate if dry. Inspect the recess in the top of the outer body where the "O" ring will seal. Run your finger over the area to be sure it is smooth and free of dirt. Place the inner body in the outer body, be sure the pressure plate springs do not catch on the outer body, and gently push the two units together.

The film counter automatically starts from zero as the pin at the bottom of the outer case projects into the hole at the bottom of the inner case near the counter. If you plan to use flash it is a good idea to check the flash terminals projecting from the side of the inner case, *Figure 1-11*, and the spring contact for the flash connector, in the outer case, *Figure 1-12*, before assembling the inner and outer body parts.

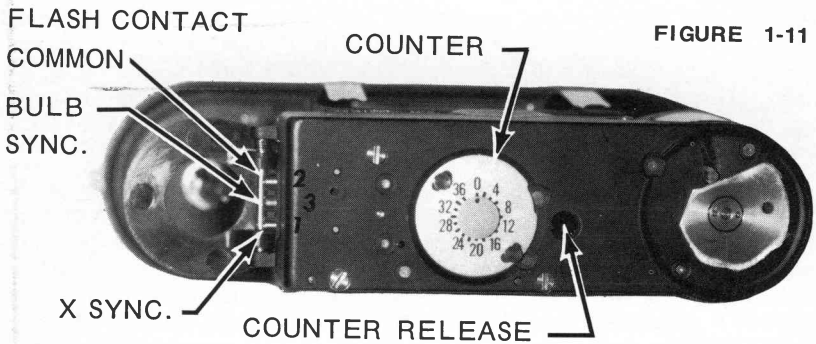
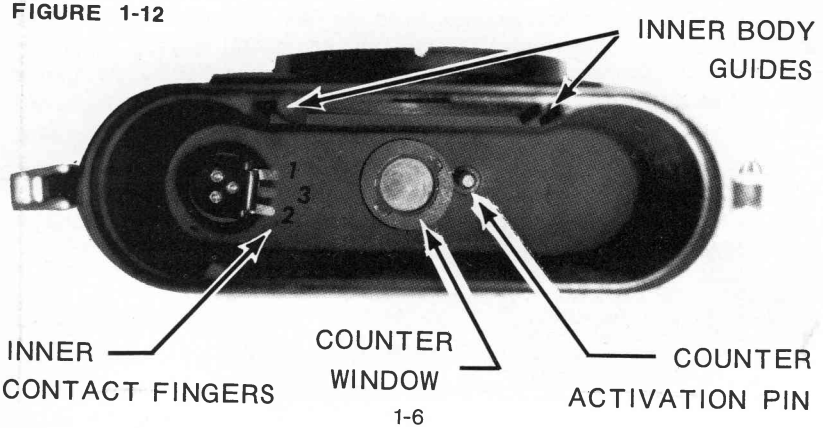


FIGURE 1-11

FIGURE 1-12



Use a cotton tipped stick with clean alcohol to clean both the contact fingers and studs, then dry both with a new dry cotton tipped stick. Be sure no material is left on either the fingers or the stud after cleaning.

With the inner body and outer body united install the lens you plan to use. Examine the "O" ring seal on the rear of the lens, clean and lubricate sparingly. Insert the lens in the reverse of removal, iris and focus knobs vertical to the body axis, focus knob near the top of the camera body. Push the lens into the body gently, be sure the "O" ring seal in the outer body is also clean and free of dirt. Then rotate the lens clockwise until the two pins drop into the body notches, *Figure 1-5.*

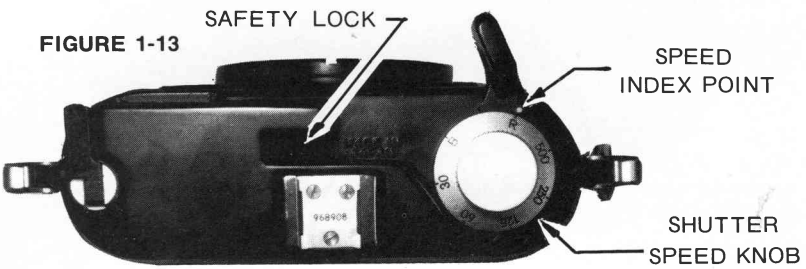
The camera is now almost ready to use. Since a portion of the film leader has been exposed to light during loading it is neccessary to clear this film from the film mask to avoid partially exposed pictures at the beginning of the roll. With the camera upright, looking down at the shutter cocking-release lever, move the "safety" lock into "safe" position, then work the lever several times to advance the film without cocking the shutter or causing the film counter to register the movement of film.

Unlock the "safety" lever and leave the shutter cocking-release lever projecting from the body. The shutter is not cocked, but the next stroke of the lever will both cock the shutter and advance the film to the first exposure. It is preferable for long shutter life to leave the shutter uncocked while not in use. Do not forget the lever "safety" lock - this little device can cost film if you try to cock the shutter with it tilted toward the speed knob. The shutter will not cock in this case nor will the counter advance, but the film still moves to the take-up spool regardless. Black unexposed frames will result in color film, clear frames if you use B&W film.

When you are ready to use the camera first check the position of the "safety" lock, move it away from the lever, then in one motion pull the cocking-release lever over as far as it will go. If you do not go the whole way in one motion, but stop short of the cocking position, and release the lever, the lever will swing back to the relaxed position and film will be wasted. If the shutter is cocked, the lever will stay parallel with the body.

If you are not going to take pictures at that time, but wish to avoid accidental release of the shutter, now move the "safety" lever in behind the the release lever. The shutter is safe from accidental release. It is also safe from use! Do remember to move the "safety" from behind the release lever before attempting that *Once in a lifetime* photo. Refer to *Figure 1-13.*

FIGURE 1-13



CONTROL OPERATIONS

The focal plane shutter and cocking and release lever are a novel combination control that can be easily operated with one finger of the right hand while gripping the camera body with the same hand.

Speed settings are engraved and color coded for ease of use. All numbers except 60 are in black, while the number 60 and the letter "R" are in red. Underwater, below 30 feet, all of the red numbers and letters will appear black so do not be confused. The camera is flash synchronized for focal plane type flash bulbs at any speed 1/30th to 1/500th second, but is only synchronized for zero delay electronic flash at 1/30th and 1/60th seconds, the latter marked in red. In order to use zero delay electronic flash the shutter curtain must be in the full open position while the flash occures. Any other position will obscure part of the film and only a partial picture will result. If you should leave the shutter speed knob set at "R", also red colored, and use strobe, the result will be partially exposed frames.

A white dot is located on the cock-release lever that serves as a position indicator for the speed setting knob. The lever and the speed setting knob move as one unit when the release lever is moved alone. However, the speed setting knob can be moved as desired without disturbing the lever.

The "B" setting of the shutter is a standard "bulb" setting which will allow time exposure as long as the lever is held released. When pressure on the release lever is relaxed the shutter will close. The setting should not be confused with a "T" o f "time" setting, not on this camera, as in that case the shutter stays open until the release lever is moved or released a second time.

Figure 1-13, shows the cocking-release lever in the normal uncocked position. This is the best way to store your camera and the position least likely to be released accidentally.

When a new roll of film is placed in the inner body, shown in *Figure 1-8,* the cocking-release lever is operated several times with the thumb safety in the "safe" position (tilted toward the speed knob.) This advances the film without cocking the shutter.

Sooner or later you will probably repeat a shutter cocking step with the safety in place when you really wanted to cock the shutter. This results in unexposed film and the counter does not reflect the movement of film. Watch the position of the thumb safety lock.

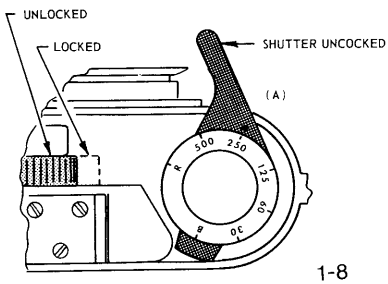
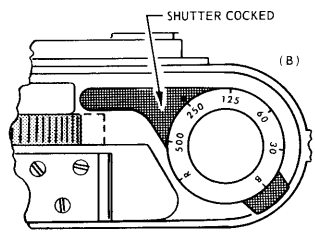


FIGURE 1-14



ACCESSORY SHOE

The accessory shoe is designed to accept standard land photography flash accessories and meters, while underwater or above, or it will accept special open frame sportfinders. Since the 35mm lens is standard equipment for the camera the optical finder is designed to cover the field of view of this lens. A 28mm wide angle underwater lens and an 80mm above or below water telephoto lens are also available, but neither will fit the built in optical viewfinder. Each of the accessory lenses have a specific open frame sportfinder, which is inserted in the accessory shoe. More detailed information on all of the Nikonos lenses later.

TO REWIND THE FILM

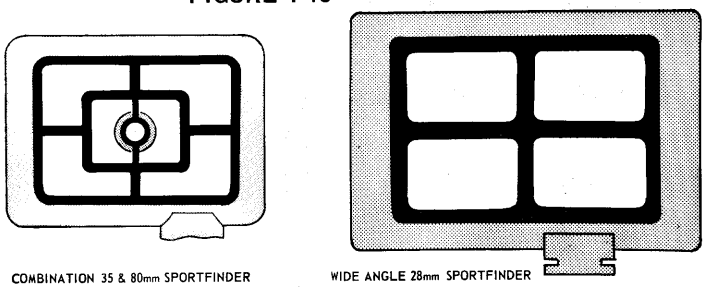
The rewind lever operated much like its topside counterpart except that the unit must be pulled upward to engage gears within the camera body. To rewind set the speed selector knob at "R", pull up the rewind lever and wind in the direction of the small arrow visible when the lever is extended (clockwise). The rewind lever can easily be repositioned when the inner body is removed from the case by holding the fork which engages the film cassette spool with the left hand and gently rotating and pushing inward the rewind lever with the right hand. Rotate the lever backwards (counter-clockwise) if it will not insert readily. When fully retracted, fold the lever over and place it in its recess in the upper portion of the body. See *Figures 1-2* and *1-13*.

USE OF THE OPTICAL AND SPORT VIEWFINDERS

When the camera is loaded and cocked all that remains is to set the shutter speed, the proper iris setting for the film you are using, focus, aim compose and shoot. Use of a light meter is recommended for available light photography.

The aim for the camera can be obtained two ways. With the optical finder for the 35mm lens or with an open frame sportfinder attached to the accessory shoe. Two open frame sportfinders are available, one for the 35 and 80mm lenses, and a second for the 28mm wide angle underwater lens, see *Figure 1-15*. Please note that the 28mm lens is designed to be used only underwater. Above water the results will show curvature and distortion to some subjects. Refer to the section on Nikonos lenses for more details.

FIGURE 1-15



COMBINATION 35 & 80mm SPORTFINDER

WIDE ANGLE 28mm SPORTFINDER

The optical viewfinder is best to use when the camera is above water. With some practice it can also be used while submerged. It is reasonably accurate over the range of the 35mm lens focus distance settings.

Looking into the optical finder you will see a bright rectangular continuous border and three bright bars, *Figure 1-16.* The main border represents the true size of the field of the 35mm wide angle lens. However, since the optical finder is not exactly on the optical axis, but rather above and to the left of the lens, parallax is particularly noticeable for close pictures. Parallax is the name given to the difference between what the viewfinder "sees" and what the lens actually "sees".

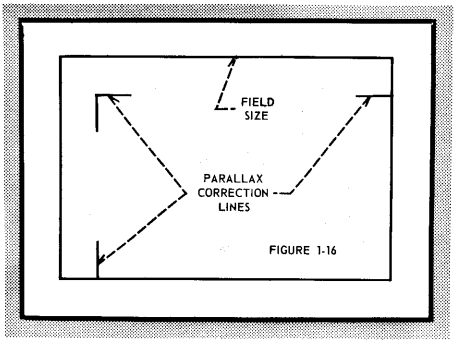


FIGURE 1-16. Camera body optical viewfinder. Field of view with the 35mm standard lens is outlined by a white full rectangle, shown in black in the illustration. Parallax correction lines are short white bars set within the field rectangle just below the top edge and to the right of the left edge of the field. To use these lines first determine the field size of the picture, compose, than shift the field so that the parallax bars form the left and top lines of the original field of view - take the picture.

Refer to *Figure 1-17,* considering the horizontal optical plane only, the viewfinder "sees" the subject, but the lens is actually displaced to the right about 3.5cm (Centimeters).

For moderate to distant subjects the parallax will probably not be too noticeable due to the small error, but for close subjects it may be very obvious. The small short lines in the viewfinder are parallax lines. Once you have framed your subject with the border, move the finder so that the subject is framed in the same way by the short correction lines, *Figure 1-16.* The camera is now displaced as in *Figure 1-17 (b),*so that the optical axis "sees" the subject where the optical finder saw the subject in *Figure 1-17 (a).*

Not only is the optical axis different in the horizontal plane, but also in the vertical one as well. The viewfinder is about 4cm above the optical axis so the camera must be tilted upward to compensate for parallax. Therefore, the correction lines are low and to the right in the optical viewfinder - to compensate for parallax you move the camera optical axis upward and to the left.

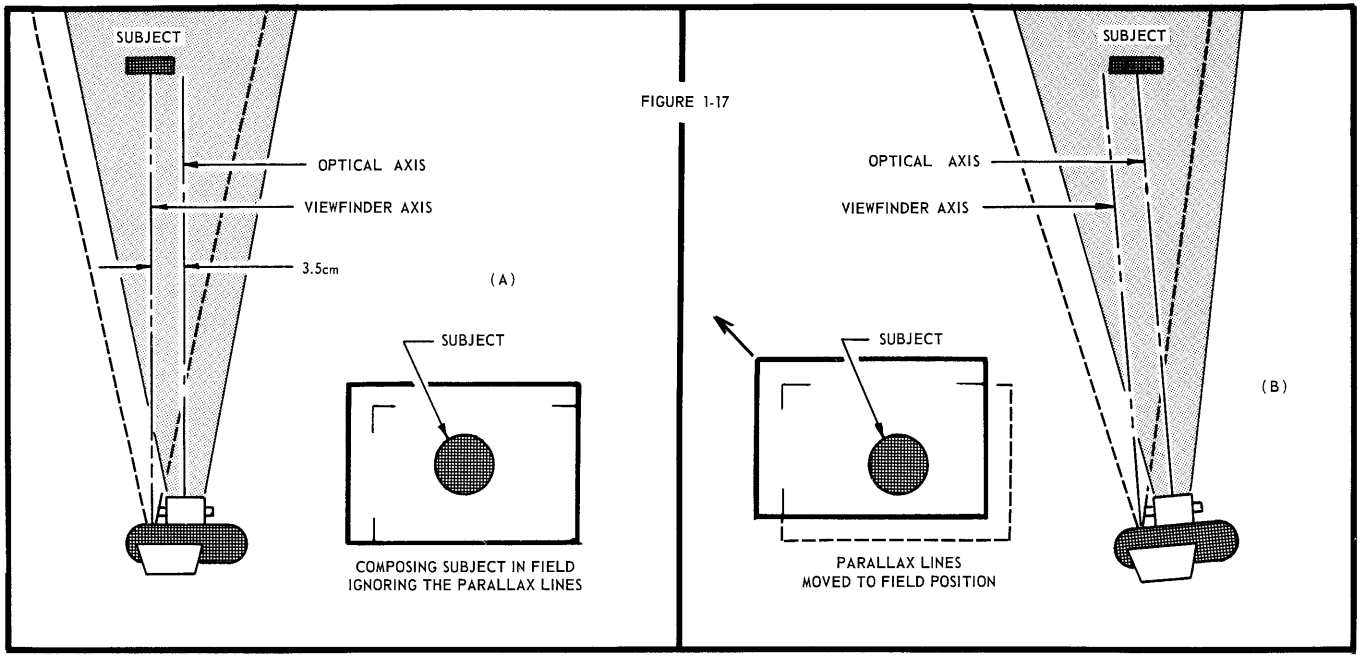


FIGURE 1-17

FIGURE 1-17. PARALLAX WITH THE OPTICAL VIEWFINDER. Illustrated in this figure is the parallax problem common to all viewfinder type cameras. The parallax exists in both vertical & horizontal planes, but only the horizontal plane is shown. In panel (A) the subject is composed in the middle of the optical viewfinder's field rectangle. Note that the lens ''sees'' the same subject slightly to the right of center. In a photo the subject would be left of center. In panel (B) the photographer has compensated by re-framing the subject with the parallax bars. Now the lens ''sees'' the subject in the center. The slight angle between the subject and the lens becomes more noticeable as the subject nears the camera. The same thing happens in the vertical plane and this is corrected at the same time by the upward shift of the parallax bars.

SECTION 2

SYSTEM ACCESSORIES

The Nikonos is a system camera with three lenses and a close-up outfit available and, although not standard with the Nikon portion of the line, other firms make Macro and Diopter type close-up lens devices and extension tubes for the system.

STANDARD NIKONOS ACCESSORIES

1. Underwater B/C flash unit.
2. Open-frame sportfinders for the 35, 28 and 80mm lenses.
3. Underwater light meter - case and Sekonic L-86 meter.
4. Leather carrying case (above water use).
5. Lens hood and filter holder for screw-in 52mm filters.
6. Ultra-close-up attachment using a supplemental lens, with a field size frames and mount for the Nikonos B/C flash unit.
7. 28mm special underwater wide angle lens.
8. 80mm telephoto lens for both surface and underwater use.
9. Flash adapter to bring internal sync connectors out to a standard PC terminal for PC type sync cords.
10. Special optical viewfinder for the 80mm lens (above water use).
11. Adaptor hood and a line of 52mm screw-in filters.

NON-STANDARD NIKONOS ACCESSORIES

Non-standard Nikonos accessories are those made by other than Nikon, but designed to fit the Nikonos camera. This list grows all of the time so the items listed below are only representative of what probably exists at this time.

1. Close-up attachments for the exterior of the standard lens.
2. Extension tubes for ½:1, 1:1 and 2:1 magnification.
3. Flashcube flash bulb guns.
4. Electronic flash units.
5. Fish-eye Nikkor lens adapter for the Nikonos.
6. Accessory shoe attached underwater light meters.
7. Accessory shoe attached flash units.
8. Accessory shoe attached optical finder for fish-eye adapted lens.
9. Carrying cases for the Nikonos system.
10. Lens focuser for establishing prime focus point for close-up work.

The selection of accessories for your Nikonos will depend on what you plan to photograph and whether you use available light or require flash.

Protective carrying cases are a very good investment to guard your camera from scrapes and possible serious damage while not in actual use. A sportfinder is helpful if you cannot get near the optical finder, such as a diver with a face mask. The flash adapter allows use of the Nikonos with accessory shoe mounted flash attachments, non-Nikonos bulb flash units and electronic flash guns. The Nikonos has what is called a "cold" shoe. A "hot" shoe is one that makes electrical connection to the inserted accessory while the "cold" shoe serves only as a holder of the accessory.

The lens hood is a valuable asset to reduce sun glare and to reduce surface reflections on the lens or filter in use. The hood is also designed to leak water between the Nikonos lens and the filter for underwater use so that the hydrostatic pressure between the elements is equalized to prevent damage to the camera lens or the accessory device.

Most of the other Nikonos accessories are for specialized use to further increase your versatility and improve the overall system concept.

THE 35mm WIDE ANGLE LENS

The standard lens supplied with the Nikonos camera is the 35mm wide angle lens. This f/2.5 lens, focusable from 0.8 meters (2.75 feet) to infinity, is an excellent compromise for the diver who wants both a camera for the surface as well as one he can take with him into the depths. The range of iris control if from f/2.5 to f/22, while the focus is calibrated in both the metric and English systems of measure, meters and feet.

The optical quality of the lens is excellent, producing crisp sharp results both above and below the surface. Above water the lens is a wide angle unit, below water it approaches what a standard 50mm normal lens for a 35mm camera would do above water. The difference, of course, is due to the index of refraction of the water-glass-air interface between the subject and the film. Refer to *Figure 2-2* for lens controls.

The accessory sportfinder for the 35mm Nikonos lens is built as a dual purpose unit for both the 35 & 80mm lenses, which are both useable above and below the water. Horizontal parallax is almost eliminated with the sportfinder as the accessory shoe is displaced only 1.5cm to the optical axis. Vertical parallax, on the other hand, is even more pronounced close-up as the finder axis is now almost 8cm above the optical axis. A central double ring is used to align the combination 35-80mm sportfinder, but this does not correct for parallax very well on the 80mm lens. Experience is your best guide on where to aim the camera for the type of pictures you frequently take.

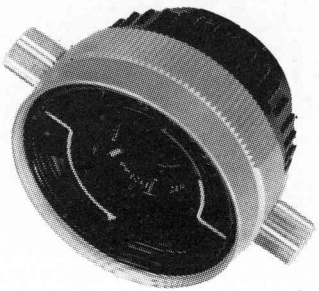


FIGURE 2-1. Nikonos 35mm Wide Angle standard lens. Designed for photos above and below the water.

Refer to *Figure 1-15* for a drawing of the combination 35-80mm open frame sportfinder and the 28mm lens open frame sportfinder. *Figure 2-8* illustrates how the finders should be used to avoid even more parallax due to improper use. Proper use of the open frame sportfinder will mean all of the difference in the world to your success with the camera - so get familiar with its idiosyncrasies early in your camera handling experience.

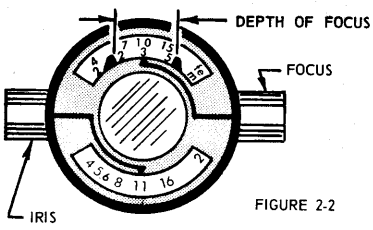


FIGURE 2-2

LENS CONTROLS & INDICATORS

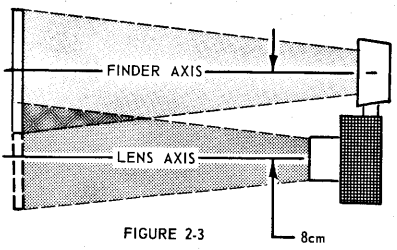


FIGURE 2-3

If you use the sportfinder frequently, do not try to position your subject so that it fills the whole field of view. Here parallax would be the most noticeable if you made a mistake in aim. This problem is more noticable with the 80mm telephoto lens than with the 35mm lens as the framer is much more critical due to its narrow field and short depth of field. Refer to *Figure 2-3,* for a better idea of the problem of vertical parallax with the accessory shoe open frame sportfinders.

Normally the designer of open frame sportfinders has no way of knowing how far away from your particular subject you are going to be, but the designer of an underwater camera knows, or should know, that most of an underwater photographers pictures will be close rather than far distant. Nikon literature packed with the combination 35-80mm sportfinder claims that this unit is without parallax for the distance of 2 meters (about 7 ft.) underwater. This has proven to be essentially true for the 35mm lens, but has yielded problems for the 80mm lens. For more on the 80mm lens see that section.

Acceptance angles for the Nikonos 28, 35 and 80mm lenses, in air and underwater are compared in *Table 2-1*

PICTURE ANGLE FOR NIKONOS LENSES - TABLE 2-1

	DIAGONAL	VERTICAL	HORIZONTAL	MEDIA
28mm	76	45	60	Air
	57	34	45	Water
35mm	62	37	53	Air
	46	27	39	Water
80mm	$30^{o}20'$	$17^{o}20'$	$25^{o}20'$	Air
	22	13	19	Water

The correct viewing angle and distance are shown pictorially in *Figure 2-10,* for both the 35 & 80mm lenses using the combined open frame sportfinder. With a little practice one can get used to moving the eye back and forth until the edges of the outer rectangle appear thin and the hole in the double circles merges. Nikon, in their instruction sheet for the sportfinder, indicates that the unit was designed such that the viewer, you, should be about 85mm (3.3 inches) from the finder for correct results. This is just about the right distance for the diver with a face mask over his eyes.

The 35mm lens can be adjusted to take pictures closer than the 0.8 meters (2.75 feet) shown on the focus scale. In fact, at least three ways exist to accomplish this feat. Refer to the section on close-up photography for supplimental lens attachments and extension tubes. The former is used before the lens, and is removable underwater, the latter is used behind the lens and cannot be removed underwater. The supplemental lens has very little effect on the relative speed of the film. There is no neccessary exposure correction, while the extension tube has great effect on the film speed and exposure must be corrected.

The third method of extending your focus is through the use of depth of field. In the section of the lens showing focus distance are two red fingers that move with the iris control, refer to *Figure 2-2.* These bracket the effective focus zone for the particular f/setting of the lens without accessories like the supplemental lens or tube in place. Every lens has one critical focus point, where the focus is the best (the circle of confusion the smallest), but on each side of this point is a zone that is considered acceptable. The distance from the rearward distance to the forward is called the *Depth of Field.*

The depth of field varies with the f/number setting, the more wide open the lens the narrower the depth of field. The more stopped-down the lens the wider the depth of field. Use your 35mm lens to illustrate the situation. Set your iris at f/2.5, observe the position of the two red fingers on the focus scale, note how close together they come. If you had focused your camera at 0.8 meters (2:75 feet) your depth of field or the distance from your lens to your subject must be very accurate. If you make an error, the quality of your pictures are degraded and lose sharpness or are just plain out of focus.

Set your iris at f/22, leave the focus scale the same. Now the red indicators are as wide as they can go. If you took the same picture as before you can now make a fairly large error in distance without seriously affecting the quality of the results. In fact you can move in closer than 0.8 meters, approximately 23cm or 9 inches to be specific, in air, and get acceptable sharpness. Underwater the apparent distance would be the same though the exact distance would be ¾ of the measured distance.

Now if you have become reasonably good at guessing the apparent distance, remember your own eye focus is affected by the index of refraction of the water-glass-air interface of your face mask, you can use this depth of field to great advantage.

For example, if your subject was thick, or like a fish at an angle to your view, you would want the central point of the subject to fall on the line of focus. See *Figure 2-4.*

The result of proper f/stop control is that both ends of the fish are in focus. If the subject was a ball or sponge the same situation would be true if you wanted the whole object to be in focus. However, suppose that a small fish is in front of the round object in *Figure 2-4.* If you are more interested in this subject than the whole large one, but you want them both in focus, you must arrange your depth of field to fit the situation, refer to

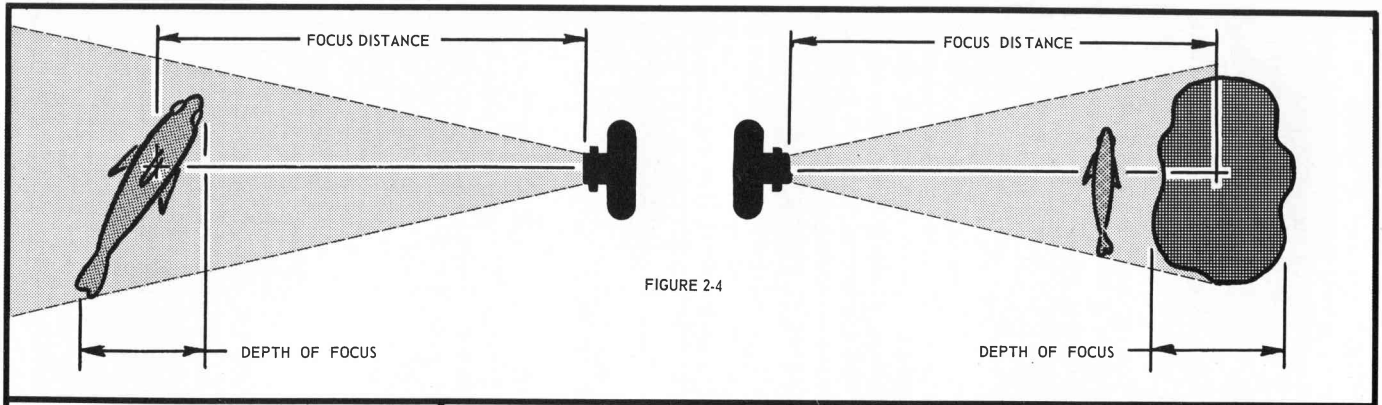


FIGURE 2-4

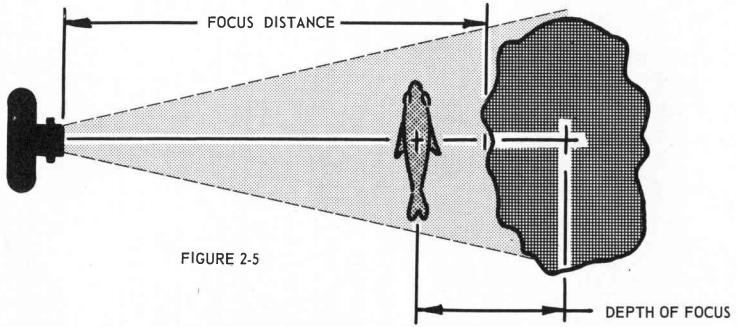


FIGURE 2-5

FIGURE 2-4. DEPTH OF FOCUS, Key Subject. Consideration must be given to the location of your subject relative to the zone of focus. This zone is commonly called the depth of field or focus. The whole fish (top left) is in focus because it falls within the zone. The fish (top right) is not in focus, but the background is. FIGURE 2-5 DEPTH OF FOCUS, Compromise Subject. (lower right) Both the fish and the background are in focus.

Judge the closer subject distance and the far subject distance; set your apparent focus to a point half way between and your iris to an f/number that provides a depth of field that covers the near and far subject distances. Doing this sounds complicated, however, it is a photographic tool you have if you wish to use it. Remember that if you set your f/number to correctly cover your required depth of field you will probably also need to change your shutter speed to match the new f/number at the ambient light level. Iris opening and shutter speed are inversely related in uniform standard steps so that you can use almost any camera and come out with the same amount of light reaching the film plane.

The f/number or f/stop, if you prefer, is a function of the focal length of the particular lens divided by the diameter of the iris opening. Larger lenses are proportionally larger, focal length and iris opening, smaller lenses are just physically smaller. It is the simple ratio of the focal length & the iris opening that controls the light striking the film at a given speed.

Standard f/stop numbers, representing full whole stops are shown in *Table 2-2*. The corresponding increase or decrease in shutter speed is shown in comparison. The table is based on the assumption that the light level was such that with a particular film an acceptable exposure could be made at f/2.5 with a shutter speed of 1/500th second. The table is used as an example, a guide to what happens between f/numbers and shutter speed, not what you should use without first consulting your light meter.

RELATIONSHIP f/STOP & SHUTTER SPEED - TABLE 2-2

f/STOP	2.8	4.0	5.6	8	11	16	22	32
SHUTTER SPEED	1/500	1/250	1/125	1/60	1/30	1/15	1/8	1/4

Each number represents ½ or twice as much light as the adjacent f/stop. The same thing can be achieved by changing the shutter speed, again if you will observe your speed dial, each speed is ½ or twice as much as the as the adjacent numbers. Therefore, if you close your lens from f/4 to f/5.6 you reduce the amount of light reaching the film, to compensate you must decrease your shutter speed, allowing the light to fall on the film for a longer period of time. The lens opening lets in ½ as much light from f/4 to f5.6, so you must increase the length of the exposure by decreasing the shutter speed from say 1/500th second to 1/250th second to make up the difference. The result is identical exposure to the film.

Once you get used to the system of f/numbers or stops, changing the shutter speed can be almost automatic - change the lens iris two stops, change the shutter speed two steps. The numbers representing the size of the iris opening might be a little confusing at first - the larger the number the smaller the opening and the smaller the number the larger the iris opening. This is true because the f/number represents a ratio of the focal length divided by the size of the iris opening. Since focal length does not change, and the iris does, the numerical results of the ratio are inverse.

Table 2-2, is just an example of this relationship. The combination of shutter speed and lens f/number will depend on the film you select. The faster the film the smaller the lens opening for a given shutter speed. Naturally where you want to maximize your depth of field, fast film is usually the best answer. Where high quality is more desirable than depth of field, slower speed films are preferred. Further discussion of film speed relationships will be made in the section dealing with flash and ultra-close-up photography.

Before leaving the discussion on depth of field one other useful result can be obtained by using the depth of field as a photographic tool. At least once you have probably photographed a person or object in front of a not too pleasant background. If from habit you used the largest f/number, the smallest iris opening, and a speed sufficient to stop motion, then the background was also probably in focus with the main subject. Take a girl in front of a chain link fence. The fence does not add much to the picture. Use the opposite extreme, lens wide open, high shutter speed, to narrow the depth of field. The girl will be in focus while the fence is diffused or out of focus.

This selective focusing can be used both above and below the water. If the subject is more important than the background, you can subdue the background by using larger lens openings (smaller f/numbers). Remember that you must be more accurate in your judgement of apparent subject distance to the lens or your subject might be out of focus while the background or foreground is in focus.

28mm WIDE ANGLE UNDERWATER LENS

A second wide angle lens is provided for in the Nikonos System. The 28mm lens is designed for the underwater photographer where dirty water, in particular, makes it very difficult to get back far enough to get the whole subject. Naturally one cannot expect to get a full length view of a large sunken vessel, unless the water is almost as clear as the air above the water, but you would have a better chance with the 28mm lens than with the 35mm standard unit. Refer to *Figure 2-6* for the lens configuration.

The 28mm lens is not intended for surface use, but is corrected for underwater aberrations and distortion. Used above water it will produce field curvature called barrel distortion. *Figure 2-7* shows a series of actual photographs taken with the various lenses above and below the water to show how the field size differs under the two conditions.

The 28mm lens focuses from 0.7 meters (2.25 feet) to infinity and is a "slower" lens than the 35mm unit in that the maximum f/number is f/3.5. The iris range of the 28mm unit is from f/3.5 to f/22. Refer to the section on depth of field under the 35mm lens for the principles of use as it is the same except for the width of field - the 28mm lens is greater due to its shorter focal length. The shorter the focal length the wider angle the lens.

The 28mm lens has its own accessory sportfinder and this finder is also designed to be used while underwater. The finder, however, is made of rubber not plastic like the combination unit for the 35 & 80mm lenses. Unless you use care while inserting the finder in the accessory shoe, you can build-in a parallax problem. Be sure the finder is well seated in the shoe and is not cocked to one side or the other. Further it is quite easy to lose the finder if poorly fixed.

Like the sportfinder for the 35 and 80mm lenses, you must move your eye back and forth for a narrow edge profile of the frame while reducing the crossbars to lines. Refer to *Figure 2-8.*

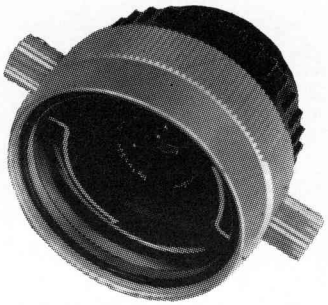


FIGURE 2-6. Nikonos 28mm Wide Angle lens. Designed for use underwater only without distortion.

The 28mm lens is a high quality optical unit producing sharp focus slides or negatives over a wide range of distance to the subject. It will allow the photographer to get closer to a given subject than the 35mm lens for the same field of view, therefore, it performs better when water clarity is consistently poor. However, no lens, no matter how well made, can "see" through dirty water.

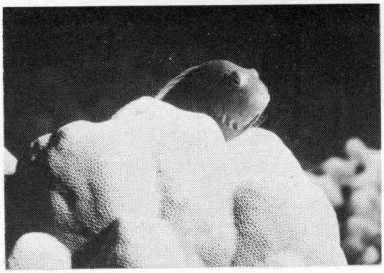
The rubber sportfinder for the 28mm lens is designed for use underwater and will see most of the field of this lens at distances of from 6 feet and beyond, parallax is still to be considered for close work. The center of the finder axis is about 8cm above the optical axis and about 1.5cm to the left. When shooting subjects perhaps as close as 3 feet, parallax will begin to take its toll in spoiled photos. To compensate after framing move the sportfinder field of view slightly to the left and tilt the camera upward to correct for parallax. Moving the center of your picture about 2/3rds of the way down the vertical bar of the finder will be just about right to correct vertical parallax at distances around 3 feet.

80mm TELEPHOTO NIKONOS LENS

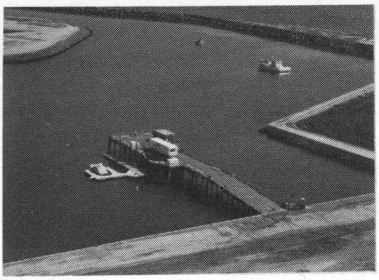
The Nikonos 80mm telephoto lens, like the 35mm wide angle lens, is designed for use in either air or underwater. It is a 4 group, 4 element design front port excluded, with a field angle of 30 degrees 20 minutes in air and about 22° underwater. The lens will offer about a 2.03x magnification of the film image at about the same distance from the subject as with the 35mm lens. Refer to *Figure 2-9.*

The f/number range is from f/4 to f/22 and the focus from I meter (3¼ feet) to infinity. The depth of field is very narrow and the effective speed of the lens the slowest of the three discussed. High speed film is definitely recommended unless you are able to determine the subject distance very accurately and can hold the camera very steady while shooting. It is more

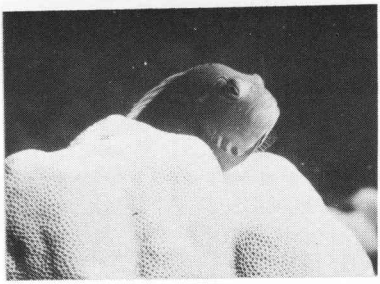
28mm lens above water.



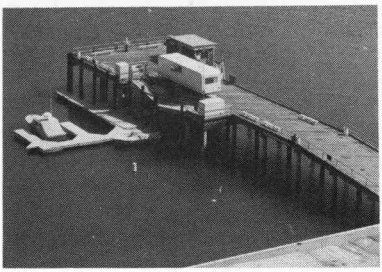
28mm lens below water.



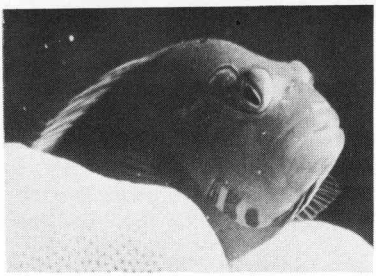
35mm lens above water.



35mm lens below water.



80mm lens above water.



80mm lens below water.

FIGURE 2-7. Comparison of field sizes of Nikonos 28, 35 & 80mm lenses from the same station. Note that the 28mm above water infinity picture is not sharp. Underwater size comparison is based on test panel results, photos are darkroom simulated with the fish the key subject for size.

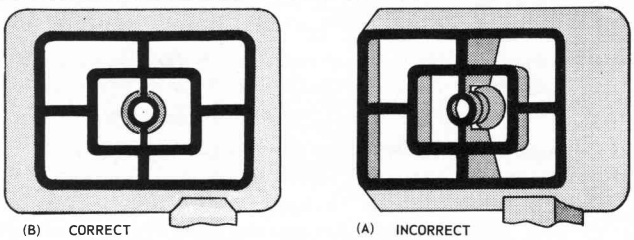


FIGURE 2-8. Combination sportfinder for the 35 & 80mm lenses. Aim by minimizing edge width of the cross-bar and center circle as shown above.

necessary than ever that you hold your camera steady or use high shutter speeds to avoid subject blur from camera movement.

There is a place for a telephoto lens underwater. It may seem to be the last thing you need underwater as the 35mm camera standard 50mm lens (not the Nikonos) acts like a telephoto lens due to the index of refraction and this reduces the effective field of view.

Have you ever tried to photograph a hermit crab going about his business on a submerged rock? He just does not like a big photographer to get too close - result, you get a picture of the shell rather than the animal. However, with the 80mm lens one can move back a respectable distance and the crab or fish will no longer worry about your proximity. Small reef fish are another prime candidate for the 80mm lens as they stay alive on the reef by staying away from large fish and for all practical purposes an underwater photographer looks like a large fish. For best results with the 80mm lens the water must be clear.

The depth of field indicators on the lens are used in a manner already discussed and you can see upon examination that you cannot stand much error in distance with the lens set at low f/numbers. The depth of field for example at f/4 is probably less than 5cm (2 inches) and it is nearly impossible to estimate distance from the lens to the subject this accurately when you are 1.1 meters (3.5 feet) away. However, with an f/number of 22 the depth of field opens to just under 30cm (12 inches) and this is more acceptable to estimating distance.

How can the photographer use the higher f/numbers? Fast film and slower shutter speeds. Unfortunately slower shutter speeds cause blur if the subject moves or you move the camera during exposure. This combination of problems is best solved with some form of artificial light source rather than available light unless you use a tripod. Electronic flash is a good solution as these have a light duration from 1/1000 to 1/10,000th of a second and work very well as a subject stopper if the available light level is not so high as to cause a double exposure. More on this subject later in the section of this manual dealing with flash.

If you chose to measure distance accurately underwater then the apparent distance the camera lens "sees" (the same one you see through your mask), now becomes the real distance and you must correct the focus scale or your subject will be out of focus. For example, if the actual distance measured to the subject from the lens was 4 meters, then multiply by ¾ or 4 x 0.75= 3 meters. Set the lens focus scale on 3 meters rather than the real 4 meters as the lens thinks the subject is at 3 meters due to the index of refraction of the glass in the lens.

If you are estimating distance from the subject to the lens, the apparent distance, the lens sees the same thing and no adjustment is required for refraction focus distance.

The correct use of the sportfinder for the 80mm lens is critical. Since you are now working with a narrow field lens at a considerable distance to a subject, parallax can be quite a serious problem. Like the 35mm lens, the sportfinder axis is about 8cm high and about 1.5cm to the left of the optical axis. At one meter that represents a very serious aiming error, refer to *Figure 2-10.*

Figure 2-10 shows the apparent field as seen by the sportfinder with a subject about 1 meter (3.5 feet) from the lens. The lens on the other hand "sees" the same subject 8cm lower and 1.5cm to the right of the apparent location as seen in the sportfinder. If you select a subject that fills the sportfinder, you will probably lose part of that subject to parallax even if you sight carefully. To get the subject you will need to tilt the camera upward slightly to compensate, and a little to the left to make-up for the 1.5cm left displacement of the finder from the optical axis. It may be debatable whether it is worth overcompensating on the small horizontal error rather than not compensating at all. Overcorrection can be just as bad as undercorrection as far as the subject is concerned.

FIGURE 2-9. Nikonos 80mm telephoto lens and accessory optical finder. The finder is for use above water only.

One rule of thumb may be of help. If you look at *Figure 2-10 (c)*, you will see that the real center of the field falls about 2/3rds lower on the vertical bar of the finder. Therefore, use the 80mm rectangle of the sportfinder to establish your subject size, then shift the center of that subject about 2/3rds of the way down the vertical bar. You are now aiming the sportfinder high on the subject, but the camera sees it in the correct place.

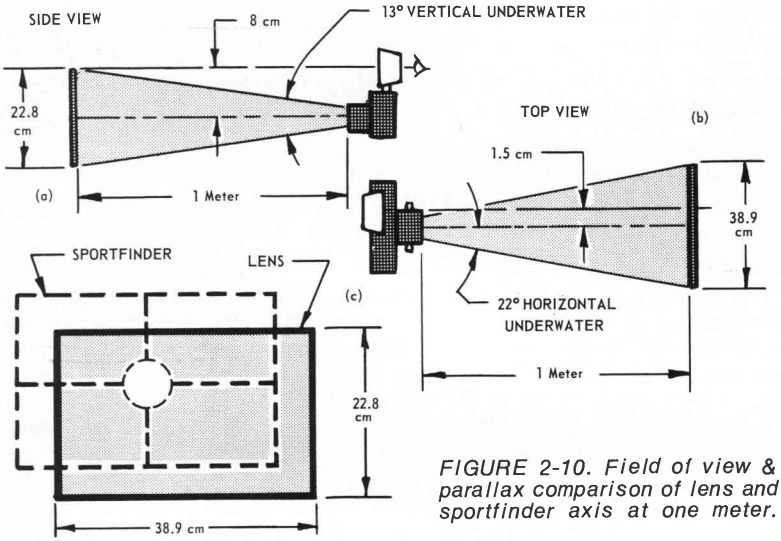


FIGURE 2-10. Field of view & parallax comparison of lens and sportfinder axis at one meter.

NIKONOS LIGHTMETER ASSEMBLY

The Nikonos lightmeter is composed of a molded plastic housing, made by Nikon, and a commercial Auto-Lumi L-86 photo electric exposure meter made by Sekonic. The housings single control is made to fit this particular meter so it is suggested that you use that meter rather than another. The combination is fairly inexpensive and is adequate for general use.

The meter is a photo electric cell unit which does not require a battery to power the movement and is a needle matching unit not a direct reading type. That is the cell generates an emf in proportion to the light falling on the cell, and this is indicated by movement of the small meter needle. The exposure is then determined by moving a calibration indicator, called the *Auto-guide indicator* in this case, to match the meter needle. Moving the guide indicator aligns a shutter speed scale on the computer dial to an f/number.

It is important to pre-adjust the f/number scale to a third dial calibrated in film speed prior to placing the meter into the housing. The film speed scale is calibrated in three rating systems, Din, ASA and EV numbers, so you should have no difficulty locating the film speed shown on your film box or literature on the meter scale. ASA speed is most generally used, but Din has also been increasingly popular for film makers to list on the same film box - use whichever system you prefer.

The housing is made with a single circular jar screw lid which should be tightened until a thin black "bead" is visible all the way around the seal. DO NOT overtighten as plastic threads tend to become locked together and it may be very difficult to open the housing later. Silicone or "O" ring grease on the seal and on the threads is valuable as a lubricant and to insure a waterproof seal with minimum effort.

The single control projecting through the side of the molded case has an "O" ring seal on the molded shaft boss concealed by the knob skirt. The seal is compressed about the drive shaft by a land on the knob.

The knob is retained to the shaft by two set screws, one a pin that passes through the drive shaft acting as a key, making the shaft and knob one.

The seal can be lubricated or replaced by removing the two set screws. It is a good idea to remove these screws once in a while with a jeweler screwdriver and put silicone or "O" ring grease on the threads and seal. If the meter case is not well cleaned after use in salt water you may not be able to remove the set screws later due to corrosion.

The meter is usable with a still camera like the Nikonos or your movie camera as well if you know the shutter speed. At 18 fps (frames per second) the approximate shutter speed is 1/55th second so when using the meter for movies always read the f/number opposite 1/50th second. A red triangle is also shown on the speed dial and this represents 1/30th second or 16 fps for movie cameras employing that shutter speed. Refer to the instructions supplied with your movie camera if you are not sure about the speed.

Be sure you check the meter zero calibration before you use it the first time. A screw adjustment is provided on the back side of the meter body proper. Adjust, if required, until the red indicator needle is over the black

dot on the scale (near the "S" in the word Sekonic) with the window of the cell completely covered with your hand or a light proof piece of paper.

To use the meter just point the circular end of the housing toward your subject, angle the meter downward if very near the surface, look at the small needle and move the matching guide until it is centered over the small needle. It is necessary to do this while aiming the meter as the unit has no memory device to hold the reading. Sometimes it is necessary to take several readings and average the results for light and dark areas.

You can also use your own hand for a reading if your subject is also light colored and inaccessible, however, it will be a little hard to point the meter and align the needles with the same hand used to hold the meter. The proximity of the meter to the subject is also important underwater. If you are too far back you may get an incorrect reading due to diffused light, reflections and material in the water. The instructions packed with the meter suggests 3 to 6 inches, but this is closer than you can usually manage, so develop a habit of reading at about the same distance, thereby, averaging out errors as you acquire experience.

Refer to *Figure 2-11,* for an overall view of the meter as well as a cross-section of the seal area of the computer dial control. Other Nikonos accessories not mentioned will be discussed in the sections to follow.

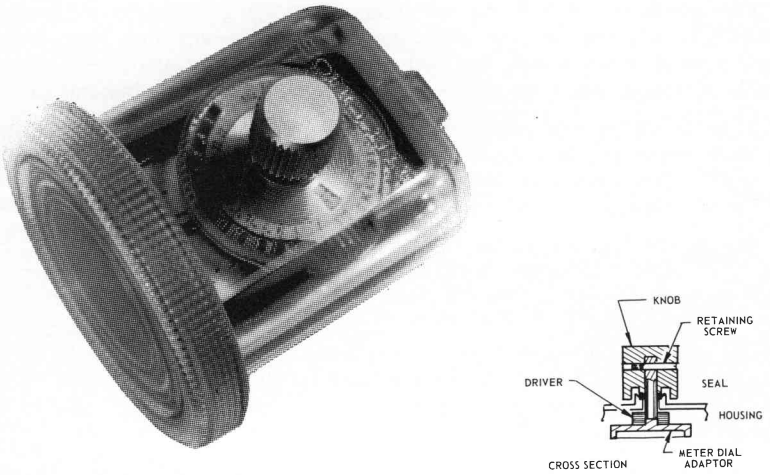


FIGURE 2-11. Nikonos-Sekonic underwater light meter. Insert shows cross section of seal area of the single meter control shaft. The Nikonos housing is designed specifically for the Sekonic L-86 meter and will not accept most other meters without modification, if at all.

SECTION 3
USING THE NIKONOS CAMERA IN AIR

One of the great virtues of the Nikonos camera is that it can be used virtually anywhere in its normal form. It is weather proof, dust proof, water proof to 160 feet and naturally humidity proof. Once loaded with film you can go most anywhere without worrying about the camera or the film. Unlike the Nikon line in general, however, the Nikonos will not accept standard Nikkor lenses and accessories, no one else makes lenses for the unit as of this printing and, therefore, it is a limited system camera. For its purpose, however, general and underwater photography, it is hard to find a more adaptable and portable system anywhere.

Using your Nikonos for above water photography is little different from any other 35mm camera. You must bear in mind that you MUST focus by estimating or measuring your camera to subject distance, use a separate range finder or a shutter speed-f/number combination that gives the necessary depth of field. Yes, you can also take a picture with the lens cap in place and never know that you have erred seriously until the blank film comes back from the processor - too late to correct your mistake.

The lenses of the Nikonos are designed to withstand water pressure to a depth of 160 feet without difficulty, but it, like any fine lens, cannot stand abuses. Always keep the port clean, using photographic lens cleaner and lens tissue. Keep the port covered with the lens cap when not in use.

Both the 35mm wide angle and the 80mm telephoto lenses are designed for multiple usage, above and below the water. The 28mm wide angle lens is specifically corrected for underwater use and will produce barrel distortion when used in the air. Refer to *Figure 2-7* for a comparison.

The built-in optical finder is intended for the 35mm standard lens, but can be used for the 80mm lens, with parallax correction, if you remember that the picture seen by the telephoto lens is about 2.03x smaller than the field encompassed by the bright rectangle in the finder. An accessory optical parallax corrected finder is available for the 80mm lens and an accessory open frame sportfinder is available for the camera shoe that allows viewing with both the 35 and 80mm lenses. For more detail refer to the section on each individual items.

The Nikonos is particularly useful to the multi-camera photographer as a good second camera. For example, I frequently use a Nikkormat equipped with the special Nikkor 55mm Micro-Nikkor f/3.5 lens which focuses from infinity to 24cm (9½ inches) without external accessories. This range allows the photographer to do most anything from scenics to macro photographs without supplementary equipment. Hours of lens juggling is saved, for example, when shooting title slides as the camera is simply moved where the the subject composes, wherever that might be in the focus range, and the picture is snapped. Most standard 35mm camera lenses have a focal length of 50mm, so this lens is only slightly telescopic. Going closer is easy too

as the lens comes equiped with a special extention ring that allows continued focus from 9½ inches to 1:1. Where does the Nikonos come in? With this versatility one may wonder what purpose a second camera could serve. The Nikkormat or Nikon F, uses the full Nikkor lens system so if one had all these superb lenses he should not have much of a problem with any subjects - but not everyone can afford all of these optics.

Considering list prices a 35mm f/3.5 auto-Nikkor lens for the Nikkormat or Nikon F, costs only a little less than the whole Nikonos camera complete with 35mm wide angle lens. The Nikonos, therefore, has its very practical usage as a second camera already equipped with wide angle lens. A 35mm wide angle lens is very useful for close-in photos and general scenics.

Not everyone wants or can afford two or more cameras. For the diving photo enthusiast the cost of his diving equipment is appreciable all by itself. If he wants to do some photography too, the Nikonos is ideal as it can be used above or below the water just as it comes from the box.

The Nikonos can also be used with most standard flash guns or its own B-C flash unit. For above water photography, when other than the Nikonos BC flash is used with its special connector, an accessory flash adaptor is available to thread into the sealed body plug located near the exposure counter. This body plug is slotted for a coin, something you might have available in the field rather than a screw driver. If you do use a screw driver it should have a very wide blade to avoid damaging the slot in the body plug. The body plug is threaded for a standard ¼-20 tripod or accessory unit.

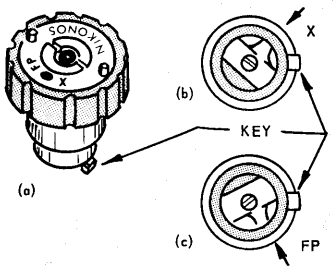


FIGURE 3-1. Nikonos flash adaptor. For use above water with standard PC cords. (a) adaptor; (b) X sync position of terminals, black dot; (c) FP sync, red dot visible.

The adaptor shown in *Figure 3-1* is an adjustable device for adapting the special internal flash connector of the Nikonos flash outlet to accept a standard PC cable. Three contacts can be seen at the bottom of the inner body and two must be utilized for each combination of flash synchronism. One terminal, the rear spring is common, while each of the others is either for X (electronic flash) or FP (focal plane delay bulbs). If you use the wrong flash sync due to improper adaptor setting the result could be a blank or partial picture.

If you are using *X* sync set the camera speed selector knob to the red 60. Rotate the flash adaptors silver ring with two round pins projecting so that the hole in the cover shows a black dot. If FP sync is desired, rotate the silver ring by the two projecting pins until the red dot of color appears in the small inspection hole. Refer to *Figure 3-1.* The white dot on the outer body will be helpful in locating the slot in the interior to accept the key.

Caution: PC cords have a tendency to move about as you do, and PC cords can rotate the upper section of the adaptor, changing the sync setting from what you wish to use to something else. If you are using the camera

above water and in difficult situations where the cord moves about, place a strip of tape over the adjusting cap after setting your sync selection to insure that the cap does not move. On one occasion while I was photographing the interior of lava tubes it was preferable to hand-hold the electronic flash unit away from the Nikonos to get proper lighting. In the process of moving the flash about, the PC cord caused the sync setting ring to revolve producing partial and underexposed pictures. (When you are out of sync the shutter may catch only part of the flash or miss it entirely, with your iris set for flash exposure an available light photo will be underexposed, in most cases.) A quantity of good photos were lost because of the movement of the setting ring. This can not happen with the Nikonos BC flash, but it can happen to even good quality 35mm cameras where the center contact of your sync connector can rotate with the sync cord, what happens in this case is that you twist-off the wire on the inside of your camera body, and no flash at all is the result. The cost of repair will make you unhappy and it could happen all over again if you do not understand the cause.

Refer to section five on the use of flash for more information relative to both air and underwater flash photography.

Precautions - as with every fine camera use care in handling the unit to avoid physical damage. The Nikonos is tough, but not indestructible. Since the Nikonos is air tight, do not leave it in the hot sun or on a hot beach because there may be a build-up of internal pressure. The lens is designed for external pressure, not internal, and the heat absorbed by the black exterior can damage the film in the camera.

STEPS TO USING THE NIKONOS IN AIR

1. Load in the normal manner.
2. Set the shutter speed and f/number for the type of film you are using. Exposure information can be obtained from your light meter.
3. Set focus.
4. Remember the Nikonos is not a single lens reflex so you CAN take pictures with the lens cap over the lens. Always remove the cap before you start shooting.
5. Cock the shutter.
6. View the subject through the optical or sportfinder, correct for parallax if required.
7. Take a deep breath, let the air out slowly, take a second breath then hold it while you snap the shutter. At high shutter speeds it is not quite so necessary to hold the camera rock steady, except while using the 80mm lens, but camera movement does effect the sharpness of the film image and this is critical in small format cameras like the 35.
8. Advance the film and cock the shutter after you snap the shutter if another photo is to be taken right away or leave the release lever in the forward uncocked position if the camera is not to be used again for a while. It is best with any camera not to leave the shutter in a cocked attitude as this can result in eventual shutter speed changes.

SECTION 4
NIKONOS UNDERWATER

Handling your Nikonos underwater is just about the same as above water in most respects. All of the controls are available, settings to shutter speed, f/number and focus can be changed as you wish.

In very clear water the camera will produce results acceptable to anyone just about as it would on the surface. However, a light meter is recommended to establish your speed-f/number relationship as the human eye automatically corrects for light variations and color and guessing at exposures is not a recommended practice for best overall results.

The sportfinder is generally recommended for underwater use of the camera as it is impossible, usually, to see the whole image area through the optical finder with some face masks.

The camera lens is like your eye underwater. It sees at the same apparent distance that you do. If you judge an object to be six feet away set the camera on six feet. If you actually measure the distance with a scale, you will need to correct the focus on the camera lens accordingly because the real and apparent distance will not be the same. Multiply the real distance measured by ¾ and set this value on the lens focus scale. For example, if you measured the distance to an object and found the actual distance to be 4 feet then set 4 x ¾ or 3 feet on the focus scale.

Judging the distance is usually acceptable and gets better with practice. If you seem to have a problem, use the depth of field indicator on the focus scale to help you correct the error. Set focus distance in the middle of the depth of field range or place your estimated distance on either end of the range depending on how you usually err.

If you have not already photographed the underwater world, or have and wonder what can be done to improve the results, a discussion on the use of filters may be of help to improve your results.

Filters are optical grade glass plates, coated or laminated, with material that absorbs some portion of the spectral energy received at the lens. Your Nikonos lens hood accepts 52mm special screw-in type filters, or you can obtain 58mm filters for top-side use as they do not leak as they should underwater without something like the hood. Nikon (Nikonos) filters are available in the 52mm thread include yellow, green, red, orange, 80B, 80C, 81A, 85, 85B, skylight, UV haze, neutral density and CC30R color compensation filters.

All of these have a definite purpose and work either with all types of film, color and B&W film, or with one or the other, but not both. Filters are are useful to correct or improve the scene as the film does not compensate for changing conditions as does the human eye automatically.

Refer to *Table 4-1* for more information on filters commonly used with the Nikonos. The table defines the basic color of the element, what it does to the light, whether it can be used with one or both types of film, color or B&W and will serve as a quick reference if you are trying to change the normal results obtained with your particular film.

In subsequent booklets of this series, means will be described to chemically increase contrast of B&W film negatives. Contrast is important to the underwater photographer as the average scene underwater is "flat", or lacks contrast. Color film sometimes helps contrast because of the different hues of color, but B&W is a system of gray scales and two shades of gray do not always separate well when printed.

Filters like the yellow and orange will absorb some of the natural color of the water, blue and blue-green respectively, and, therefore, reduce the "flat" character of the scene.

On the other hand, with color film, you may have your camera loaded with daylight film for use above the water, then wish to use flash underwater. If you have blue flashbulbs you need no filter, but if all you have are white bulbs, the flash must be balanced with the film and an 80C filter may be used. The reverse might also be true requiring a different filter.

Water itself acts as a natural filter, but since it is not consistant you can not afford to rely on its properties. It does act as a scattering medium due to the small particles suspended in it.

If you are taking available light color pictures underwater with the Nikonos or any other camera, and the water is clear and blue colored, the CC30R color correction filter will help by absorbing some of the blue color. The result is more natural color rendering and improved contrast. The same filter helps correct color when shooting through some commercial aircraft windows and the glass windows of a vista dome car of a train.

Another pair of useful filters are the neutral density 4X and 8X. These are intended to reduce the effective speed of your film, change the effective f/number or reduce the light that can reach the film. The 4X filter reduces your film speed by a factor of 4, and the 8X by a factor of 8. If you were using a color film with an ASA speed or 64, and used the 4X filter, the effective speed of the film would be 64 divided by 4 or ASA 16. The 8X N.D. filter represents a factor of reduction of 8, so the ASA 64 film with the 8X filter over the lens has a new speed of 64 divided by 8 or ASA 8. If you remember the discussion on f/numbers and speed, you will equate the 4X speed change to 2 iris stops and the 8X to 3 stops change. The "X" factor can be applied either to the film speed itself or the shutter speed, as the end results are the same, effecting the amount of light reaching the film.

Neutral density filters are more useful than one might think. If, for example, you started your roll of film with the 80mm telephoto lens, and wanted maximum depth of field you might have done one of the following things: used Anscochrome T500 film, ASA 500; used high speed Ektachrome film ASA 160 boosted to ASA 400 with ESP-1 (special processing available from Kodak, at extra cost) or had used B&W film rated for development in a speed increasing developer like Acufine.

The underwater world is not noted for its brightness, and it matters not in this case since you intended to stop down to a high f/number to maximize your depth of field. Let us say that with your particular subject you are able to shoot at f/22 with a shutter speed of 1/125th second with the 80mm lens. Just suppose you did not finish the roll of film, but took your Nikonos back home with a partial roll of film. For ease of discussion let us assume that the film was rated at ASA 400.

The next day you want to use the camera above water at the beach. Here the brightness is extreme. With ordinary color film you probably would be stopped down to f/16 or f/22 at 1/125th second shutter speed, but with your camera loaded with a film much faster, you cannot stop down enough to obtain the correct exposure. You can increase your shutter speed to 1/500th second, but this too may not correct the exposure differential of the film.

Back to the 80mm lens? No, that will not help now because you are not underwater where the light level was low, you are on the beach where the light level is very high.

Now is the time to use a neutral density filter. These optical glass elements will not effect color film as far as spectral response is concerned, but they will uniformly decrease the percentage of all wave lengths of light that will pass through. Nikonos N.D. filters are available in 4X & 8X, with 52mm threads for the Nikonos hood. You need a 4X N.D. filter for your beach photo. The 4X N.D. filter reduces your film speed from ASA 400 to ASA 100. You now have a film speed that you can handle in the bright light and still follow-through with your developing plan required for the earlier underwater shots.

Ordinarily N.D. filters of 4X and 8X are on the denser side of the N.D. scale for general use. These are intended for massive speed changes as in the example. However, the same light intensity problem could occur if you began taking available light pictures, then switched to flash, particularly very small lens to subject distances experienced in ultra-close work.

At best photography is a precise well planned action to record an event or a thing on film. Decide what you wish to photograph, plan your film, developing and lens to match the situation, and follow-through. Filters will help if your plans need to be altered or you need to modify the visual image to suit the circumstances.

Photography underwater with your Nikonos is an extension of normal photography in air. Everything is the same as far as composition and techniques are concerned, only the environment is alien - and it is very alien.

DIRTY WATER

If you cannot see your subject, your camera usually cannot see it either. If you need low shutter speed and large apertures, camera or subject movement can result in blur. Very little can be done generally to correct dirty water - it is something some divers in some areas live with all or part of the time. However, you can help yourself by moving closer to the subject to reduce the amount of material between the subject and the lens. Here the 28mm wide angle lens will be a great help, NOT the 80mm telephoto lens as this would put you further away, not closer to the subject.

Available light photography is frequently difficult to perform simply because your subject might be in near darkness and there is no practical way to shoot in the darkness without help. That help is in the form of prepackaged daylight - the flash bulb or lamp.

USE OF FILTERS TABLE 4-1

FILTERS	COLOR ABSORBED	NORMAL USE	FILM		FILM TYPE	
			B&W	COLOR	PAN	ORTHO
YELLOW	BLUE	INCREASE CONTRAST	X		X	X
GREEN	RED	INCREASE CONTRAST	X		X	
RED	BLUE & GREEN	INCREASE CONTRAST	X		X	
ORANGE	BLUE & GREEN	INCREASE CONTRAST	X		X	X
80B	COLOR BALANCE	DAYLIGHT TO 3400 FLOOD		X		
80C	COLOR BALANCE	D/L TO WHITE FLASH BULBS		X		
81A	COLOR BALANCE	TYPE B FILM TO 3400 DAYLIGHT TO ELECT. FLASH		X		
85	COLOR BALANCE	TYPE A FILM TO DAYLIGHT		X		
85B	COLOR BALANCE	TYPE B FILM TO DAYLIGHT		X		
SKYLIGHT	BLUE	REDUCE EXCESS BLUE	X	X	X	X
UV HAZE	ULTRA VIOLET	REDUCE ATMOS. HAZE	X	X	X	X
N.D. 4X	NEUTRAL DENSITY	REDUCE FILM SPEED	X	X	X	X
N.D. 8X	NEUTRAL DENSITY	REDUCE FILM SPEED	X	X	X	X
CC30R	BLUE	REDUCES OVERALL BLUE UNDERWATER		X		

1. 52MM THREADED FILTERS TO FIT NIKONOS SUN HOOD.
2. 58MM THREADED FILTERS TO FIT LENS THREAD DIRECTLY. NOT MADE BY NIKON.
3. 58MM FILTERS USED UNDERWATER SHOULD BE INSTALLED SUBMERGED TO FLOOD AIR SPACES.
4. ALL FILTERS SHOULD BE CLEANED AFTER UNDERWATER USE ON ALL SURFACES.

CAMERA CLEAN-UP AFTER USE

It is particularly important to take prompt and complete care of your Nikonos after use in or about salt water. A good diving photographer deals with his cameras, his diving gear and himself in that order after a dive.

Reliable operation of all mechanical devices underwater is more than just important - it could mean your life, if the malfunction was in your breathing device, or no pictures if it is a camera or flash failure. Further, such malfunctions can seldom be properly or even partially repaired while submerged. Therefore, take good care of your equipment.

Wash all of your equipment thoroughly in fresh water after use in salt or dirty water, or where the camera was used near corrosive chemicals in the air, such as near hot mineral springs or industrial processes. If you cannot wash the equipment within a reasonable period after exposure, and the equipment dries, soak the camera and its accessories fully assembled in dive configuration in a sink or bath tub full of warm water as soon as you can. The warm water will speed the dried salt into solution. Warm not hot!

Ordinarily washing under running tap water will scrub away most of the surface salts. Be sure the water reaches every possible seam, recess and blind area where salt residue could be lodged. Dry the equipment by natural evaporation or use a soft lint free towel. Use particular care about the lens glass port as sand lodged in the towel could do considerable damage to the port. Keep the lens cap in place at all times when the lens is out of action, but do not forget to remove it before you dive, or otherwise use the camera, as you cannot tell when the lens is covered as you could with a single lens reflex camera. The Nikonos is a viewfinder type camera.