THE CAMERA

F3

TECHNICAL MANUAL

Nikon


Nikon
F3
Nikon
F3
NIKKOR 50mm 1:1.4 4112353

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INTRODUCTION

The culmination of more than thirty years of experience in 35mm camera design, the Nikon F3 is undoubtedly the finest camera Nikon has ever built. Nikon's design goal was simple: to create the first *truly* professional-quality electrically controlled camera. Based on years of experience in dealing with professional photographers around the world, Nikon decided the F3 should have the following features: 1) A proven system of automatic and manual exposure control usable with all current Nikkor and Nikon Series E lenses, 2) full manual digital control of all shutter speeds, 3) a compact yet durable camera body, 4) a battery and metering system able to operate in below-freezing temperatures, 5) a full line of professional-quality accessories, and finally, 6) the capability to cope with every photographic innovation yet to come.
Electronically, the Nikon F3 is literally "state-of-the-art." All microelectronic components have been integrated on rigid substrates which are then bonded to the flexible printed circuit (FPC) board. The result is incomparably accurate automatic exposures over a wide range of shutter speeds from 1/2000 sec. down to 8 full seconds. In addition, all manual shutter speeds are quartz timed for unparalleled precision. Moreover, the Nikon F3 is certain to become a trend-setter, because it's the world's first camera to utilize liquid crystal display (LCD) for exposure readout. By doing away with the ubiquitous LED's found in most other cameras' viewfinders, Nikon has reduced the F3's battery power consumption down to the lowest possible level.
However, the F3's innovative microelectronic circuitry would be diluted in importance without a truly elegant mechanical design to go along with it. Therefore, Nikon went back to the drawing board to completely redesign most internal workings of the camera. Simply stated, the Nikon F3 represents a quantum leap forward in smooth and quiet operation through the use of *eleven* ball bearings in its shutter and film winding assemblies. Heretofore, no camera has incorporated more than one or two ball bearings in its design. And to reduce film winding torque even more, Nikon created a completely new film winding mechanism. By using a special connecting shaft, all major rotational axes are now placed close together. This simplifies the interconnecting gear trains, resulting in more efficient transmission of energy.
Yes, Nikon's attention to small details in the F3's overall design makes it a formidable photographic instrument indeed.
Like the Nikon F and F2 before it, the Nikon F3 is destined to become *the* professional 35mm camera of its era. Therefore, Nikon felt that a technical manual explaining all aspects of the F3 in detail was necessary. This manual not only explains how the camera operates, but it goes below the surface to explain *why*. As such, we hope you find it a worthwhile guide to the Nikon F3.

FEATURES

- Highly accurate metering system with single silicon photodiode (SPD) located in camera body for on-axis through-the-lens metering; aperture-preferred automatic and manual exposure control possible with *all* interchangeable viewfinders.

- Accurate quartz timing of all manual shutter speeds from 1/2000 sec. down to 8 full seconds; 10 sec. self-timer delay, 16 sec. meter-on period, picture-taking mode selector, mirror box combination magnet, as well as sequential operation of shutter release also quartz timed.

- Fully automatic through-the-lens flash exposure control directly off the film plane with Nikon Speedlight SB-11 and SB-12; built-in light-emitting diode (LED) ready-light inside finder.

- Extremely low battery power consumption via the use of liquid crystal display (LCD) for exposure read-out of shutter speeds, plus manual, over- and underexposure indications.

- State-of-the-art microelectronics with all elements, including 6 IC's, SPD metering cell, quartz oscillator, LCD block, and functional resistance element (FRE) integrated on rigid substrates and then bonded to one flexible printed circuit (FPC) board.

- Exceptionally low winding torque through liberal use of ball bearings in shutter drum and film winding mechanism, plus completely redesigned winding mechanism; all axes of film advance lever, shutter drum, film sprocket, and takeup spool now in close proximity to special connecting shaft, thus simplifying the gear trains.

- Continuous firing rates of up to 6 frames per second and automatic film rewinding with Motor Drive MD-4.

- Cold weather performance down to −20°C with Motor Drive MD-4 and NiCd battery pack attached.

- Strongly center-weighted metering pattern concentrating 80% of sensitivity in the central 12mm-diameter area of the focusing screen.

- Feather-light shutter release via electronic triggering of reflex mirror.

- Low-vibration mirror movement thanks to air-dampened shock absorber in mirror box.

- Easy-to-read, three-way viewfinder information, consisting of LCD shutter speeds, ADR (aperture direct readout) f/number, and LED flash ready-light; built-in illuminator for viewing of LCD and ADR number in dim light.

- Backup mechanical shutter speed of approx. 1/60 sec. in case of battery failure by using separate mechanical release lever.

- Exposure memory lock for locking in meter reading on Automatic.

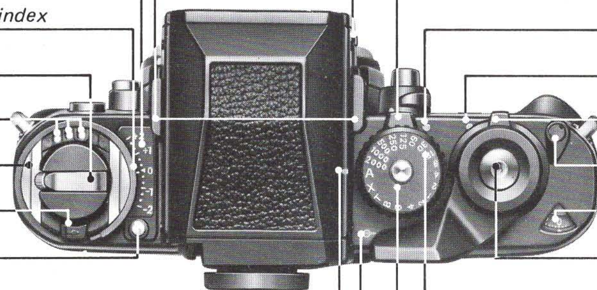
- Exposure compensation in one-third increments from +2 to −2 EV.

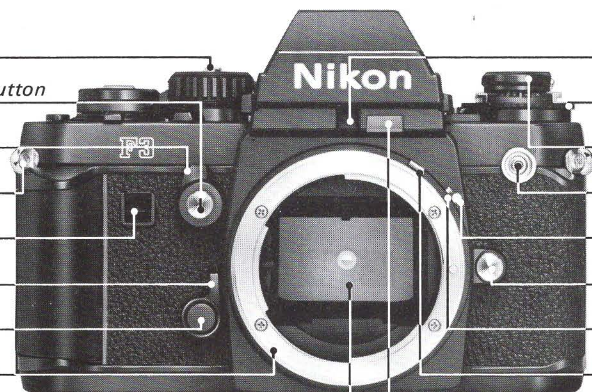
- 100% accuracy in viewfinder frame coverage.

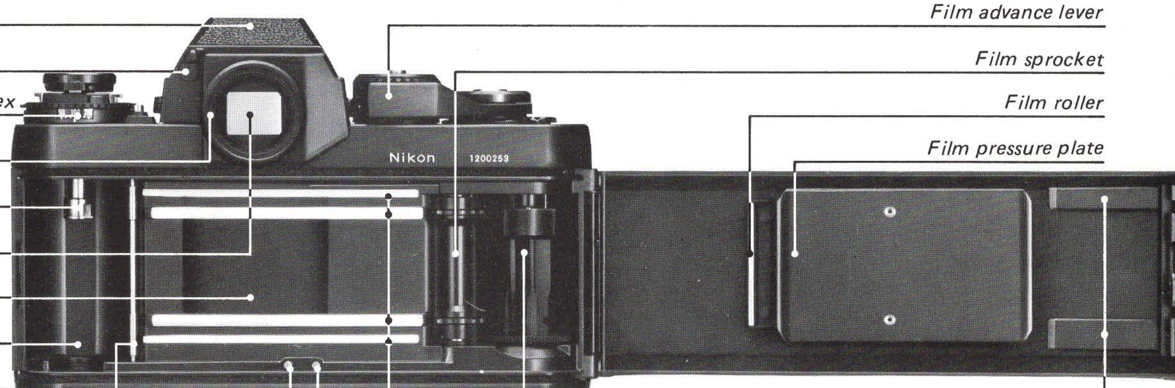
- Quick and easy method of viewfinder/focusing screen interchange.

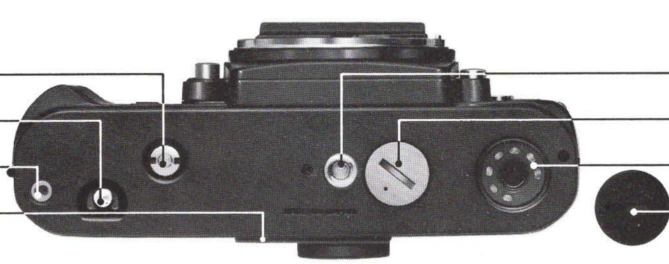
- Full line of professional-quality accessories.

NOMENCLATURE

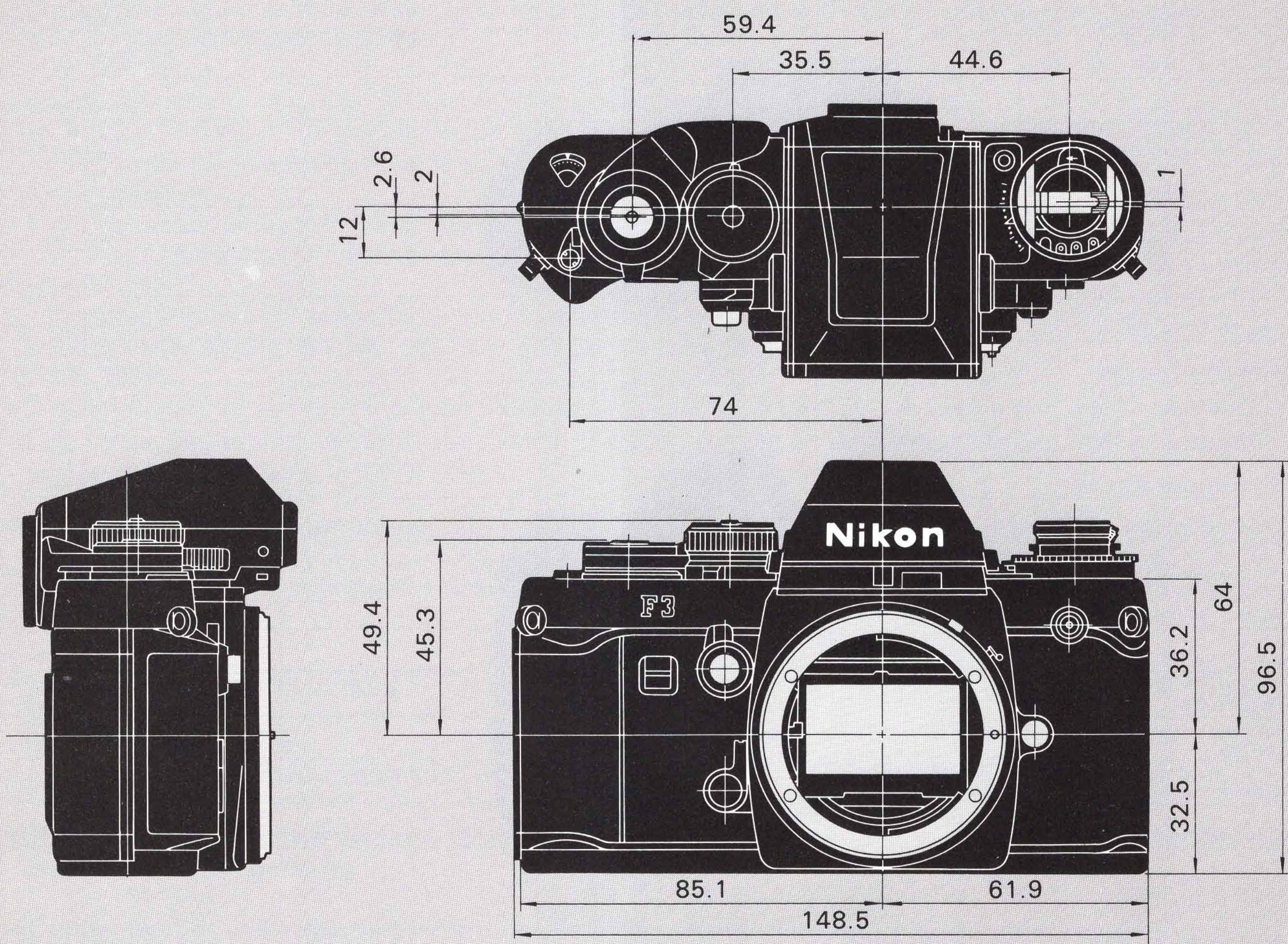




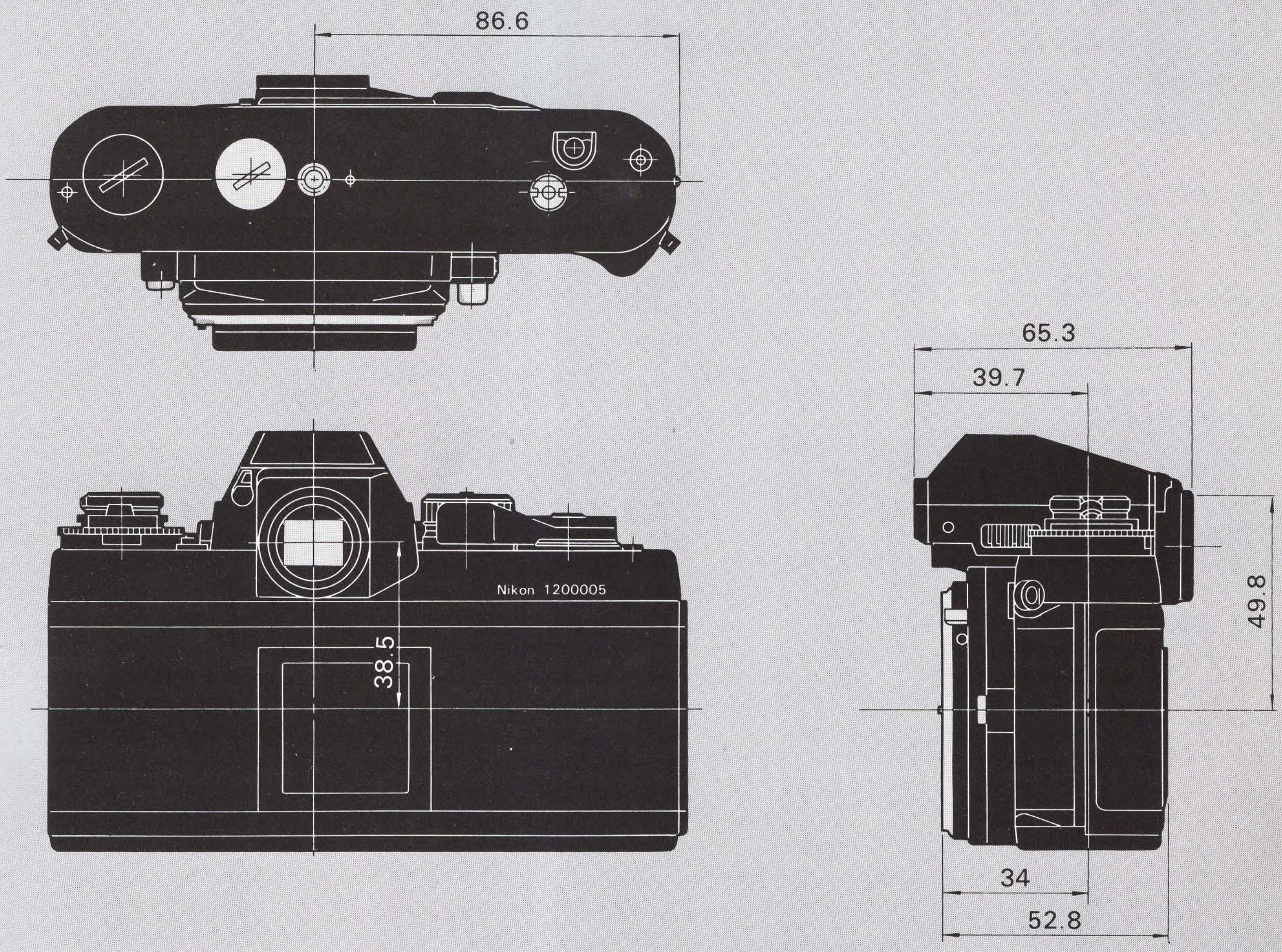




DIMENSIONAL DRAWINGS AND SPECIFICATIONS



Type of camera	35mm single-lens reflex
Picture format	24mmx36mm (standard 35mm film format)
Lens mount	Nikon bayonet mount
Lenses	Nikkor 50/1.2, 50/1.4, 50/1.8, and Nikon Series E 50/1.8 as standard; more than 60 Nikkor and Nikon Series E lenses available
Shutter	Horizontal-travel, titanium focal-plane shutter
Shutter speeds	Auto: Electromagnetically controlled stepless speeds from 8 to 1/2000 sec.; Manual: Quartz/electromagnetically controlled discrete speeds from 8 to 1/2000 sec., plus B and X (1/80 sec.); mechanical: T setting on shutter speed dial and 1/60 sec. when using backup mechanical release lever
Shutter release	Electronic shutter release; initial pressure on shutter release button switches on meter (after release lock is unlocked), meter then remains on for 16 sec. after finger is taken off button
Backup mechanical release lever	Trips shutter at 1/60 sec. regardless of shutter speed dial setting except at T; used when batteries are dead
Self-timer	Quartz-timed 10 sec. delayed exposure; LED blinks at 2Hz for first 8 sec. then at 8Hz for last 2 sec.
Exposure control	Aperture-priority automatic exposure with manual override and backup mechanical control; through-the-lens, full aperture metering via silicon photodiode (SPD) with center-weighted metering pattern and metering circuits incorporated into camera body; meter works with all viewfinders
Film speed range	ASA/ISO 12 to ASA/ISO 6400
Metering range	EV 1 to EV 18 (1 sec. at f/1.4—1/2000 sec. at f/11) at ASA/ISO 100 with f/1.4 lens
Exposure compensation dial	Provided; ±2 EV in one-third increments
Exposure memory lock	Provided; operates on Auto to electronically lock in shutter speed
Accessory shoe	Provided; special Nikon type located at base of rewind knob; accepts Nikon SB-12 shoe-mounting electronic flash unit or TTL connecting cord from SB-11 for TTL direct flash output control using camera's SPD metering cell
Flash synchronization	Speeds up to 1/80 sec. with electronic flash; with SB-12, flash sync is automatically set to 1/80 sec. when shutter speed dial is set at "A," or 1/125 sec. or above; flash synchronizes with shutter speed set at slower shutter speed settings; threaded sync terminal provided for off-camera or multiple flash photography



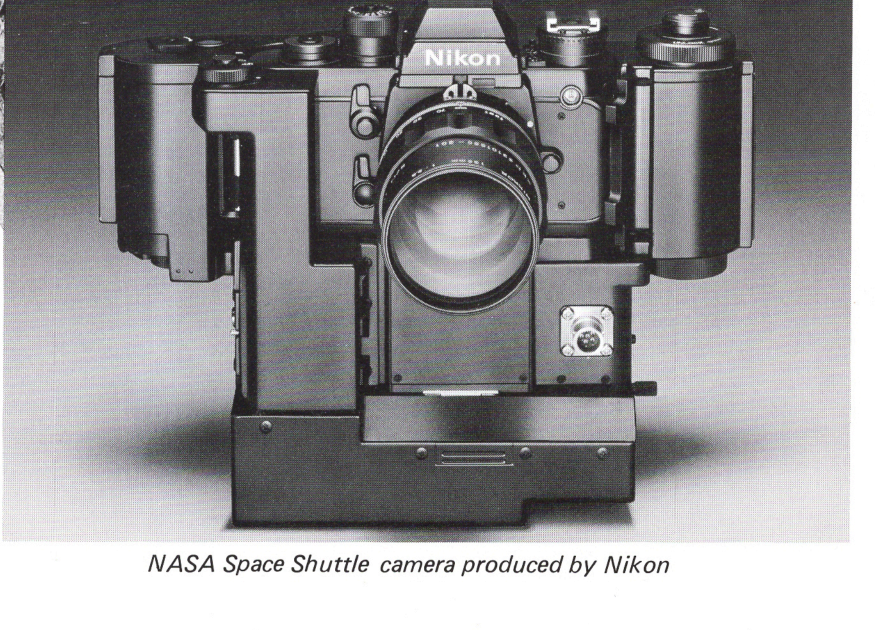
(unit: mm)

Auto flash control	TTL direct flash control governs SB-12's flash output using camera's SPD sensor; effective ASA/ISO range from 25 to 400
Viewfinder	Interchangeable eyelevel pentaprism type DE-2 as standard; 0.8X magnification with 50mm lens set at infinity; virtually 100% frame coverage
Viewfinder display	Liquid crystal display (LCD) shows shutter speed; on Auto, + 2000 indicates overexposure, –8⁻ underexposure; on Manual, M appears with + indicating overexposure, – underexposure, and – + correct exposure; LED ready-light glows when Nikon SB-11 or SB-12 Speedlight is completely recycled; aperture in use also shown through aperture-direct-readout (ADR) window
Viewfinder illuminator	Provided; illuminates both liquid crystal display and ADR f/number
Film advance lever	Wound in single stroke or series of strokes; 30° stand-off angle and 140° winding angle; shutter speed automatically set to 1/80 sec. until frame "1" for fast loading when shutter speed dial is set to "A" or 1/80 sec. (X) and above
Frame counter	Additive type, self-resetting
Film rewind	Folding crank with rewind button in baseplate
Eyepiece shutter	Provided; prevents stray light from entering viewfinder from the rear
Focusing screen	Type K as standard; interchangeable with 19 other types
Depth-of-field preview button	Provided; coaxial with mirror lockup lever
Reflex mirror	Automatic instant-return type with lockup facility; incorporates air dampened shock absorber
Multiple exposure lever	Provided; disengages frame counter for correct count
Camera back	Hinged, interchangeable type; memo holder provided
Release lock	Provided
Batteries	Two 1.55V silver-oxide cells (Eveready EPX76, D76 or equivalent); when MD-4 motor drive is attached, camera gets battery power from batteries in motor drive
Dimensions	Approx. 148.5mm (W) x 96.5mm (H) x 65.5mm (D)
Weight	Approx. 700g with DE-2 Eyelevel Finder

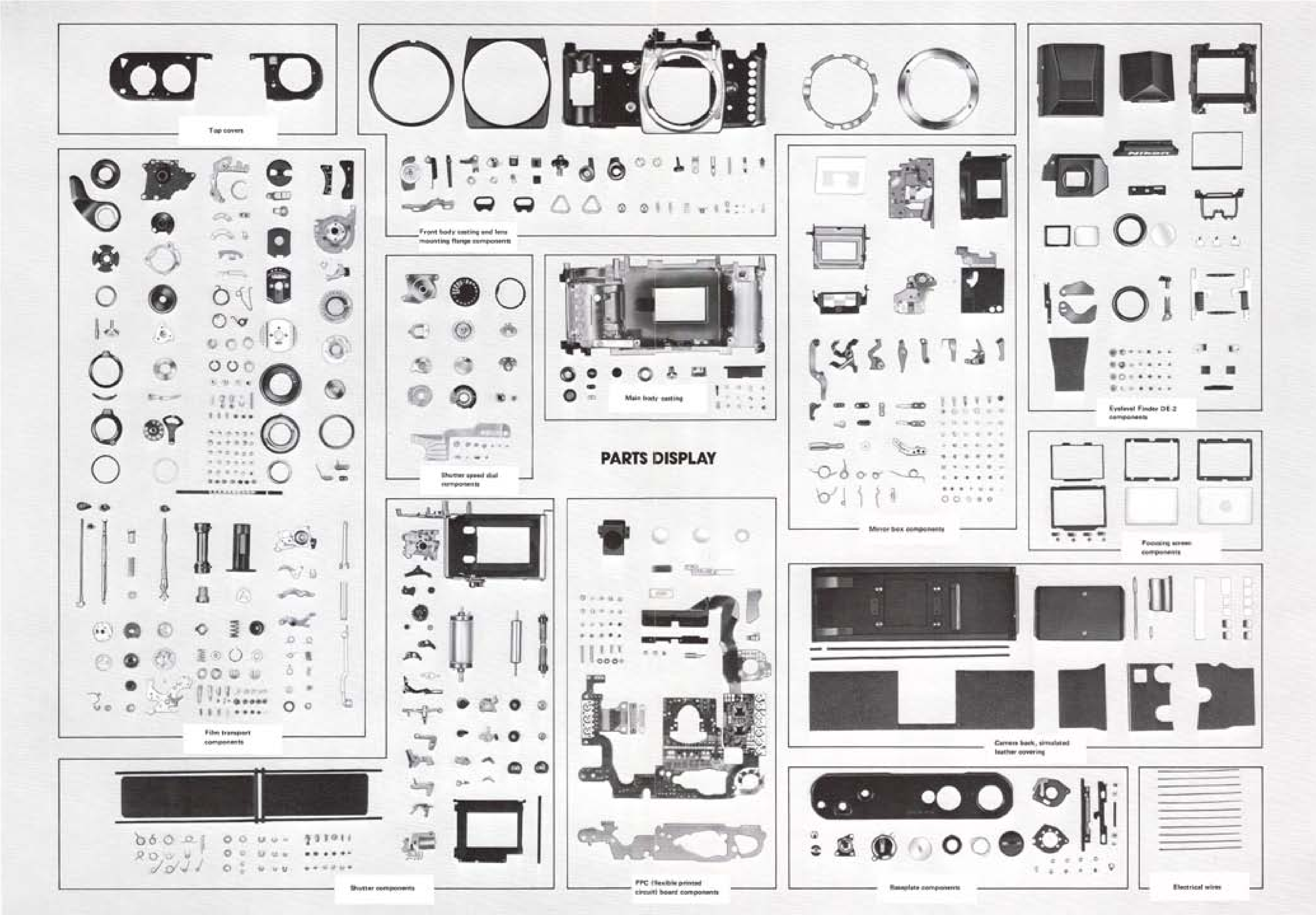
Space Shuttle

NASA

National
Aeronautics and
Space
Administration



NASA Space Shuttle camera produced by Nikon


PARTS DISPLAY
Top covers
Front body casting and lens mounting flange components
Shutter speed dial components
Main body casting
Mirror box components
Eyelevel Finder DE-2 components
Focusing screen components
Film transport components
Shutter components
FPC (flexible printed circuit) board components
Camera back, simulated leather covering
Baseplate components
Electrical wires

DESIGN

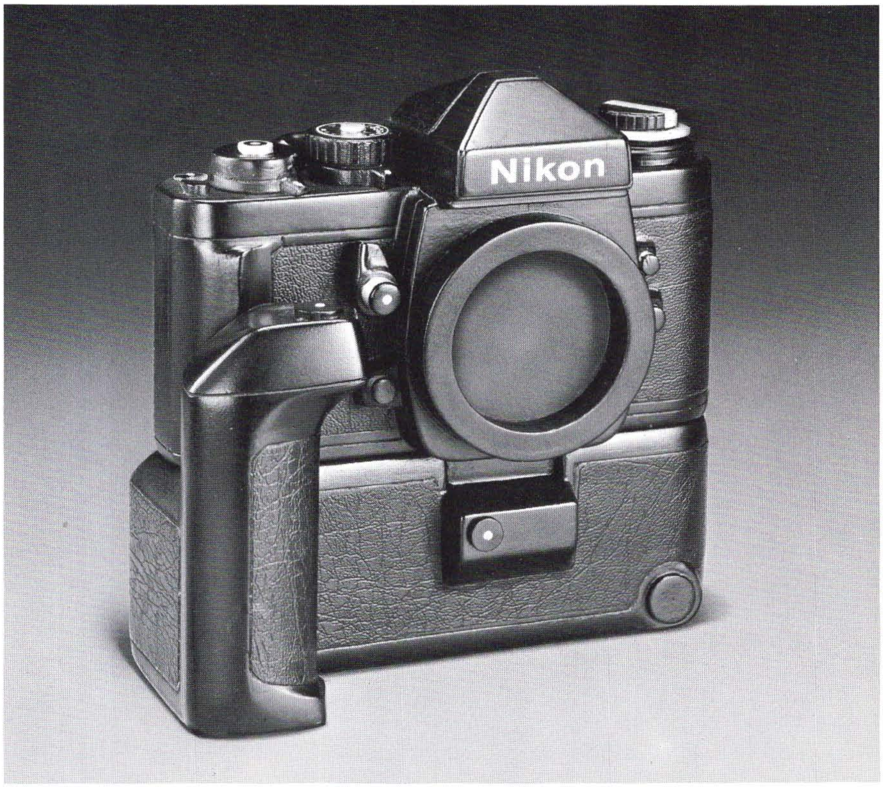
In the design of the Nikon F3, the camera body and motor drive were conceived of as a single unit, because this combination is very popular with advanced amateurs and professionals—the intended users of the Nikon F3. The camera/motor drive is so well balanced that it doesn't tip over even when a 200mm telephoto lens is attached.

Continuing Nikon's tradition of sturdy construction, the F3 is made almost entirely out of metal. The backbone of this camera is a two-piece, die-cast body. To insure the interchangeability of its numerous accessories, including lenses, finders, and focusing screens, the camera body had to be rugged, yet manufactured to exact tolerances. For these reasons, Nikon selected a special alloy of copper silumin aluminum, because it is rigid, corrosion-resistant, and less susceptible to blowholes during manufacture. This alloy has a high tensile strength of approx. 33.5 kg/mm^2 (475.5 lb/in^2). For rigidity, the thickness of the casting's walls is never less than 1.4mm, while the portion that attaches to the bayonet mount is 2mm thick. Moreover, the body is then treated with alunite and coated with black paint for additional corrosion resistance. The camera back is made of brass as are both the top covers and baseplate.

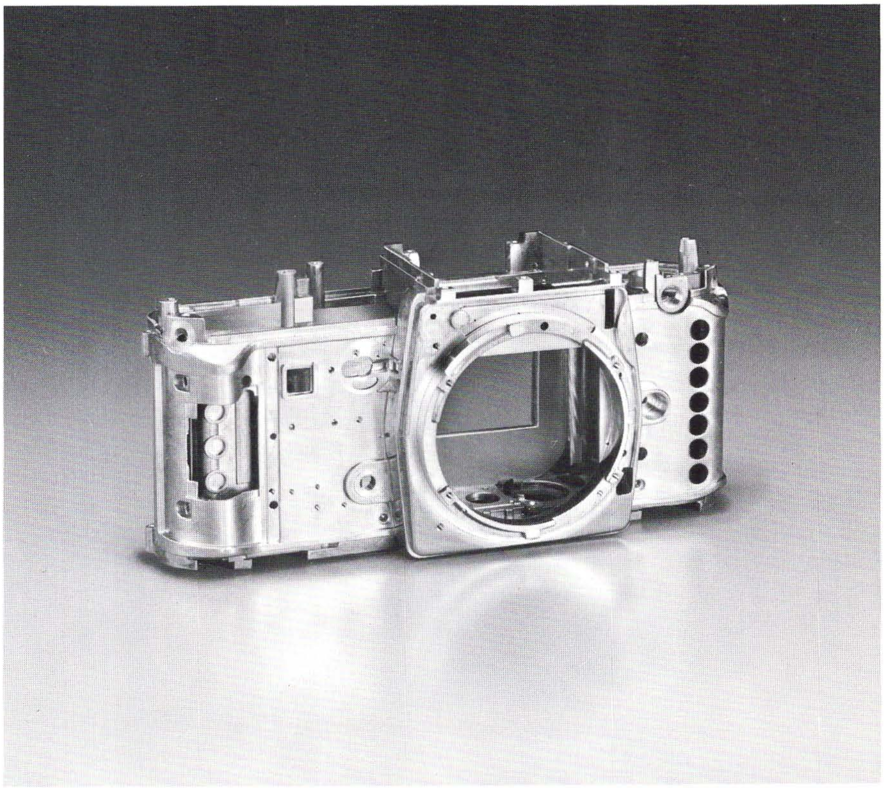
Since there are no microelectronics in the camera's pentaprism, there is less chance of camera malfunction even if the finder receives a sharp blow as is often the case when the photographer works with more than one camera around his neck.

Because of its sophisticated design, the Nikon F3 was selected by the U.S.A.'s National Aeronautics and Space Administration (NASA) for use in the Space Shuttle Program. In the past, Nikon cameras have flown into space on every manned flight since the APOLLO program. This includes SKYLAB and the joint venture, APOLLO-SOYUZ. However, to meet the unique environmental conditions encountered in space flight, various modifications were made to the Nikon F3.

From drawing board to final production, the Nikon F3 took more than 5 years to create and is the perfect marriage of innovative mechanical design with the most advanced electronics available at the present time.



One of the F3 mock-ups



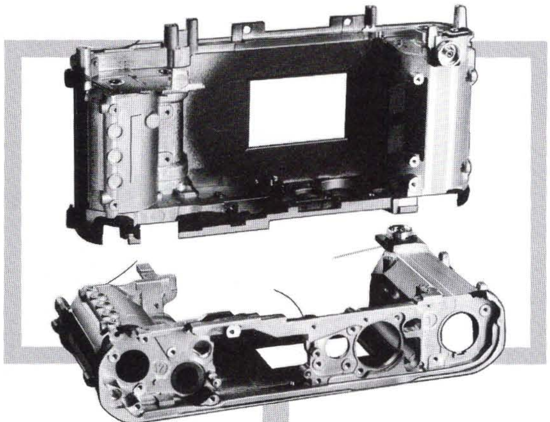
F3 die-cast body

MANUFACTURING

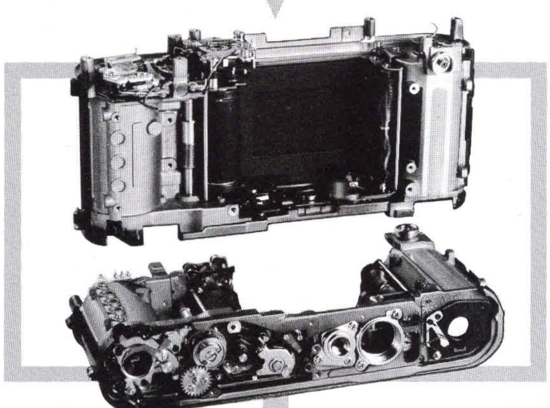
To simplify the manufacturing process, the die-cast body as well as the shutter and mirror box assemblies, winding mechanism, shutter speed dial, and FPC board are manufactured as separate modules by Nikon. Then, all these elements are brought together in the main Ohi plant in Tokyo where each Nikon F3 is literally put together by hand.

In addition to scores of highly skilled technicians, the assembly line includes numerous testing devices designed exclusively by Nikon. One such computerized instrument can be plugged into the F3's microelectronic circuitry to provide automatic adjustment of shutter speeds and the LCD exposure readout (See the ***COMPUTERIZED AUTOMATIC ADJUSTMENT AND TESTING*** section on page 14 for more details). In fact, the Nikon F3 is subjected to more than 20 individual tests for such things as shutter speed accuracy, winding torque, and proper mirror adjustment during the course of its assembly. Please refer to the flow chart and captions on the next page for the step-by-step procedures used in the assembly of the Nikon F3.

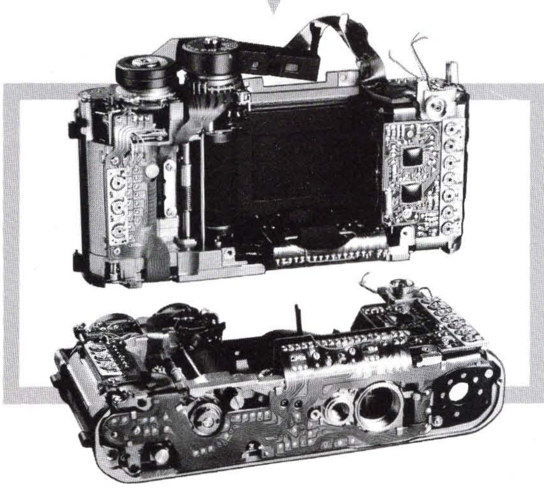
Step-by-Step Assembly Process



1. The first step in the assembly process begins with the main body casting.



2. Next the connecting shaft, winding gears, and shutter mechanism are installed.



3. Then the flexible printed circuit board, plus the winding lever and shutter speed dial are added.

4. The mirror box, front body casting as well as the lens mount go on next.

5. With the addition of the hot shoe, rewind knob, top covers and baseplate, plus grip and simulated leather covering, the F3 is near completion.

6. The completed Nikon F3 camera body with standard Eyelevel Finder DE-2 attached.

COMPUTERIZED AUTOMATIC ADJUSTMENT AND TESTING

To insure the reliability of ***each and every*** Nikon F3 coming off the assembly line, the camera's shutter speeds, LCD display and light metering system are automatically adjusted and tested by a bank of computers (see diagram I). To facilitate adjustment, the camera's microelectronic circuitry contains ten variable resistors. When the FPC board is installed into the camera body, the ceramic strip of three resistors is located on the front of the camera body underneath the grip, whereas the strip of seven is below the rewind knob. A series of holes in the die-cast body then provides easy access to all ten resistors during assembly.

The first stage in the testing process, the ***Hybrid IC Module Test***, is performed even before the microelectronic components are bonded onto the FPC board. Done in a separate facility, the performance of each IC module is memorized on a disk. This data in disk form is then transferred to the central computer at the main Nikon plant in Tokyo.

In the preliminary adjustment to the camera body, an ***FPC Test and Automatic Adjustment*** are performed by a series of two minicomputers, linked directly to the central computer. Using minute probes, which touch the check lands and fit into the center of the three variable resistors, the resistors are rotated automatically in the initial adjustment. Should the minicomputers be unable to make the appropriate adjustment, a command is sent back to the central computer asking for advice.

The next stage, ***Automatic Camera Body Adjustment***, the Nikon F3 is attached to a specially Nikon-designed testing apparatus which is controlled by three minicomputers. As in the previous step, the minicomputers are linked directly to the central computer and can draw upon its memory unit in case their capacity is exceeded.

Used to adjust the automatic and manual shutter speeds as well as the LCD display, the apparatus is made up of the following sections (see diagram II) :

Shutter Tester. Here the camera's shutter speeds are automatically checked for accuracy. The tester consists of the light box, sensor, and controller. The light box produces three standard levels of illumination, while the sensor measures the shutter speed at each level. The controller automatically controls both the light box and sensor in accordance with the minicomputers' program.

Variable Resistor Adjustment Probes. Tiny probes operated by pulse motors fit into the seven variable resistors and turn them to make computerized automatic adjustments of all camera operations.

AI Section. A standard Nikkor 50mm f/1.4 lens is used as a reference for testing. In this section, the lens aperture ring is automatically rotated by a pulse motor to vary the aperture in precise increments.

ASA/ISO Adapter. It consists of the ASA/ISO dial section and special electrical probes. The ASA/ISO dial section automatically rotates the brush of the camera's functional resistance element (FRE) for inputting information about the film speed. The special probes make direct contact with fine wiring patterns on the FPC board to intercept the electronic signals sent to the LCD display. The purpose of this section is to test the accuracy of the displayed shutter speeds.

Shutter Dial Section. Automatic rotation of the shutter speed dial by pulse motor is provided by this section. In this way, manual shutter selection can be tested.

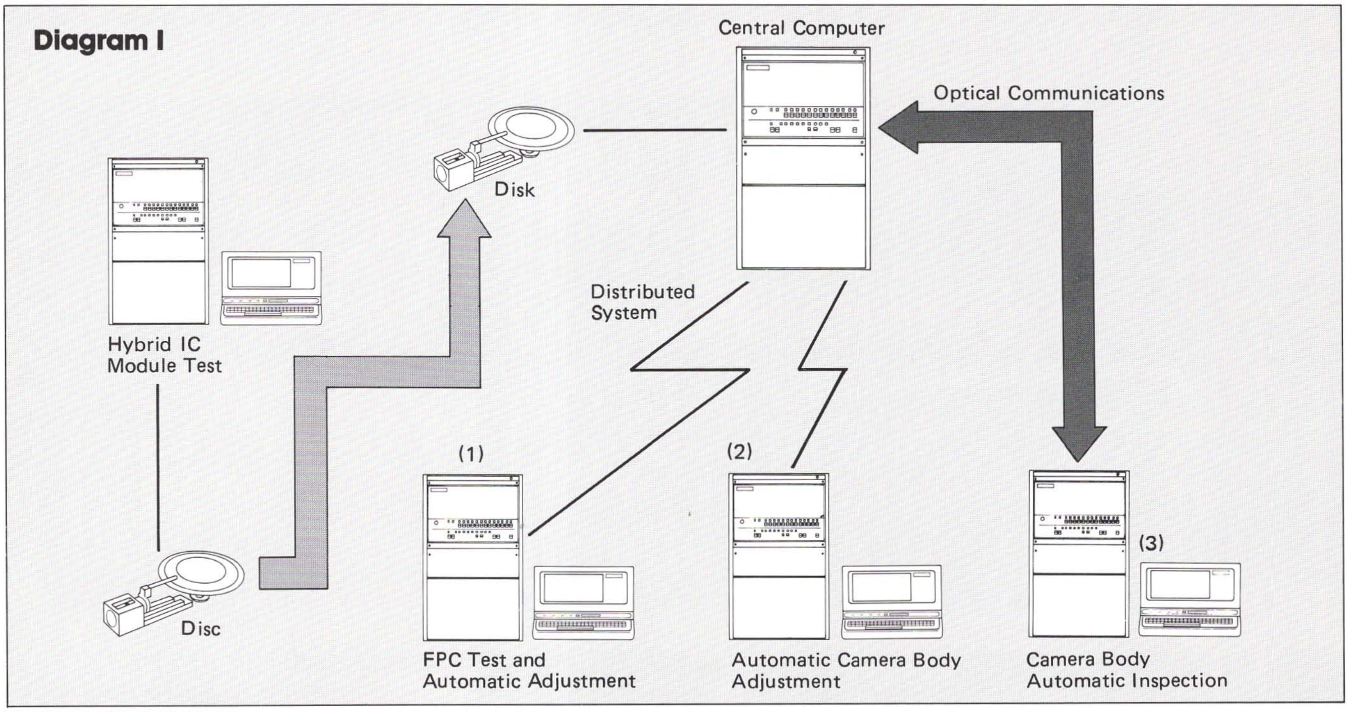
MD Section. Specially designed for this testing apparatus, the motor drive cocks and trips the camera's shutter in addition to checking the power ON-OFF circuitry.

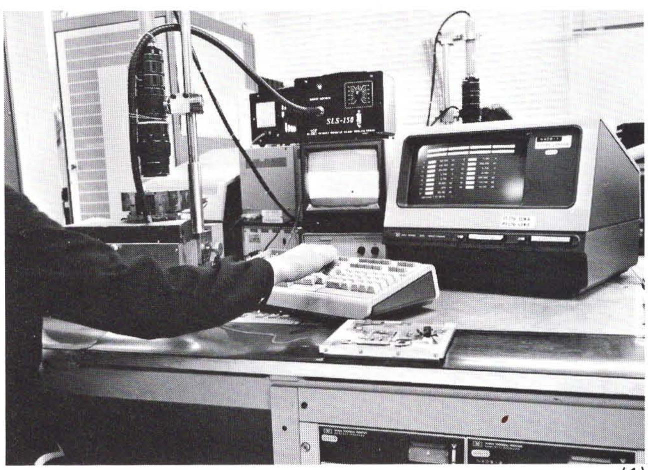
This testing apparatus displays the results on a Cathode-Ray-Tube (CRT) display and prints them out on paper for future reference.

The final stage of testing is called the ***Camera Body Automatic Inspection***. Using a task processor which is linked directly to the central computer via a sophisticated optical fiber communications system, the F3 is given a final intensive examination.

Computerized testing and adjustment of the Nikon F3 speeds up the assembly process tremendously and assures that every camera put on the market is operating as it should be.

Diagram I





(1)

(3)

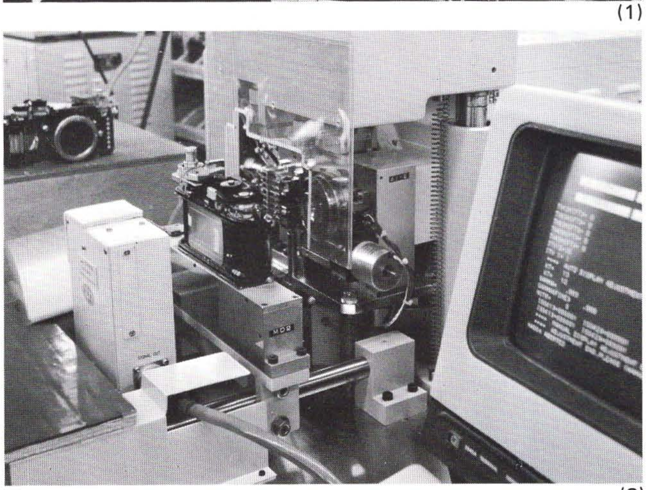


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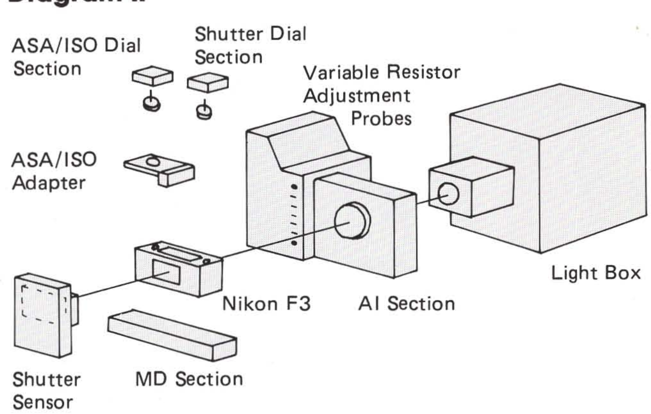
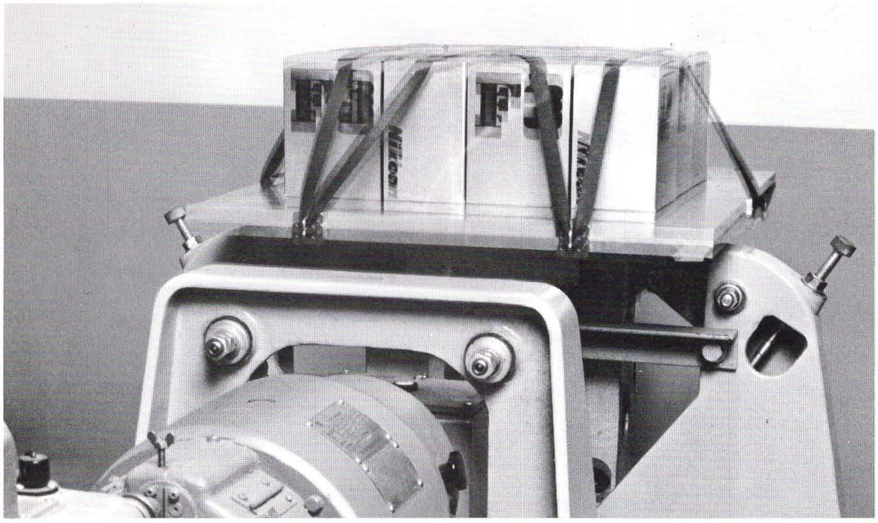
Diagram II



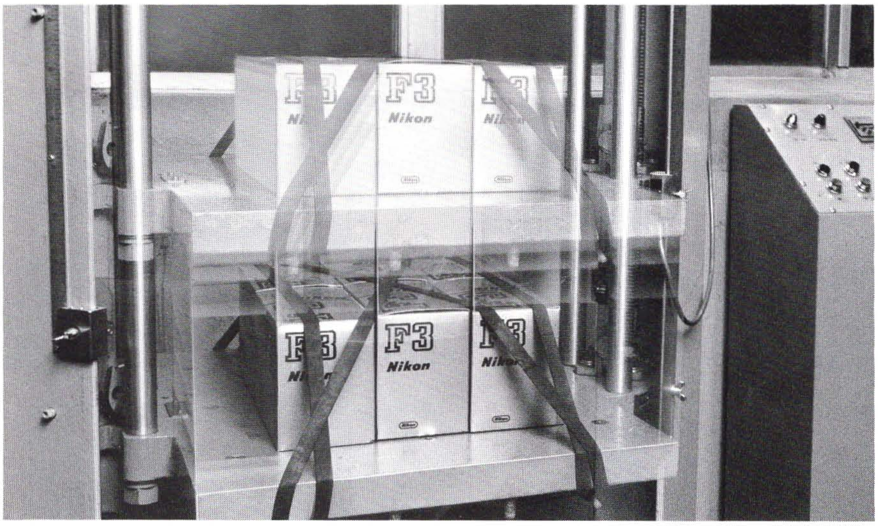
DURABILITY TESTING

To insure the durability of the Nikon F3 under actual operating conditions, cameras coming directly off the assembly line are subjected to a battery of special Nikon-developed tests.



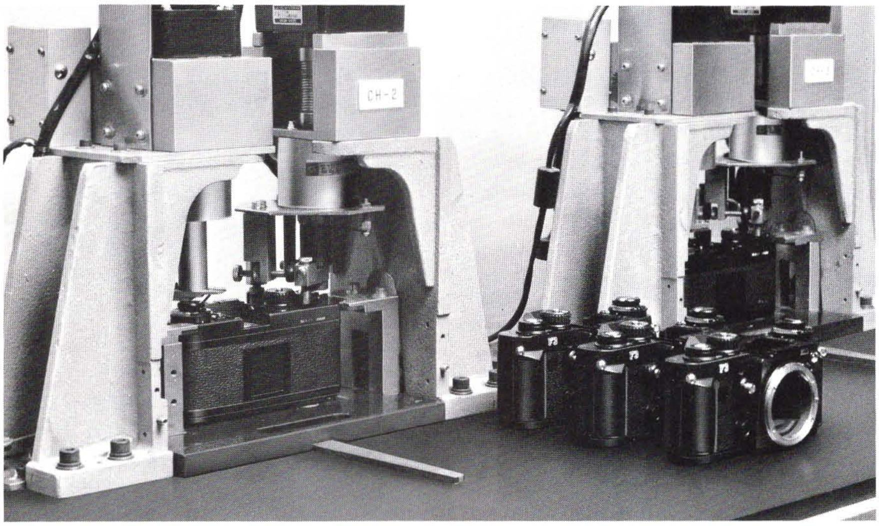
Vibration Test

Packed in their regular boxes, Nikon F3's are vibrated for one hour. This test shows the Nikon F3 can withstand the vibration encountered on various types of transportation vehicles, such as automobiles, trucks, trains, and airplanes, without its mounting screws or assemblies coming loose.



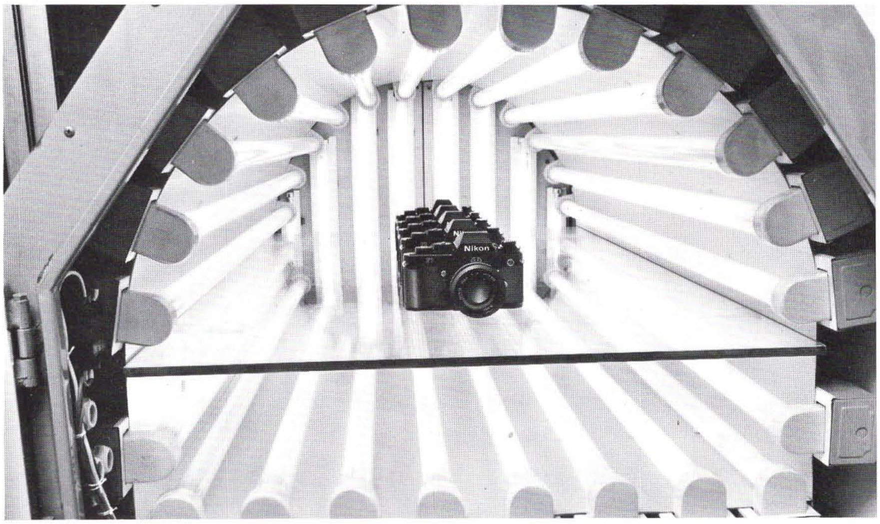
Shock Test

Again, with the cameras packed in their boxes, F3's are secured to a platform and then dropped. The acceleration of the impact is 90 G's.



Performance Test

To simulate actual operating conditions, the shutter is automatically released many times (using another Nikon-developed machine) to determine if all operations, such as film winding, film transport, and winding/rewinding torque, are as they should be. The result is that the Nikon F3 performs for more than 150,000 shutter firings.



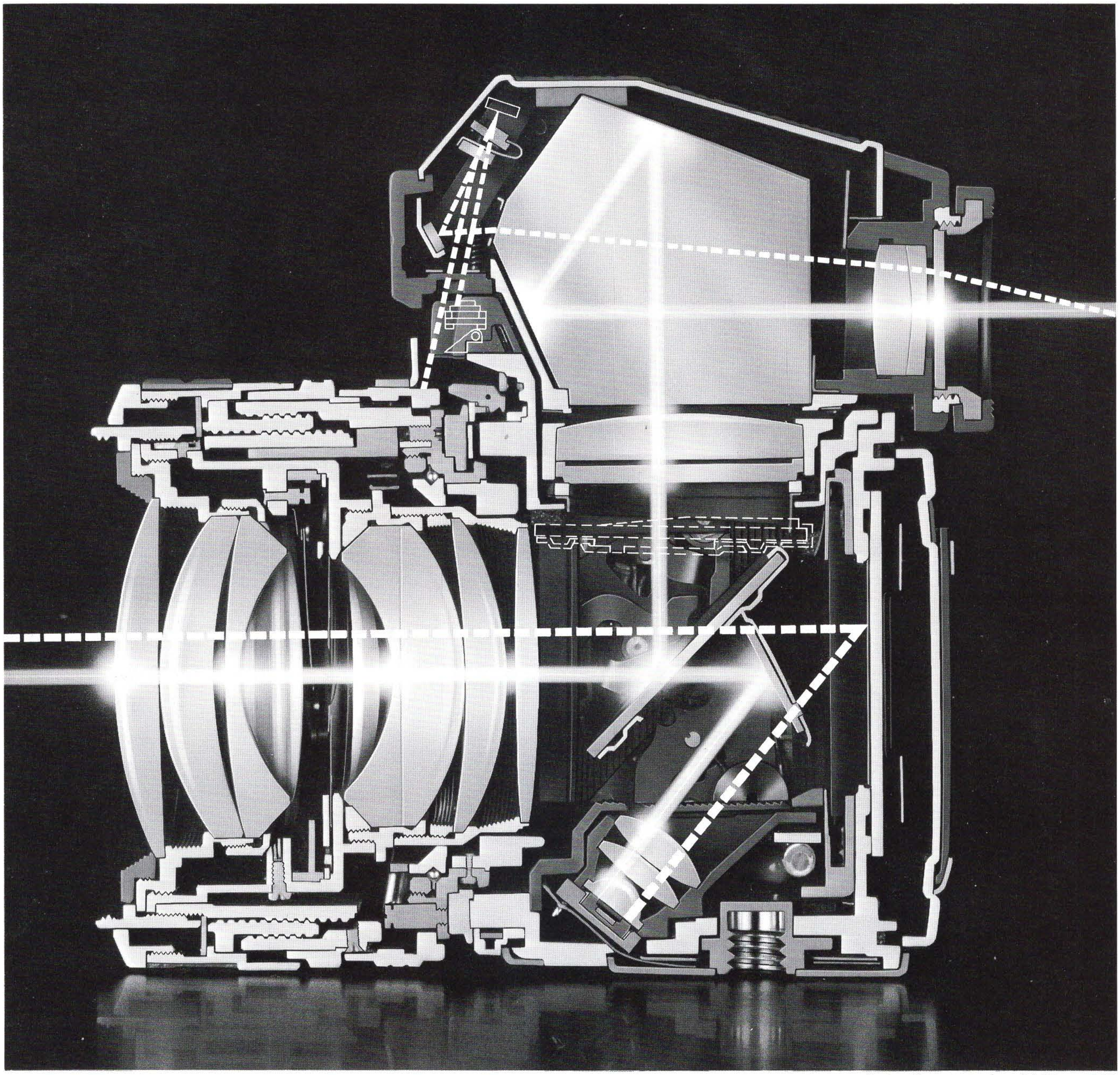
Light-Leak Test

A Nikon F3 is loaded with ASA/ISO 400 film and then placed in a box and subjected to 20,000 lux. of high-intensity illumination for a period of twenty minutes. The result shows that the F3 is absolutely light-tight; even high-speed film will not become fogged when exposed to a total of 400,000 lux·min.

Heat and Cold Test

Finally, the Nikon F3 is subjected to extremes of heat and cold. Placed in a special room to simulate tropical and arctic conditions, the camera is heated up to +70°C (158°F) and frozen at –40°C (–32°F). The results show that the F3's performance is not affected when the temperature remains at +70°C for one full day after which the camera is cooled down at normal room temperature for one day before testing. In the same way, the camera can withstand sub-zero temperatures of –40°C for one day and still operate flawlessly after its one-day warming-up period. Moreover, the F3's LCD is guaranteed to operate in the temperature range from +60°C down to –20°C (+140° to –4°F).

These are only small sample of the vigorous tests the Nikon F3 is subjected to.
They prove that the F3 can withstand the daily use and abuse given to it by professional photographers.



Actual cutaway of Nikon F3

The Nikon F3 utilizes a single silicon photodiode (SPD) for automatic and manual exposure control regardless of the finder in use. In previous Nikon cameras, the metering cell was located in the pentaprism and read the diffused light off the focusing screen. However, now the SPD is located in the camera body at the bottom of the mirror box and faces toward the rear; thus the light coming through the lens is measured ***on-optical-axis*** for more reliable exposure measurement. Other benefits of this system are that exposure measurement is virtually unaffected by stray light from the finder eyepiece, and it is no longer necessary to make exposure compensation when different focusing screens are used.

According to the photograph, this is how the system works: In continuous-light situations, light from the scene (indicated by a solid line) comes through the lens, strikes the reflex mirror, and is reflected up to the focusing screen and pentaprism for viewing. However, a small amount passes through the center portion of the mirror and is reflected off the secondary mirror and down to the SPD for exposure measurement. During electronic flash exposures (with the appropriate Nikon speedlight), the SPD reads the light (indicated by a wide broken line) reflected directly off the film itself, while the mirror is in the up position.

Pinhole Mirror

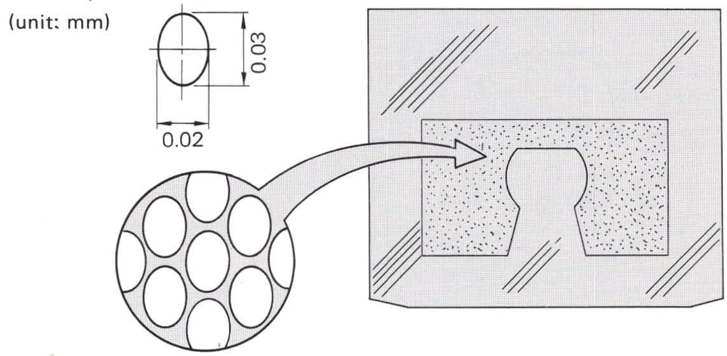
In a breakthrough in camera design, Nikon has created the world's first "pinhole" mirror ever to be used in a single-lens reflex camera. The F3's mirror contains some 50,000 randomly placed unsilvered areas (called "pinholes") which are located in the central rectangular portion. The pinholes are oval rather than circular in shape to compensate for the fact that light rays coming in through the lens strike the reflex mirror at an oblique angle. Each pinhole is exactly 0.03mm tall by 0.02 mm wide.

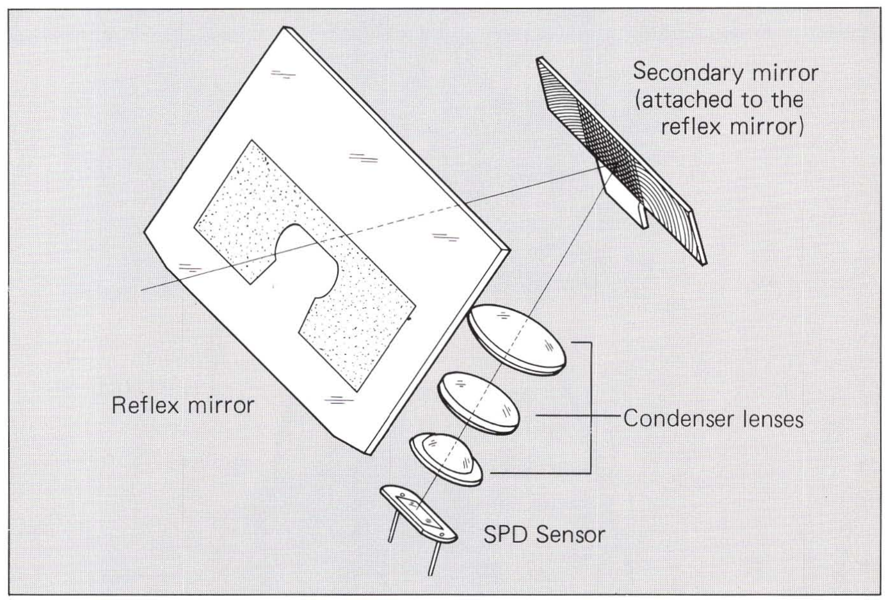
In the center of the pinholes is a completely silvered, keyhole-shaped area. The exact shape of this "keyhole" was determined by extensive testing and serves two purposes: 1) it reflects the maximum amount of light up to the center of the focusing screen to prevent darkening of the split-image and/or microprism focusing aid, and 2) it provides an extremely accurate meter reading even when different focal length lenses are used at the same aperture.

The pinhole area allows precisely 8% of the total amount of light striking the mirror to pass through. Again, after a variety of tests, Nikon determined that 8% is just the right amount of light to allow accurate metering without causing any darkening of the image in the viewfinder. For maximum brightness, the F3's pentaprism is silver coated, whereas the finder eyepiece and cover glass are multilayer coated, using Nikon integrated coating (NIC).

When compared with traditional semi-silvered or half mirrors, Nikon's pinhole mirror has the following advantages:

1. All colors of the spectrum, regardless of their wavelength, are allowed to pass through the mirror in equal proportion. This means that the light striking the metering cell is the same color as that striking the film, so the meter reading is more accurate. In addition, there is no unnatural color cast in the viewfinder.
2. The transmission ratio (the ratio of light transmitted through the mirror to that reflected back by it) is always constant, because the size and shape of the pinholes are the same throughout. With a semi-silvered or half mirror, the transmission ratio is likely to vary.
3. There is no problem when using standard polarizing filters. With a semi-silvered mirror, the polarized light is not allowed to pass through in the correct proportion, thus causing an incorrect meter reading. However, with the pinhole design, polarized light can pass through freely.





Secondary Mirror

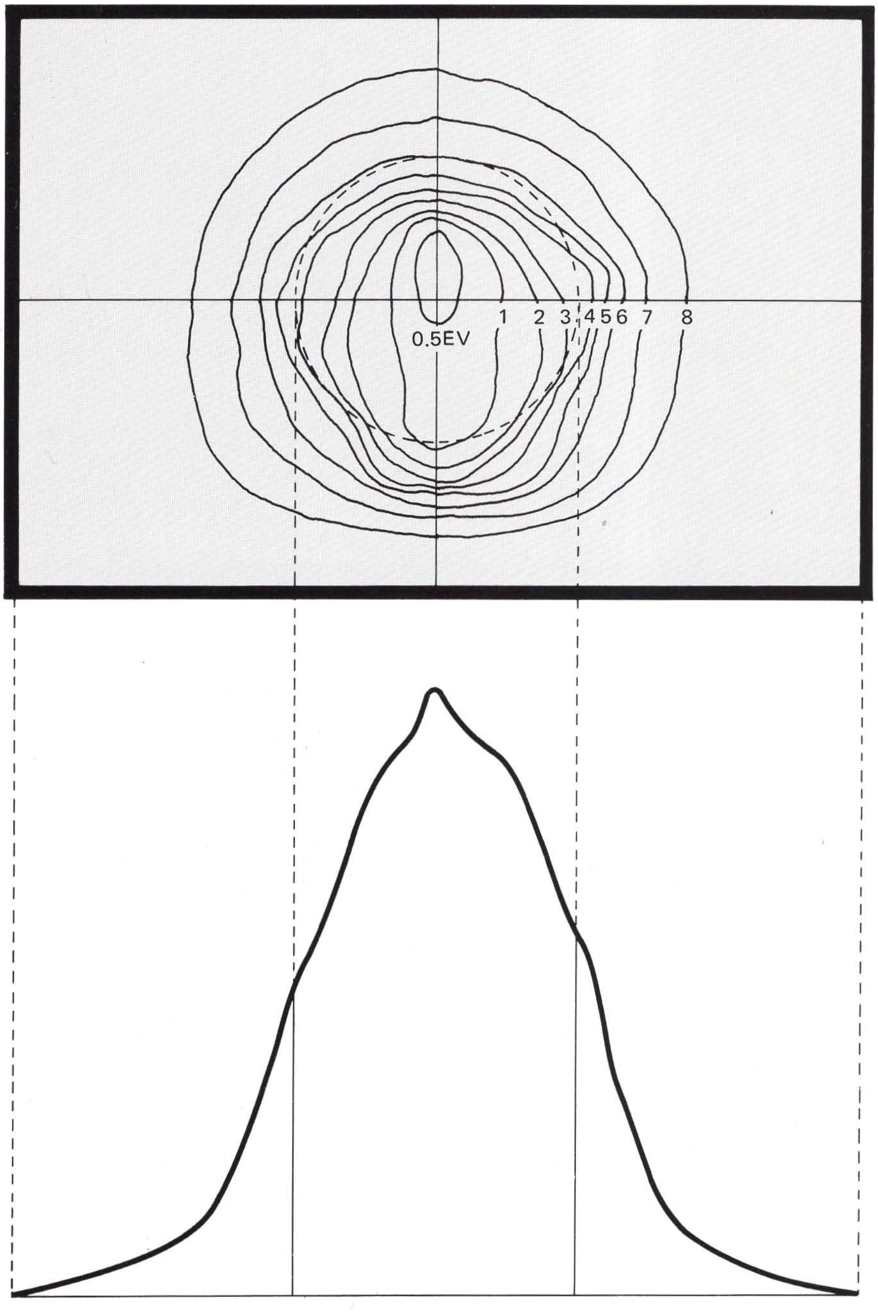
Directly behind the main mirror and hinged to it is the secondary mirror. The purpose of the secondary mirror is to reflect and focus light down to the SPD. The mirror is composed of four parts: two outer wings and two central portions. Each wing contains a Fresnel lens which concentrates the light in toward the center, while the two center portions serve to diffuse the light in a random pattern. The combined effect of all four sections insures that, regardless of the lens in use, the same amount of light will always be directed to the SPD for accurate metering.

Silicon Photodiode (SPD)

With the SPD cell at the base of the mirror box and facing toward the rear, why didn't Nikon use the direct off-the-film reading system for normal continuous-light exposures? There are two main reasons:

1. A highly concentrated center-weighted metering pattern is virtually impossible to achieve when the light is read directly off the first shutter curtain and/or the film itself.
2. Because metering is done during the actual exposure, an exposure memory lock cannot be incorporated into the camera's design.

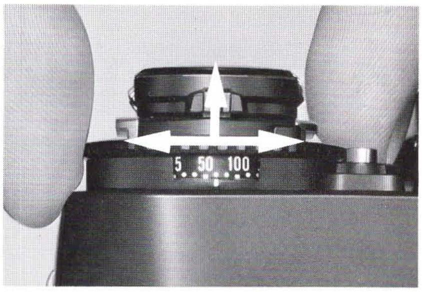
In front of the SPD are three multi-coated condenser lenses which focus the light. The top lens is aspherical and was first employed in the Nikon F Photomic T Finder as early as 1965 to produce a center-weighted pattern. These condenser lenses as well as the secondary mirror are responsible for the F3's strongly center-weighted metering sensitivity pattern.



Center-Weighted Pattern

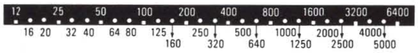
Departing from Nikon's traditional 60%-40% center-weighted pattern, the Nikon F3 concentrates ***80%*** of its sensitivity into the 12mm-diameter circle found in the center of most focusing screens; the remaining 20% is also highly center-weighted with almost no sensitivity at the edges of the screen.

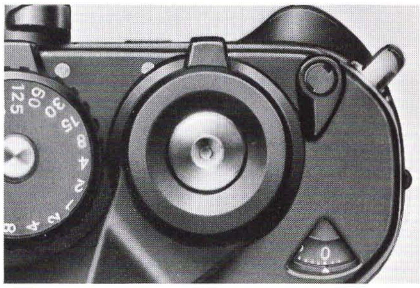
This new center-weighted metering pattern was developed to meet the demands of serious photographers who shoot under a variety of lighting conditions and want to know exactly what they are metering. For the exact sensitivity pattern with the standard 50mm lens, refer to the diagram above.



ASA/ISO Film Speed

The Nikon F3 allows setting of any film speed from ASA/ISO 12 to 6400. Speeds are numbered 12, 25, 50, 100, etc. with intermediate speeds, such as 64 and 80, indicated by two dots in between each pair of numbers. The table shows all the ASA/ISO film speeds.

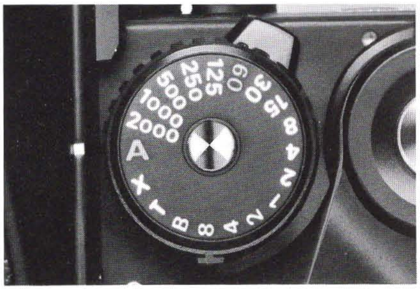




Shutter Release Button

When depressed halfway, the shutter release button on the Nikon F3 turns on the meter. After pressure is removed from the shutter release button, the meter circuit stays on for exactly 16 seconds, turning itself off automatically to conserve battery power. To prevent accidental shutter release, the shutter release button can be locked using the lock lever. The button is threaded in the center for use with a standard cable release, such as the Nikon Cable Release AR-3.

AUTOMATIC EXPOSURE CONTROL



The F3 uses the proven method of aperture-preferred automatic exposure control first introduced in 1972 on the Nikkormat EL. In this system, the photographer presets the ASA/ISO film speed and selects a shooting aperture. Then the camera's metering system takes over from there, automatically selecting the precise shutter speed necessary for correct exposure. With the shutter speed dial locked at the A setting, continuously variable shutter speeds ranging from 1/2000 sec. to 8 full seconds are possible. Thus, if a shutter speed of exactly 1/432 sec. is required at a particular aperture, that's what is provided by the electromagnetically controlled shutter.

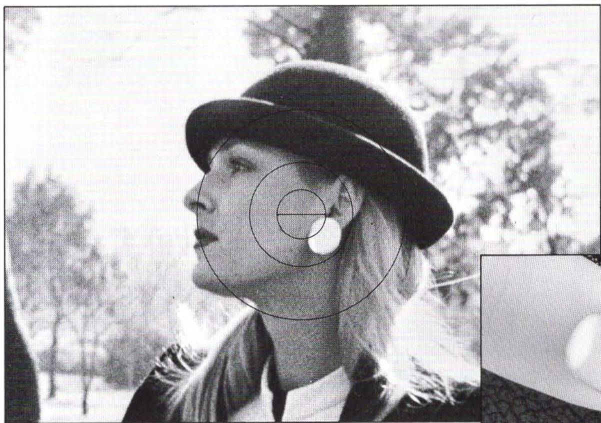
At the time of its introduction in the spring of 1980, the Nikon F3 was the first automatic exposure camera with ***both*** interchangeable finders and focusing screens to retain its automation regardless of the finder in use. This was possible by incorporating all the necessary electronics, including the metering cell, into the camera body rather than putting them into a special finder as was the practice in the past.

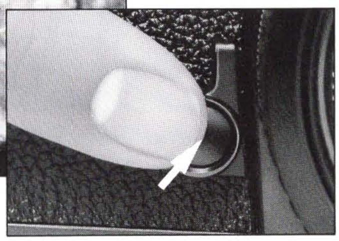
Exposure Memory Lock

Unlike some other automatic-exposure cameras on the market today, the F3 allows the photographer to lock in an exposure meter reading on Automatic. Even with the shutter speed dial locked at the A setting, the photographer still has control over his exposures. In situations where the light is coming from the rear, he can move in close to his subject and take a close-up reading of the face. Then, by depressing the exposure memory lock button (while the metering system is on), the exposure can be retained while he moves back and shoots. As long as the button is depressed, the automatically selected shutter speed is "frozen" into the metering circuit. Moreover, the shutter speed displayed in the viewfinder does not change during memory lock operation.

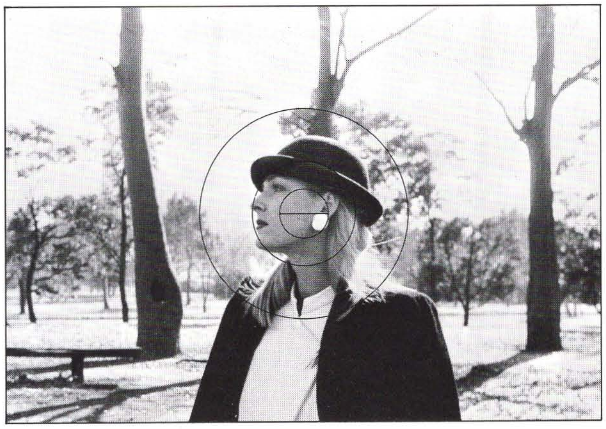
250 5.6

60 5.6



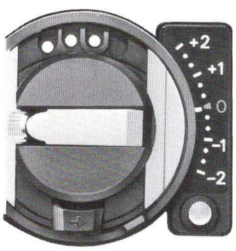


60 5.6



Exposure Compensation

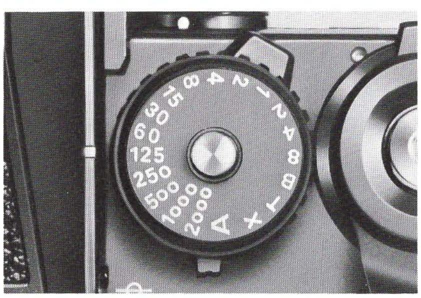
With the Nikon F3 on Automatic, the photographer can modify the overall meter reading by using the exposure compensation dial. Graduated in one-third increments from +2 to −2 EV, this dial is used to create intentional over- or underexposure. (At ASA/ISO 12, it is possible to set the dial only up to +1 EV; at ASA/ISO 6400, only −1 EV can be set.) For special effects or whenever the scene is predominately light or dark in tone, it is necessary to make compensation. The following chart gives some examples of typical shooting situations and the amount of compensation needed.



EXPOSURE COMPENSATION CHART

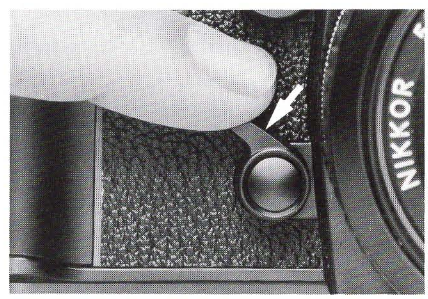
Scale	Exposure Correction	Application
+2	2 f/stops overexposure	White background, snow scene
+1	1 f/stop overexposure	Backlit subject, white background occupying half of viewing area
0	Normal	Most picture-taking situations
−1	1 f/stop underexposure	Spotlighted subject, black background occupying half of viewing area
−2	2 f/stops underexposure	Black background

MANUAL EXPOSURE CONTROL



In addition to automatic exposure operation, the Nikon F3 offers manual selection of all shutter speeds, which are quartz timed for extreme accuracy. By depressing the lock button located in the center of the shutter speed dial and rotating the dial off the A setting, any one of 15 discrete shutter speeds ranging from 1/2000 sec. down to 8 full seconds can be selected. Unlike the Nikon F2, intermediate shutter speeds cannot be set. Three other settings on the dial are also possible: B, T, and X. B (BULB) is the traditional setting used when making exposures of longer than 8 seconds by using a cable release. At the T (TIME) setting*, the shutter remains open until the dial is rotated to another setting, thus allowing time exposures to be made without a cable release. Finally, the X (X-SYNC) setting provides the correct synchronization speed of 1/80 sec. for use with electronic flash units other than the Nikon Speedlight SB-10, 11, or 12. As a safety feature, the shutter speed dial is locked at the X setting to prevent the dial from being inadvertently moved while shooting flash pictures.

* The shutter must be tripped with the back-up mechanical release lever when the metering system is off; otherwise battery drain will occur for as long as the shutter remains open.

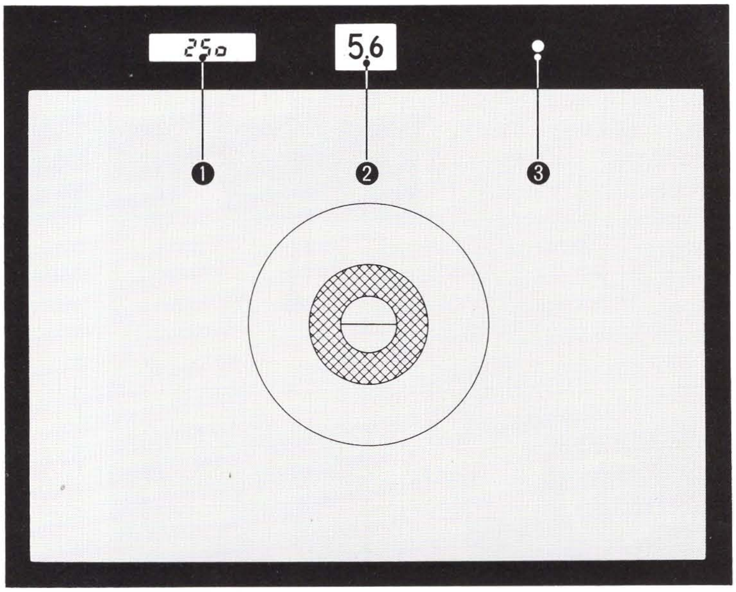


Backup Mechanical Release

In the event of battery failure, the F3's electronic shutter release button ceases to operate. However, the shutter can still be tripped by using the back-up mechanical release lever. The shutter speed is completely mechanical and approximately 1/60 sec. In addition, with the shutter speed dial set to T, time exposures should be made by using this lever.

VIEWFINDER INFORMATION DISPLAY

All information needed for taking photographs is displayed in a logical and easy-to-see manner in the Nikon F3's viewfinder above and ***outside*** the picture area for unobstructed viewing. From left to right are the liquid crystal display (LCD) of the shutter speed, the aperture direct readout (ADR) of the f/number set on the lens, and the LED electronic flash ready-light.

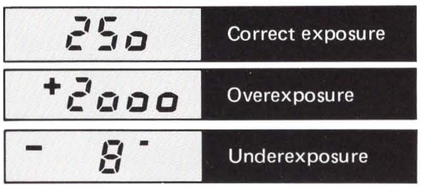


Liquid Crystal Display (LCD) ❶

On Automatic

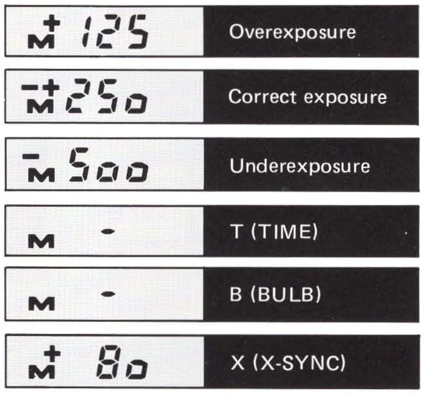
Even though continuously variable shutter speeds are provided at the automatic setting, the discrete shutter speed which is closest to the one automatically selected by the camera is displayed. The reason: the actual shutter speed, for instance 1/734 sec., would be difficult to understand at a glance. Moreover, the response time of the LCD to rapid changes in lighting has been intentionally limited to 1/2 sec., so as not to distract the photographer with a constantly changing number.

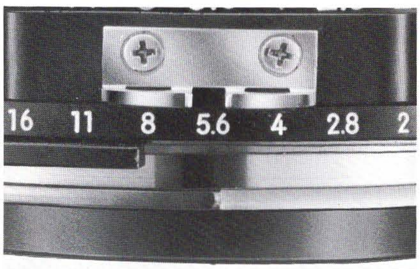
Each shutter speed from 1/2000 sec. to one second is indicated in the display by a whole number—for example, 1/250 sec. is displayed as 250. Speeds longer than one second are indicated with a whole number followed by a raised dash (⁻). Thus, 8 seconds is shown as 8⁻. Overexposure at the selected aperture on Automatic is signaled by a ⁺2000 display, whereas underexposure is shown as – 8 .



On Manual

To indicate when the F3 is in the manual mode, an M appears in the LCD just to the left of the displayed shutter speed. In addition, a – or + above the M indicates under- or overexposure by 1/4 stop or more, respectively. If both the – and + appear together, that indicates the exposure is correct. With the dial set to either B or T, an M – appears. At the X setting, M⁺ 80 is displayed.



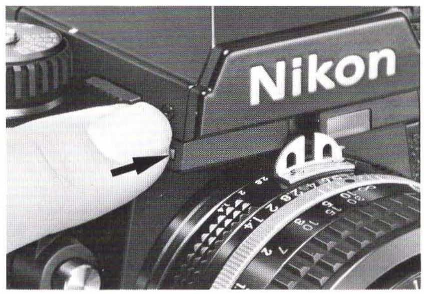


Aperture Direct Readout (ADR) ❷

Using the same method as other recent Nikon cameras, the Nikon F3 provides a viewfinder display of the f/stop set on the lens. All current Nikkor and Nikon Series E lenses have a small ADR scale at the rear of the aperture ring which corresponds to the f/numbers. This ADR number is then projected through the ADR window, which is located in the center of the LCD block, to provide the f/stop display inside the viewfinder.

LED Flash Ready-Light ❸

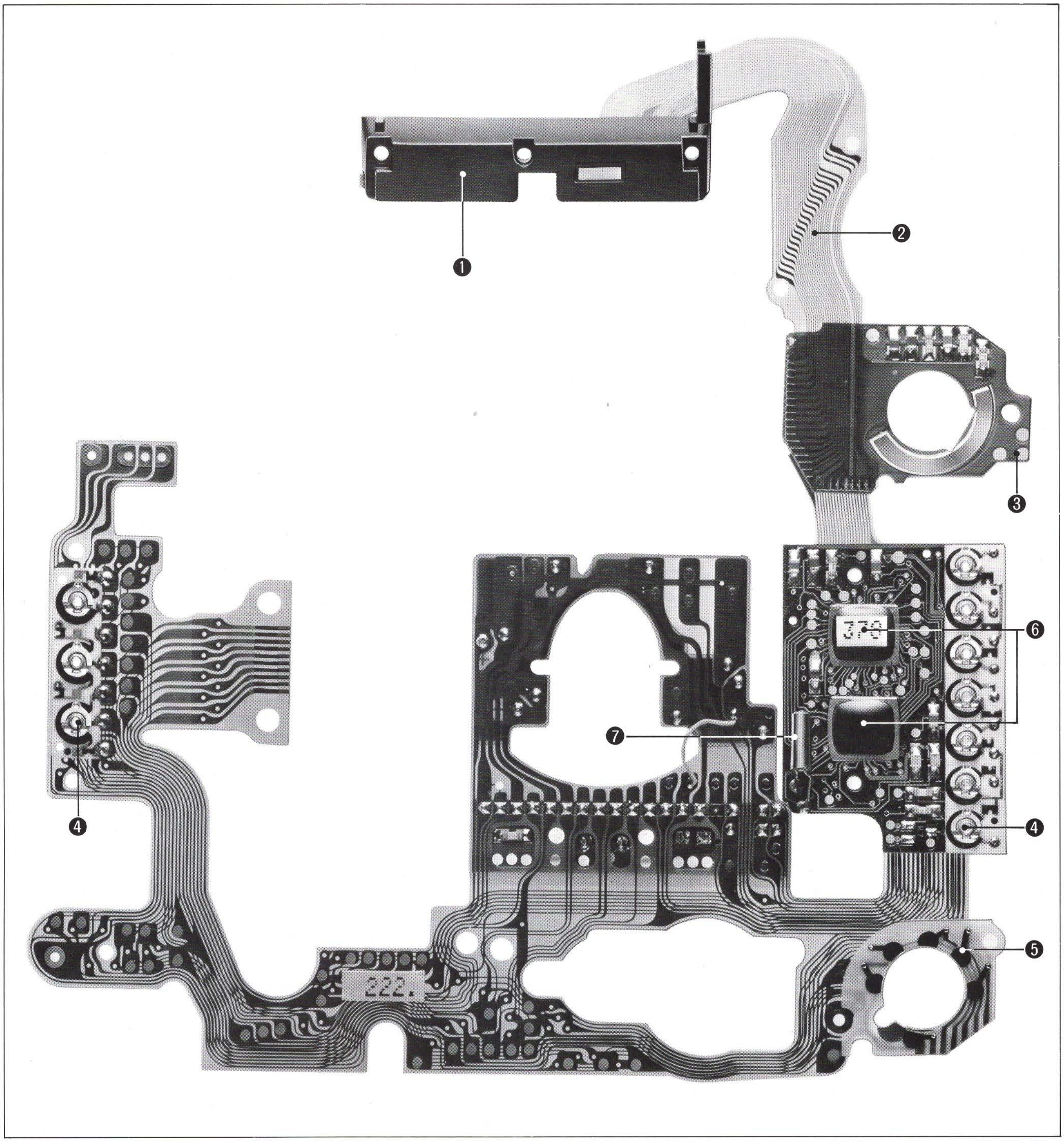
The third bit of information provided in the Nikon F3's viewfinder is an LED electronic flash ready-light. When used with the Nikon Speedlight SB-10, 11, or 12, the LED lights up when the flash unit is recycled and ready to fire. For more information, please refer to the Speedlight section of the *NIKON F3 TECHNICAL MANUAL–ACCESSORIES.*



Viewfinder Illuminator

Because the LCD and ADR scale on the lens depend on ambient light for visibility, the Nikon F3 has a tiny built-in illuminator, which allows viewing of the exposure information in dim light or at night. To activate the viewfinder illuminator, the red illuminator button must be pushed when the meter is on and the shutter speed is actually displayed; otherwise, the illuminator will not operate.

DATA PROCESSING



❶ Liquid Crystal Display (LCD) Block
LED electronic flash ready-light
Aperture direct readout (ADR) window
LCD panel

❷ FPC Ultra-Fine Wiring Pattern
The thickness of the wires leading to the LCD block is only 0.15mm, which is close to current manufacturing limitations

❸ Speedlight Hot-Shoe Contact

❹ Variable Resistor Ceramic Strips

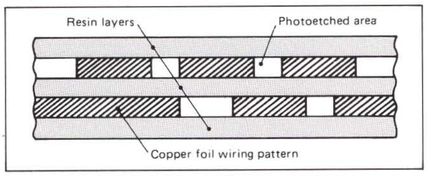
❺ Motor Drive Connector

❻ IC's

❼ Quartz Oscillator

In creating the F3's electronic circuitry, Nikon had three goals in mind: low battery power consumption, low voltage operation, and high reliability. To realize these aims, Nikon utilized the most up-to-date microelectronics technology available today for processing of all data. Instead of using a number of separate electronic components which require connection with soldered wires, the F3 uses the "chip on board" technique to bond each IC chip directly to a rigid substrate. These substrates are then bonded onto a flexible printed circuit board using infrared soldering, an exclusive technique originally developed by NASA for use in the United States space program.

"Chip on board" is used to produce three hybrid IC modules in the F3. They are called the Exposure Measurement and Auto Control IC Module, the Quartz Control IC Module, and the LCD Control IC Module. Creating such IC modules not only saves space and contributes to more reliable performance, but also reduces assembly time and cuts labor costs.



Cross-sectional diagram of FPC board

Flexible Printed Circuit (FPC) Board

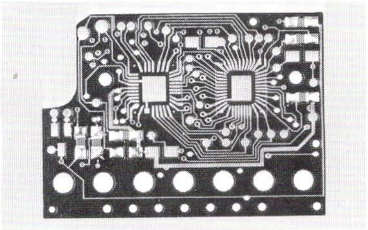
Nikon's multilayer FPC board is composed of two thin sheets of copper foil (each approx. 35 microns thick) separated by three layers of a resin. The total thickness of the FPC board is approx. 0.2mm. To preserve the upmost clarity of detail, a high-resolution Ultra-Micro Nikkor lens is used to print intricate patterns in the same way it's used in manufacturing IC's and LSI's.

The FPC board is utilized in the F3, because it has a number of advantages over rigid circuit boards:

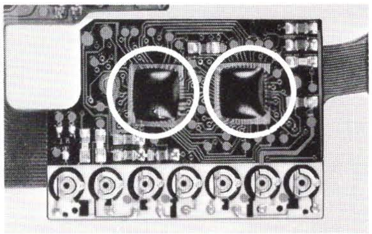
1) An FPC board is very thin and can be etched on both sides with separate wiring patterns, thus allowing many more microelectronic components to be incorporated into the same amount of space.
2) Because all wiring is included on the FPC board, it eliminates the need for connecting wires and the traditional soldering techniques required. This results in an increase in reliability and a saving in labor costs.
3) An FPC board is not susceptible to environmental effects, such as moisture and dust, because the board is sealed in the resin.
4) An FPC board is flexible and scratch-resistant. Therefore, it can be bent to fit around components, thus taking up less space and contributing to more compact camera design.

General Information about "Chip on Board" Technique

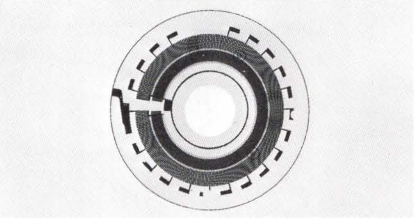
Ordinarily, microelectronic components, such as IC chips, must be wired into the circuitry one by one. However, by utilizing a technique called "chip on board," tremendous savings in space and assembly time are possible. "Chip on board" means exactly that: the IC chip is mounted directly onto a single rigid board or substrate. First, the IC chip is bonded onto the substrate. Then, the IC's bonding pads are wired to the substrate's wiring patterns using the latest automatic soldering method, called "gold wire bonding." Gold is extremely high in conductivity. In addition, gold doesn't corrode, therefore, the soldering is not likely to cause a change in the IC's performance over a long period of time. Finally, to protect the IC chip from moisture and dust, it is encased in a layer of epoxy resin.



Rigid substrate containing wiring patterns

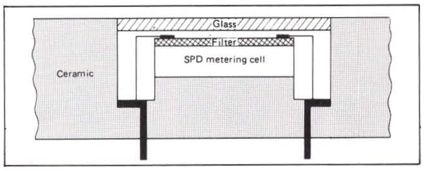


Rigid substrate after "chip on board" technique



Functional Resistance Element (FRE)

One bit of information sent to the Exposure Measurement and Auto Control IC Module is in the form of a resistance value. Converting the ASA/ISO film speed, lens aperture, and exposure compensation into a single input, the FRE is an important element in the Nikon F3. Developed exclusively by Nikon, the FRE consists of a metallic thin-film resistor sealed by a layer of silicon oxide and then placed on a 1mm-thick hard glass baseplate. Through the use of gold alloy in its conductive taps and noise-free brushes, it is virtually impervious to environmental effects. Furthermore, because the brushes slide over the taps instead of touching the resistor itself, there is no change in resistance value even after years of operation.



Silicon Photodiode (SPD)

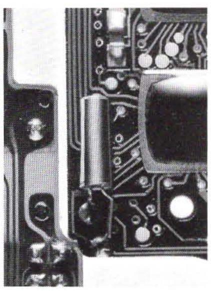
A second bit of information sent to the Exposure Measurement and Auto Control IC Module is provided by the SPD. The SPD is actually a solar battery, meaning that when light strikes it, electricity is produced. Because the current generated is in direct relation to the amount of light striking the diode, the SPD is very reliable as a light metering cell. Other reasons why an SPD was used include the following: 1) it has extremely fast response to changes in light levels, 2) its spectral response is very flat and can be made to match that of the human eye through the use of a filter, and 3) it produces accurate meter readings even after being exposed to very bright light sources, such as when the camera is used to take pictures of the sun itself.

Exposure Measurement and Auto Control IC Module

The first of the three IC modules used in the Nikon F3's circuitry, the Exposure Measurement and Auto Control IC Module consists of two IC's plus other elements, such as chip and variable resistors.

One IC functions as a logarithmic compressor/progressor. Because the current produced by the SPD is so miniscule, it must be logarithmically compressed and progressed to convert it into voltage for computation. This IC is ideally suited for dealing with such small currents.

The other IC takes the resistance value of the FRE and the logarithmically progressed voltage supplied by the logarithmic compressor/progressor and computes the exact voltage corresponding to the correct automatic shutter speed.

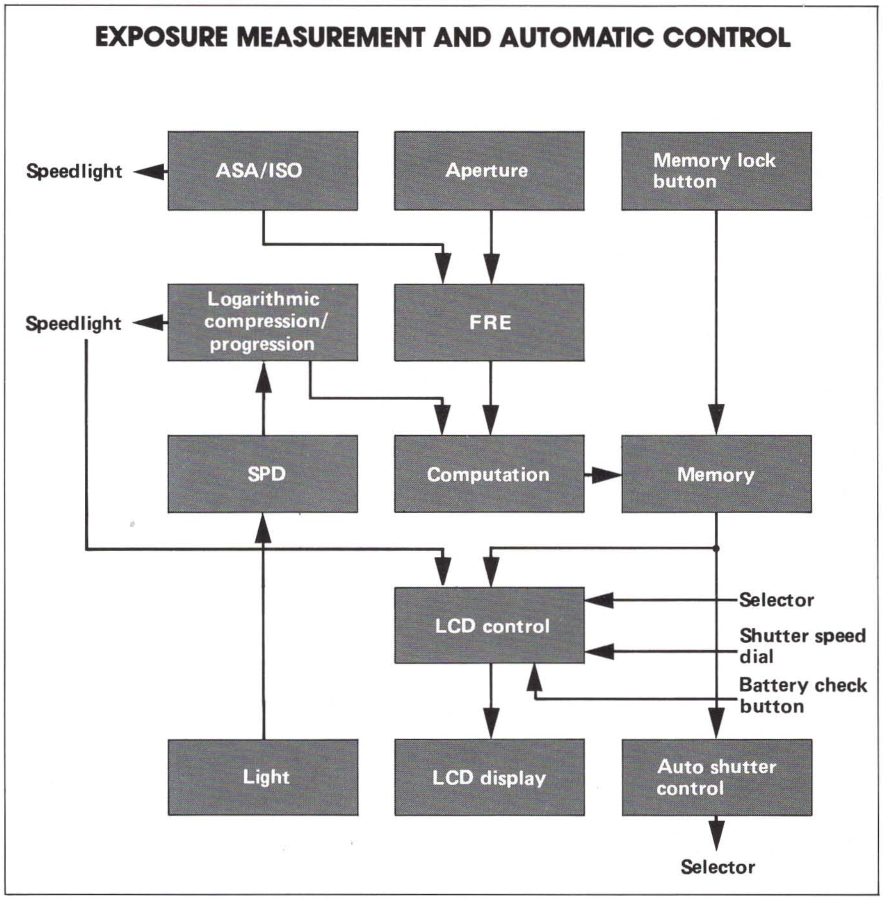


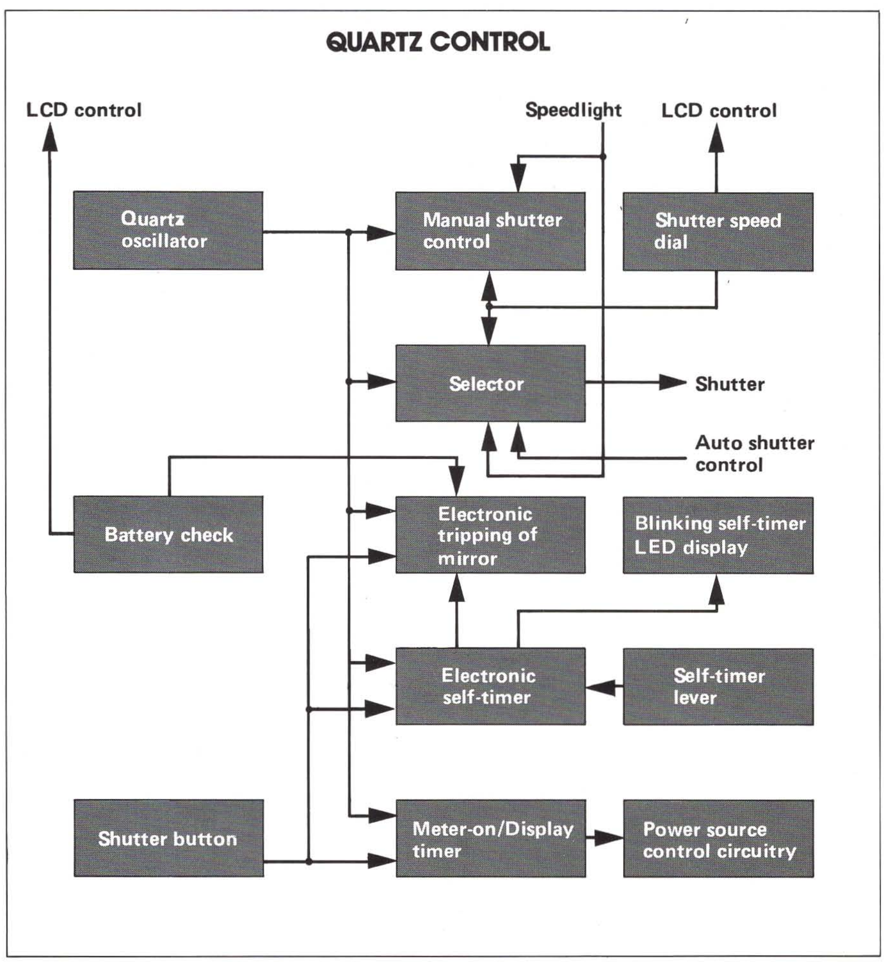
Quartz Control IC Module

The second IC module used in the F3 is the Quartz Control IC Module. It consists of a quartz oscillator, two IC's, and other elements, including chip condensors and resistors.

For unparalleled precision, a quartz oscillator is used as an electronic clock. Its purpose is to establish a standard frequency of exactly 32,768 cycles per second (Hz) which is then used for timing of many camera functions. Unaffected by temperature, humidity, or spurious vibration, quartz provides years of trouble-free performance. The function of the first IC is to divide and count down the quartz oscillator's standard frequency of 32,768Hz to obtain precise timing. Consuming little battery power and virtually immune to electrical noise, this IC is responsible for the electronic accuracy impossible to obtain by mechanical means.

The second IC digitally controls the timing of all manual shutter speeds. In addition, the self-timer's 10-sec. delay, the meter-on and LCD display period of 16 sec., as well as the picture-taking mode selector, mirror box combination magnet, and other sequential operations are also quartz timed.





Liquid Crystal Display (LCD) Block

In another breakthrough in camera design, the Nikon F3 is the first camera in the world to employ the LCD for its exposure readout. Why was LCD selected? First, because it doesn't emit light, the LCD is easy on the eyes and can be viewed for long periods without causing fatigue. Second, the LCD is *very* low in battery power consumption. For example, an LCD uses approximately 1/10,000 the amount of power needed to drive an LED.

To meet the design criteria of a professional-grade camera, the LCD used in the Nikon F3 has excellent contrast, fast response time in cold weather, and extremely low battery power consumption. Nikon then arranged the liquid crystal to provide up to a four-digit indication of the shutter speed, as well as the M, + and – signs. To match the compact dimensions of the camera, the digits are only approx. 1mm high or approx. ***one-forth*** the size of those used in a standard LCD wristwatch. In the F3, the LCD module is located at the front edge of the mirror box just below the pentaprism to provide a magnified image of the display in the viewfinder.

Nikon's LCD is designed to operate in an extremely wide range of temperatures from +60 to –20°C (+140 to –4°F). However, when the temperature goes above 60°C, the whole surface of the LCD turns black and becomes impossible to read; but it returns to normal when the temperature drops. And when the temperature falls below 0°C (32°F), the LCD's response time becomes longer, but then returns to normal when the temperature rises. To prevent permanent damage to the LCD, the F3 should not be stored in excessively hot places, such as the trunk of a car during the summer.

Under normal conditions, the LCD used in the Nikon F3 should last for more than seven years, after which time, replacement can be made.

General Information about Liquid Crystal

Liquid crystal is exactly what its name implies: it is an organic compound that exhibits both liquid and crystalline properties. There are many varieties of liquid crystal, but the one usually used for information display is of the "twisted nematic" type. In the normal state, its molecules are arranged in a helix which is twisted 90°. However, when a voltage is applied, the molecules become rearranged, so that the twisted helix disappears. Now, if this liquid crystal is sandwiched between a pair of polarizers at right angles to each other, the system will have the ability to pass or block light. Normally, the light coming through the first polarizer is rotated 90° by the liquid crystal, so that it can pass through the second polarizer; thus the area looks transparent (Fig. 1). However, when an electrical potential is applied, the light passing through the first polarizer is not rotated and is therefore blocked by the second polarizer. When this happens, the area becomes opaque and appears dark (Fig. 2). For each digit in a display, liquid crystal is usually arranged in a pattern of seven tiny sealed segments with transparent electrodes connecting them to the power source (Fig. 3). By applying voltage to the right combination of segments, any digit from 0 to 9 can be produced.

Fig. 1

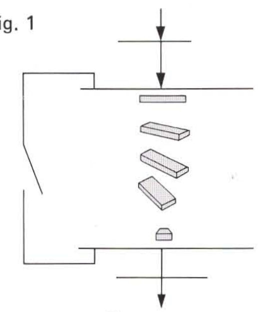


Fig. 2

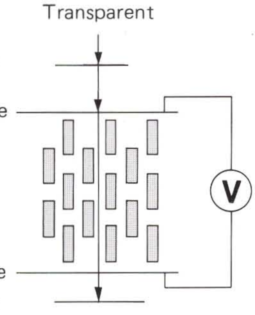
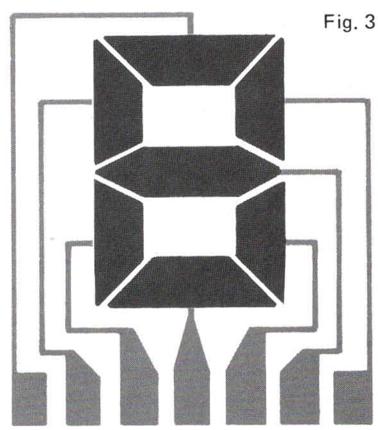


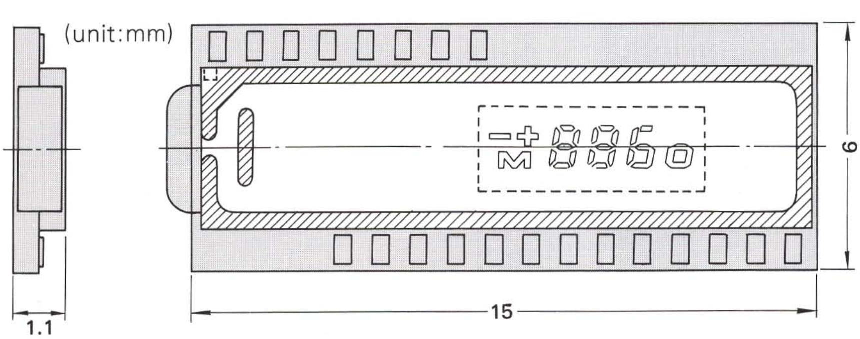
Fig. 3



LCD Control IC Module

The third IC module is the LCD Control IC Module. Consisting of two IC's, this module controls the digital display of shutter speeds, plus the M, + and – symbols in the LCD panel.

One IC works as the analogue to digital converter. It converts the analogue voltage corresponding to the correct automatic shutter speed into digital information which determines the shutter speed displayed by the LCD. The second IC is the LCD driver. It generates the digital signals used to control each individual segment in the LCD display. Very low in battery power consumption, this IC is not susceptible to input noise, making the digital display extremely accurate.



To match the sophisticated electronics of the F3, Nikon has gone back to the drawing board to redesign many of the mechanical components of the camera.

Film Winding Mechanism

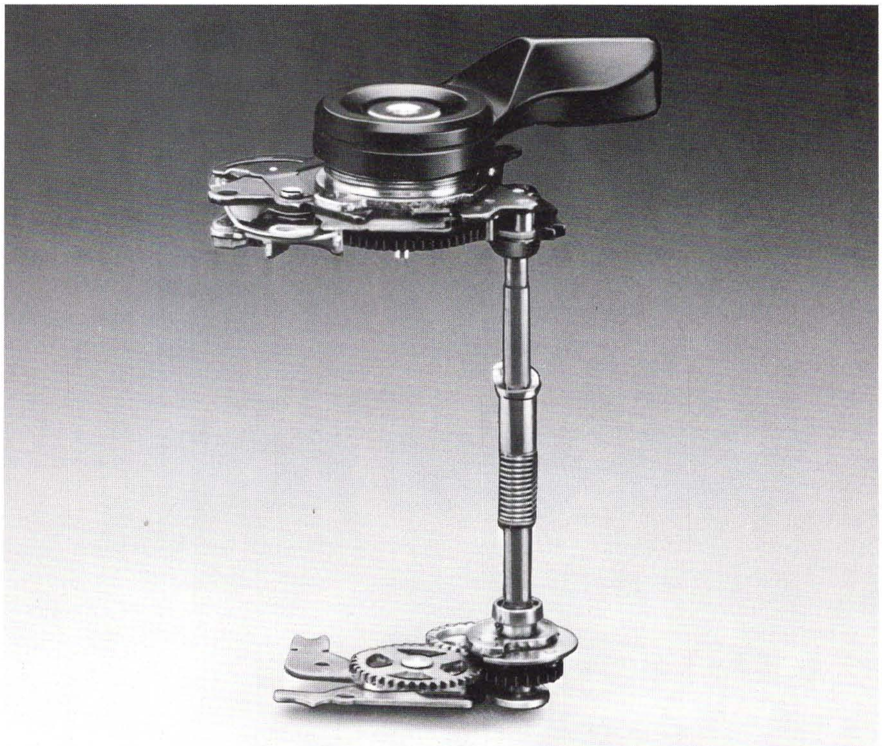
For reduced winding torque, the F3 features an entirely new film winding mechanism. By the liberal use of *ball bearings,* film winding is now much smoother. Furthermore, the main winding axis is no longer directly between the film advance lever and the takeup spool, but has been moved off center through the use of a special *connecting shaft*. This connecting shaft allows the axes of the shutter drum, film sprocket, and takeup spool to be placed very close together, thereby simplifying the gear trains between them. To prevent wobble and increase rotational efficiency, the connecting shaft was made as long as possible, while its bearings were spaced far apart. All these factors contribute to more efficient energy transmission with a substantial reduction in torque. Even when the F3 is loaded with a 36-exposure roll of film, winding torque is virtually the same as when there is no film in the camera.

But why is a reduction in torque so important? Of course, it makes the film advance lever easier to operate. But more importantly, it conserves battery power and increases the firing rates possible when the MD-4 Motor Drive is used. And remember, one of the main design objectives of the Nikon F3 was low battery power consumption.

An additional advantage of using a connecting shaft is that two important mechanical operations are now performed by this shaft without affecting the delicate shutter mechanism. They are the resetting of the mirror box combination magnet armature (see diagram I) and the cocking of the mirror spring tensioning lever (see diagram VIII on page 33).

Finally, to speed up the manufacturing process, the winding mechanism, including the shutter button, film advance lever, and frame counter, is preassembled in a separate Nikon plant before reaching the main assembly line.

Referring to diagram II, this is how the film winding mechanism works: Stroking the film advance lever(1) in direction A rotates takeup gear(2) in direction B by way of clutch(3) and roller (one-way clutch)(4). This power rotates gear(5) and incomplete gear(6)



and reaches gear(7) through the connecting shaft(8). As incomplete gear(6) rotates controlling gear(9) to cock the shutter, gear(7) drives sprocket gear (10). This in turn drives spool idle gear(11), and spool gear(12) to rotate sprocket(13) and film takeup spool(14) in the respective directions C and D. When the Motor Drive MD-4 is used, motor drive coupling(15) is rotated in direction E for film advance.

The F3's film advance lever has a 30° stand-off angle and a throw of 140°. The lever can be operated in one complete stroke; plus it is ratcheted for operation in a series of short strokes.

Multiple Exposure Mechanism

For making more than one exposure on the same frame, a multiple exposure lever is provided on the Nikon F3. When the lever is pushed out to the ready position, the film advance lever can be stroked to cock the shutter without actually advancing the film. Diagram III illustrates the inner workings of this system: As the multiple exposure lever(1) is cocked, axle(2) is rotated in direction A. Cam(3) pushes set lever(4) in direction B. Takeup claw(5) is then disengaged from the cutout of lower gear(6). Therefore, when the connecting shaft(7) rotates as the shutter is cocked, the lower gears for the film sprocket and takeup spool (8) do not rotate. Thus, the film remains stationary.

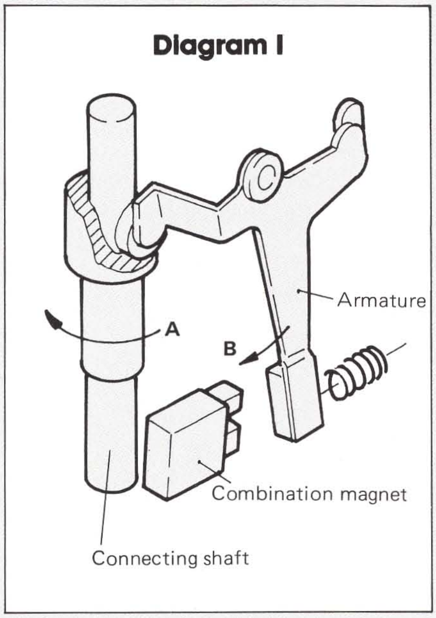


Diagram I
A
B
Armature
Combination magnet
Connecting shaft

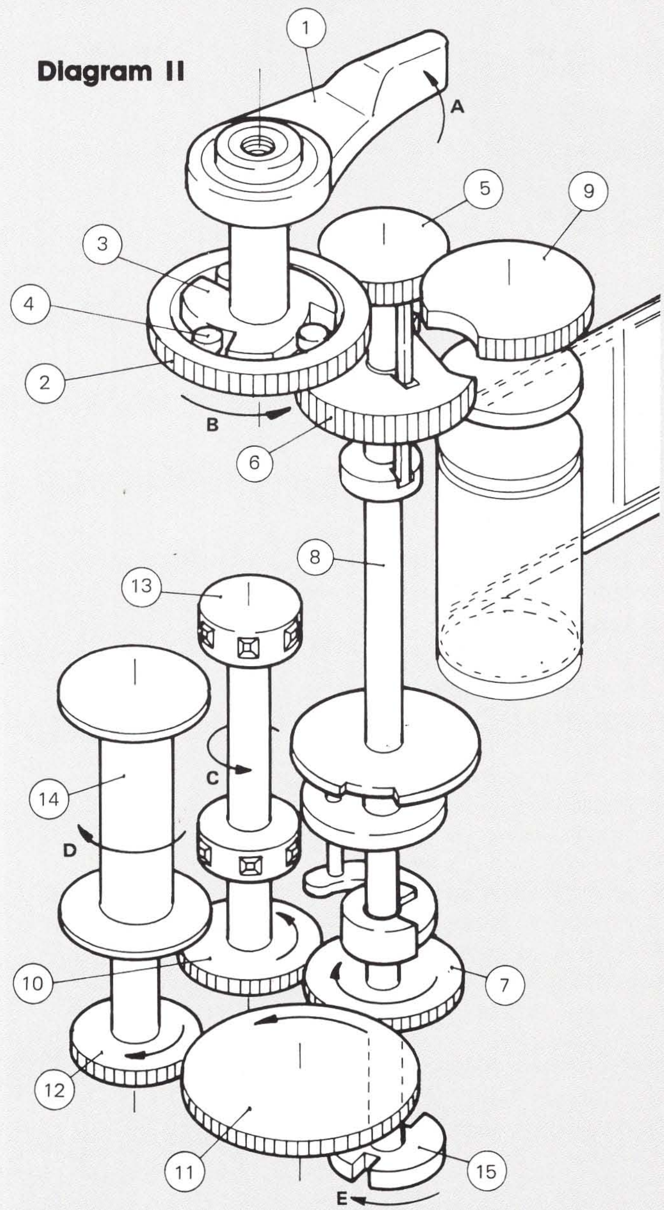


Diagram II
1
A
5
9
3
4
2
B
6
8
13
C
14
D
10
12
7
11
15
E

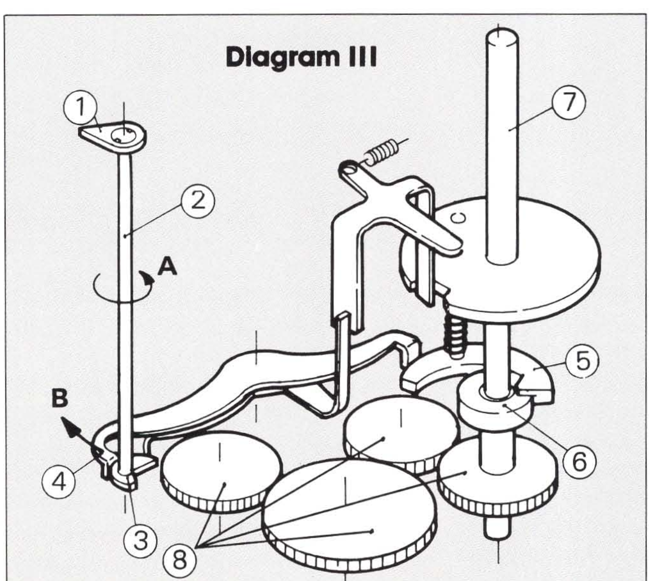
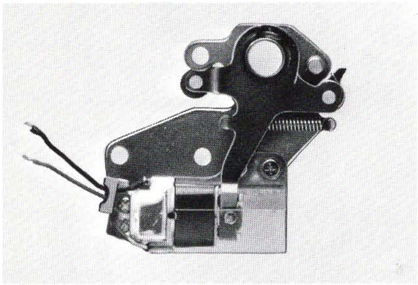
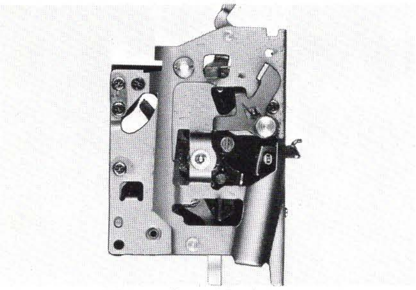


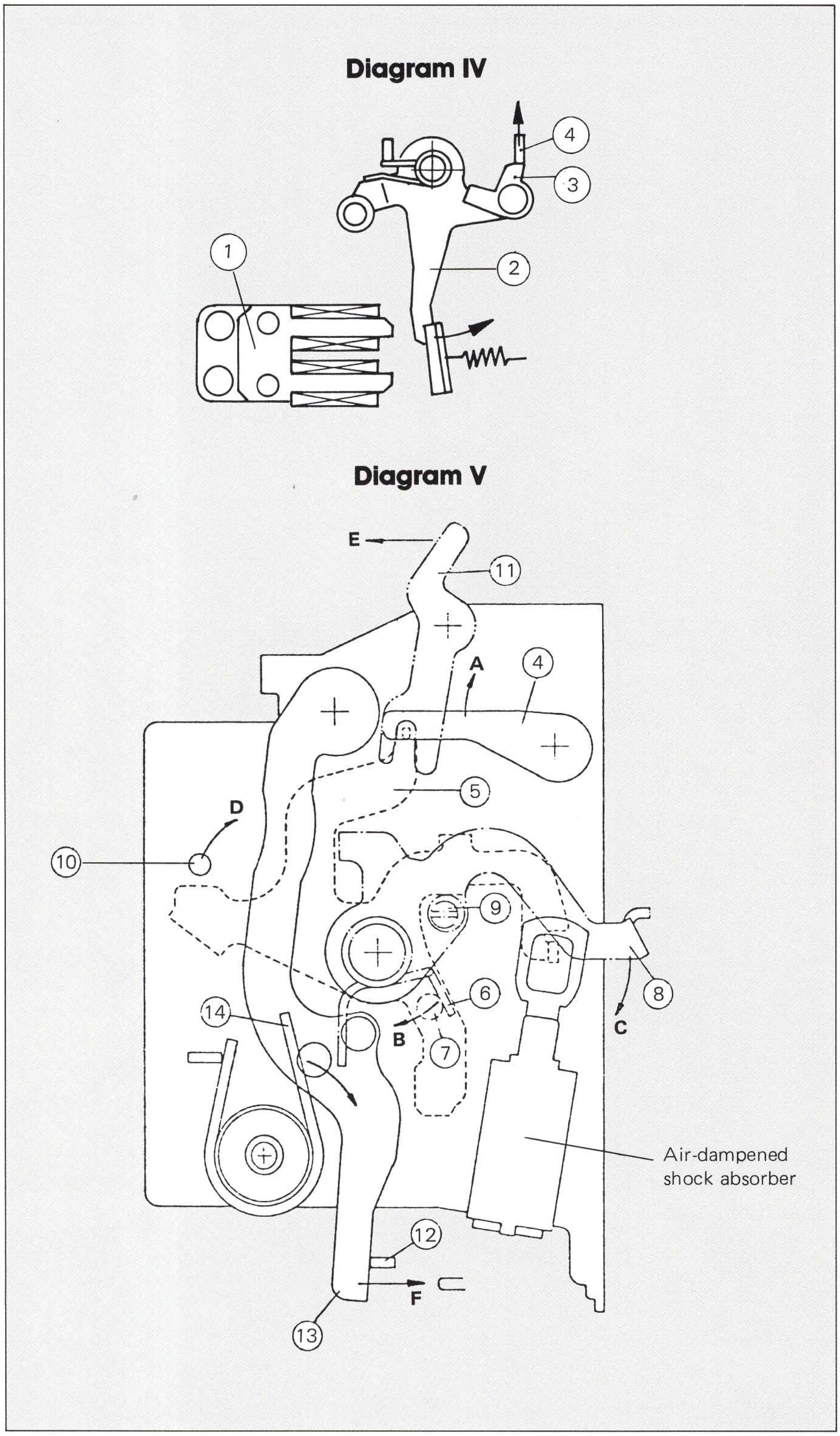
Diagram III
1
2
A
B
4
3
8
7
C
5
6



Mirror Box Combination Magnet



Mirror Box Mechanism



Mirror Box Mechanism

Departing from the design of the Nikon F2, the F3's mirror box mechanism is preassembled as a separate unit and features many refinements. The incorporation of a combination magnet for electronic tripping of the reflex mirror marks a first for Nikon. Now, tripping of the mirror is electrically rather than mechanically controlled, so operation is more positive. And because the magnet is larger than usual, there is no chance of the mirror (and shutter) being accidentally tripped even if the camera receives a sharp jolt when the shutter is cocked. Mirror shock and vibration have also been substantially reduced through the use of an air-dampened shock absorber and mirror brake.

Electronic tripping of reflex mirror

The F3 is the *very* first Nikon camera to feature electronic triggering of the mirror. Following the diagrams, this is what happens:

Diagram IV (mirror box combination magnet)

As the shutter button is depressed all the way, a release signal is sent to the mirror box combination magnet(1), causing it to momentarily lose its magnetism. Immediately, spring-loaded armature(2) pulls away from the magnet allowing claw(3) to travel up to trip lever(4) on the mirror box.

Diagram V (mirror box mechanism)

When lever(4) is pushed in direction A, main lever(5) becomes disengaged. At the same time, mirror-up spring(6) which is engaged with pin(7) on the main lever is released, allowing the main lever to rotate in direction B. When this happens, lever(8) is pushed in direction C via pin(9) to stop down the lens. Simultaneously, pin(10) which is attached to the side of the reflex mirror is pushed in direction D to raise the reflex mirror. As the mirror rises, lever(11) at the top of the mirror box is pushed in direction E, thus starting the sequence of operations leading to shutter release (see diagram VIII on page 33).
After shutter release, lever(12) at the bottom of the shutter unit disengages mirror spring tensioning lever(13) allowing it to return to its original position (direction F) via mirror-down spring(14). All other levers in the mirror box mechanism return to their original positions, too.

Reflex mirror

The Nikon F3 employs a rapid return mirror having a very large mirror surface. Thus, there is virtually no image cutoff even when using super-telephoto lenses up to 800mm in focal length.

Like the Nikon F2, the reflex mirror has a lightweight titanium frame for extra strength. And through the use of a special coating, the mirror's reflecting surface has been made highly resistent to scratches.

For reliable operation, the secondary mirror is attached to the back of the reflex mirror using a special "toggle-type" hinge design (see diagram VI). Like the toggle switch used to turn room lights on and off, the mirror can not stop at the halfway position; it is either at the down position for meter readings or flat against the back of the reflex mirror during exposure. This eliminates any possibility of the secondary mirror blocking the light to the film while the shutter is open.

Due to the elegant design of the mirror box mechanism, the amount of work required to move the main and secondary mirrors is virtually the same as that of other cameras having single mirrors. In addition, the F3's mirror-up travel time is a short 25 milliseconds. And remember, mirror-up travel time is an important consideration when designing a camera whose mirror must operate rapidly during motor drive operation.

Air-dampened shock absorber

To minimize the shock and vibration of the reflex mirror as it stops at the top of its travel; an air-dampened shock absorber is incorporated into the design of the mirror box (see diagram V). The cylinder of this shock absorber is sealed against dust to prevent sluggish performance or a possible malfunction.

Mirror brake

To absorb the inertia as the reflex mirror returns to its normal 45° rest position, a newly designed mirror brake is used. This brake is very effective when the camera is used with the MD-4 Motor Drive. With the shutter firing at 5.5 frames per second, an efficient braking system is needed to absorb the mirror shock on the down stroke. According to diagram VII this is how it works: As the reflex mirror comes back down (direction A), its edge(1) pushes against lever(2), which is located on the inside of the mirror box. Connecting shaft(3) is then rotated in direction B which also rotates lever(4) in direction C. Spring(5) becomes tensioned and pulls lever(6) in direction D to force brake shoe(7) against the hub of lever(4). The friction produced stops the rotation of connecting shaft(3) which in turn stops the downward movement of lever(2) to finally cushion the mirror as it stops.

Diagram VI

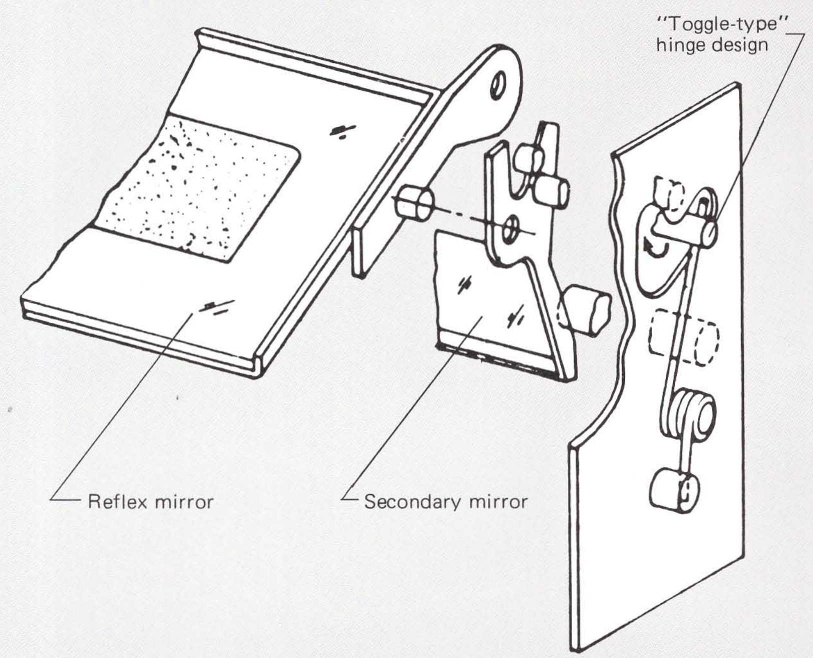
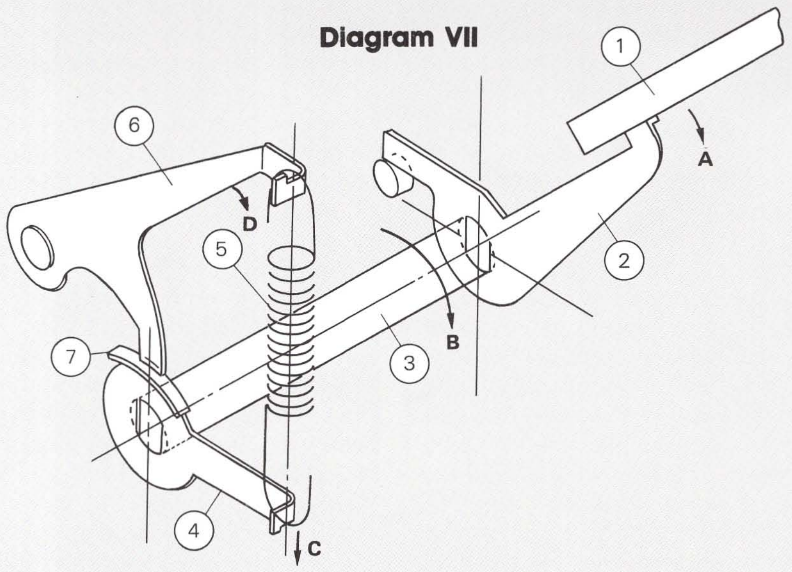


Diagram VII



Shutter Mechanism

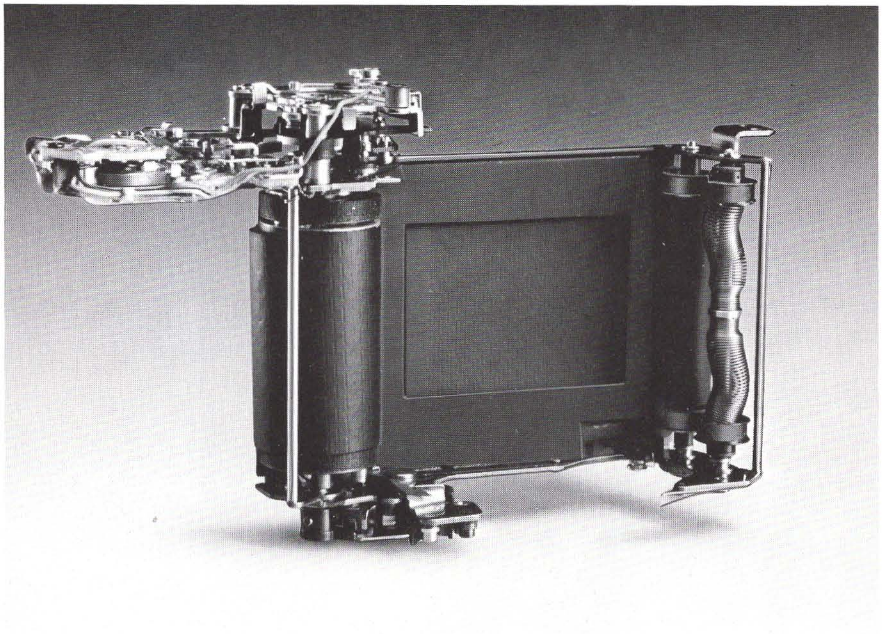
Like all top-of-the-line cameras from Nikon, the F3 uses a horizontally running focal plane shutter designed and manufactured exclusively by Nikon. In Nikon's design, the shutter is of the *single drum* type, meaning that the drums for the first and second shutter curtains have the same axis. The big advantage of this type of shutter is extreme durability due to simple mechanical construction.

In addition, the F3's shutter curtains are made of titanium—a tradition first established by the Nikon SP rangefinder camera of 1957. Titanium is used because it is very durable, yet light in weight. Made of more than 99.5% pure titanium, the curtains are only 0.02mm thick; thus their moment of inertia is very small. For additional strength and dimensional stability, a vertical pattern of tiny dimples is then embossed onto the thin foil sheets (see illustration on next page). Finally, the curtains are treated with a special matte black paint to minimize reflections.

However, the similarities with previous Nikon shutters ends here. Probably the biggest difference is that this new shutter is the first one to feature unitized construction. Instead of each shutter being assembled simultaneously with the camera, the F3's shutter is put together as a separate module and tested before reaching the main assembly line. This not only speeds up the manufacturing process, but improves reliability, too.

Another important difference is that this is the first Nikon-designed shutter to use an electromagnet for release of the second shutter curtain. The F3's electromagnet is exceptionally large, so its magnetism is greater than the magnets used in other electronically controlled cameras. Additionally, the armature which is set free from the electromagnet to trigger the second curtain is very long. Thus, the armature is held securely by the electromagnet while the shutter is open, yet becomes detached instantaneously to close the shutter. This insures that shutter speeds, especially the top ones of 1/1000 and 1/2000 sec., will be more precise.

Of course, like all electromagnetically controlled shutters, the first curtain is still tripped mechanically. Yet, the F3 has a unique system for minimizing the inherent variation in the curtain's release time. Before the curtain is released, a spring-loaded controlling gear at the top of the shutter drums starts rotating. Because the gear is rotating at full speed when it releases the lever for tripping the first curtain, its power is greatest, thus ensuring a constant release time ***every time***.



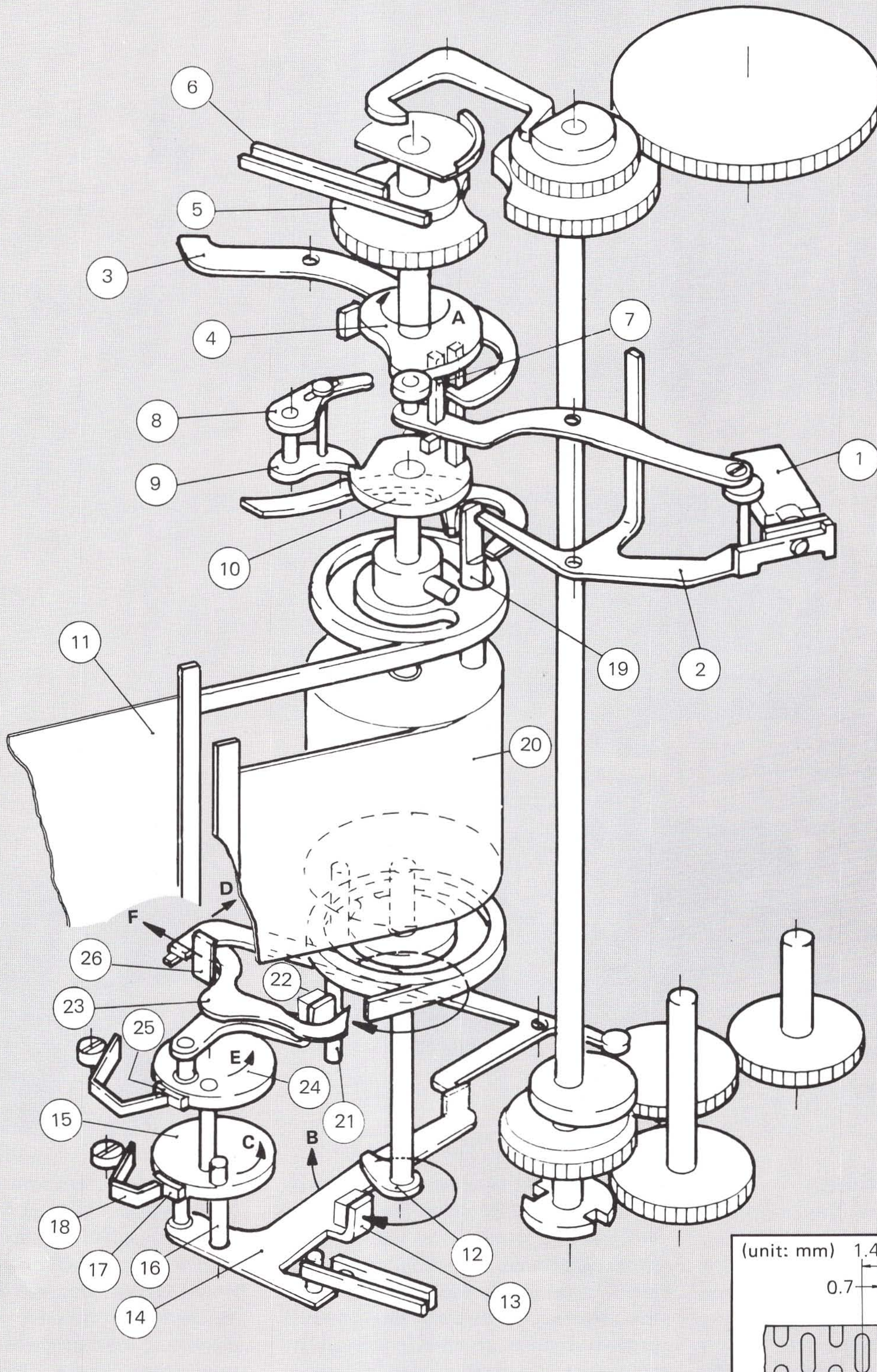
For reduced friction and inertia, numerous ball bearings are used in the main shutter drum. Also, two space-age plastic collars on the takeup drum as well as precision-wound double takeup springs are utilized. Furthermore, highly stable shutter travel is now possible, because the total mass of the shutter mechanism has been reduced.

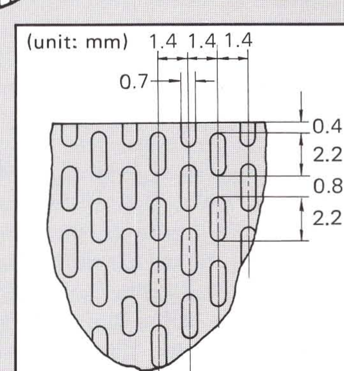
Other improvements include an efficient braking system for both shutter curtains through the use of silicon rubber bumpers and large brake drums, plus the use of extra-wide curtain ribbons to make the shutter absolutely light-tight. Based on more than three decades of technical know-how, the F3 shutter is as rugged as they come and is able to provide approximately 150,000 releases with smoother curtain travel. Moreover, shutter noise and shock is now at a new low level.

Diagram VIII shows the step-by-step operation of the F3's shutter: As the mirror rises, electromagnet(1) becomes changed and holds armature(2) with its magnetic force. Then lever(11) at the top of the mirror box (see diagram V) disengages lever(3) from cam(4). Spring-loaded controlling gear(5), which is connected to cam(4), starts rotating in direction A. At the same time, controlling gear(5) opens trigger switch(6), sending an electronic signal to the camera's metering circuit. While this is happening, post(7) of cam(4) is rotating in direction A and strikes lever(8). Then, lever(9) unlatches cam (10), allowing the first shutter curtain (11) to start its travel across the film gate.

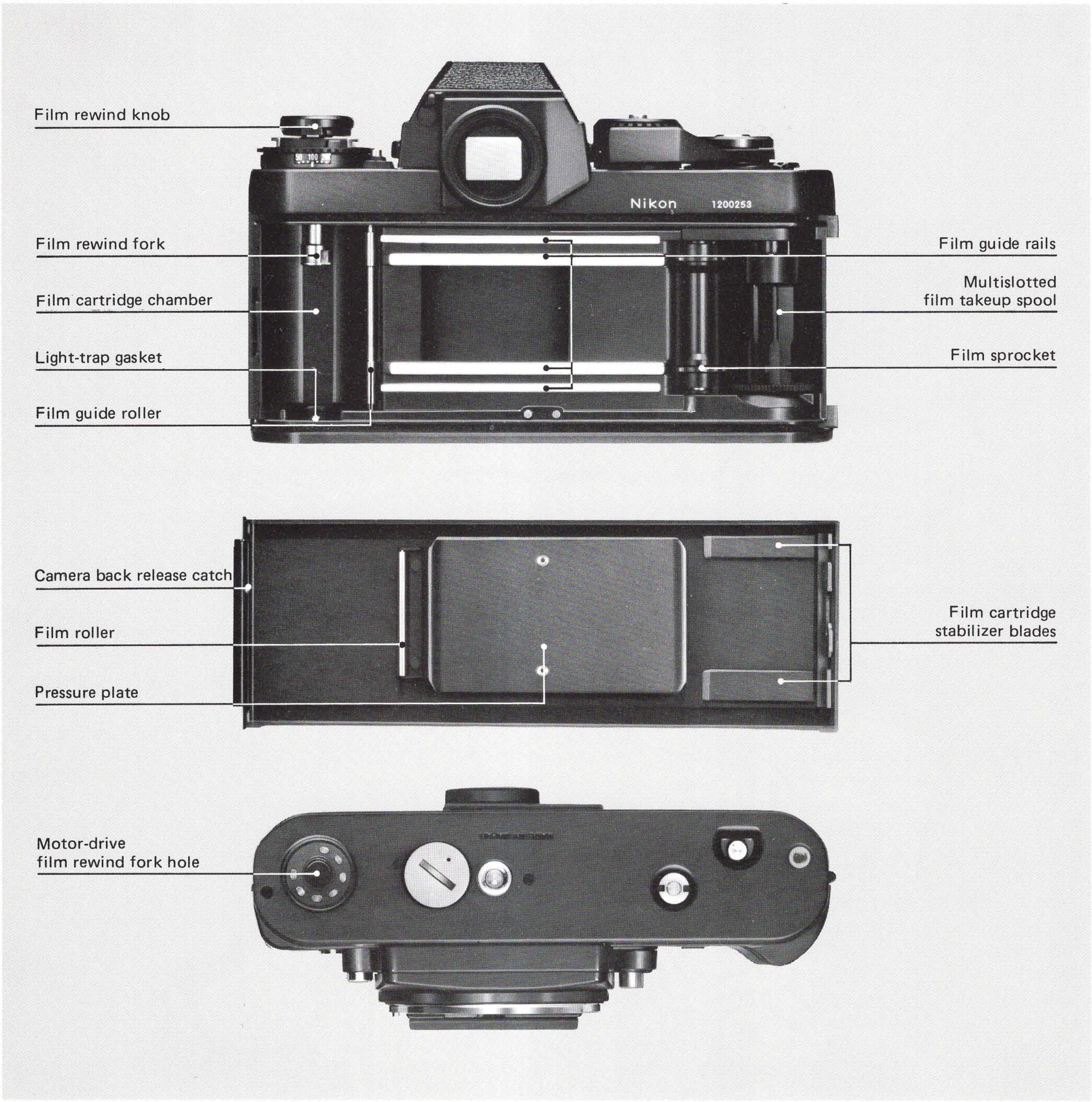
As the first shutter curtain nears the end of its travel, first braking lever(12) bumps into front bumper(13). This pushes lever(14) in direction B. Because lever(14) is connected to front brake drum(15) via shaft(16), the front brake drum is rotated in direction C. Brake shoe(17) is forced against the drum by spring(18), creating friction which absorbs the inertia of the front shutter curtain as it stops. After a specific time lapse (depending on the electronically determined shutter speed), the current flow to electromagnet(1) is cut off. The electromagnet then frees armature(2), which disengages post(19) to release the second shutter curtain(20). Also, as the rear shutter curtain nears the end of its travel, second braking pin(21) strikes second bumper(22) moving lever(23) in direction D. Second brake drum(24) is rotated in direction E. Friction is applied by second brake shoe(25) to absorb the inertia of the second shutter curtain. Simultaneously, lever(23) releases mirror spring tensioning lever(26) in direction F, allowing the reflex mirror to return to its normal down position.

Diagram VIII





Shutter curtain dimpled pattern



Film Transport System

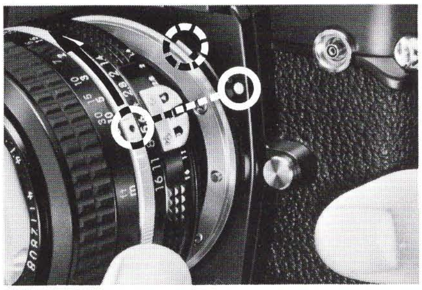
To guide the film smoothly from cartridge to takeup spool and to maintain superior film flatness across the film gate, the Nikon F3 utilizes the same outstanding film transport system as the F2. In this system, the film is wound onto the takeup spool in the opposite direction to that of the natural film curl to insure tautness. All components are the same in the F3, except a large film guide roller was placed on the right side of the film cartridge chamber to move the film smoothly from cartridge to guide rails. Film loading has been improved, too, thanks to the new multislotted design of the film takeup spool. Now there are six slots instead of the usual three, and the film leader can only be inserted in the direction of film winding. Nikon's proven system of film transport insures that film winding will be smooth and scratch-free throughout the entire roll, from first shot to last.

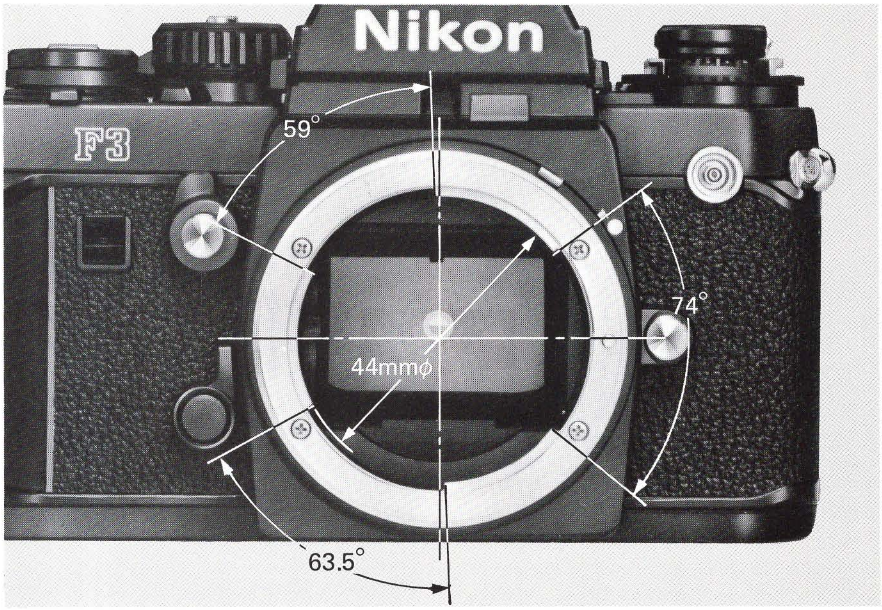
Camera Back

For rigidity, the Nikon F3's camera back is made out of brass—the same material as used for the top covers and the baseplate. On the outside of the camera back, there is a memo holder, which accepts the end flap from the film box as a reminder of the film in use. Inside, the back is sprayed with matte black paint to minimize reflections and contains the following elements to maintain film flatness: a film roller, extra-large pressure plate, and two film cartridge stabilizer blades. In addition, the back has a spring-loaded release catch, allowing easy camera back removal when the attachment of an interchangeable back is desired.

Bayonet Lens Mount

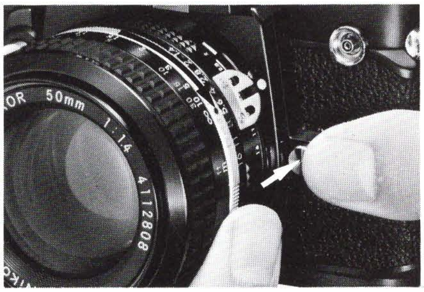
The Nikon F3 uses the same bayonet mount first introduced on the Nikon F in 1959. That means all Nikkor and Nikon Series E lenses manufactured since that time can still be attached to the F3. The lens mounting flange is made of specially treated and hardened stainless steel. Thus, the mount is virtually impervious to wear, insuring that the lens remains at exactly 46.5 mm from the film plane even after thousands of lens interchanges.





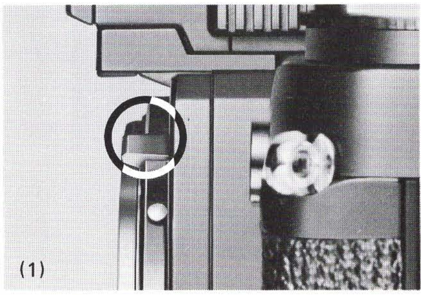
Lens Mounting

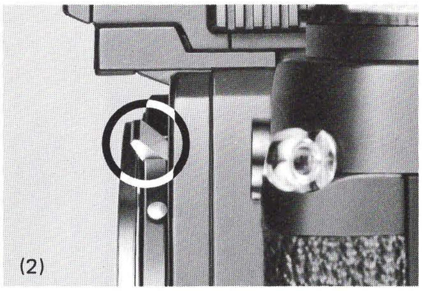
Easy lens mounting is made possible by the elegant design of the mount itself—just insert and twist one-sixth of a turn counterclockwise to lock the lens securely into place. The bayonet mount lugs are spaced at various distances apart (see picture at upper right), so that the lens will go on only one way and can be mounted easily even in the dark.



Lens Dismounting

Solid body/lens connection is provided via a spring-loaded pin locking system at the lens mounting flange. The locking pin engages the slot in the rear surface of the lens mount as the lens is bayoneted into place. When depressed, the lens release button retracts the pin, allowing the lens to be twisted and removed. Moreover, the lens release button is located in exactly the same position as on the Nikon F and F2 for continuity in camera handling.


(1)


(2)

Meter Coupling

When an AI-type Nikkor or a Nikon Series E lens is mounted on the Nikon F3, the AI coupling ridge on the lens automatically engages the camera's meter coupling lever for maximum aperture indexing into the metering system (see photograph 1). However, when a non-AI Nikkor lens or accessory is used with the F3, the meter coupling lever must be locked in the up position before mounting (see photograph 2). This is done by pushing in the lever's release button as the meter coupling lever is flipped up. Then stopped-down metering may be performed in the following manner:

For non-AI Nikkor lenses with automatic diaphragms

On AUTO: Push in and hold the depth-of-field preview button as the shutter is tripped.

Caution: If the depth-of-field preview button is not depressed all the way, the mirror may remain in the up position.

On MANUAL: Select a shutter speed. Then hold in the preview button and turn the aperture ring until the —+ symbol appears in the finder. Release the preview button and take the shot.

For non-AI lenses or accessories without automatic diaphragms

On AUTO: Stop the lens down manually until the desired shutter speed appears in the finder. Then take the picture.

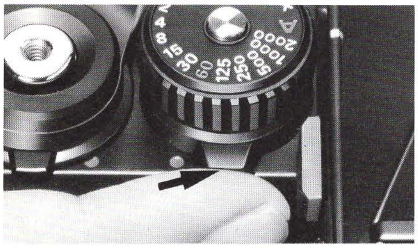
On MANUAL: Adjust the shutter speed or aperture until the —+ sign appears.

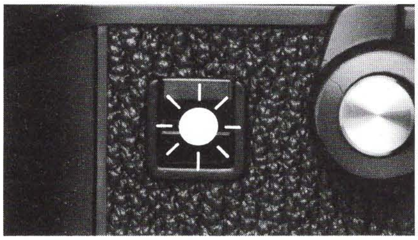
For fixed-aperture reflex lenses, photomicrography, or astrophotography

On AUTO: No control is necessary.

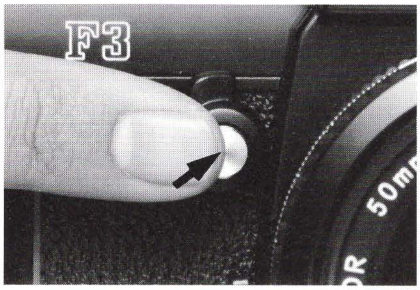
On MANUAL: Adjust the shutter speed dial until the —+ appears.

MISCELLANEOUS CONTROLS



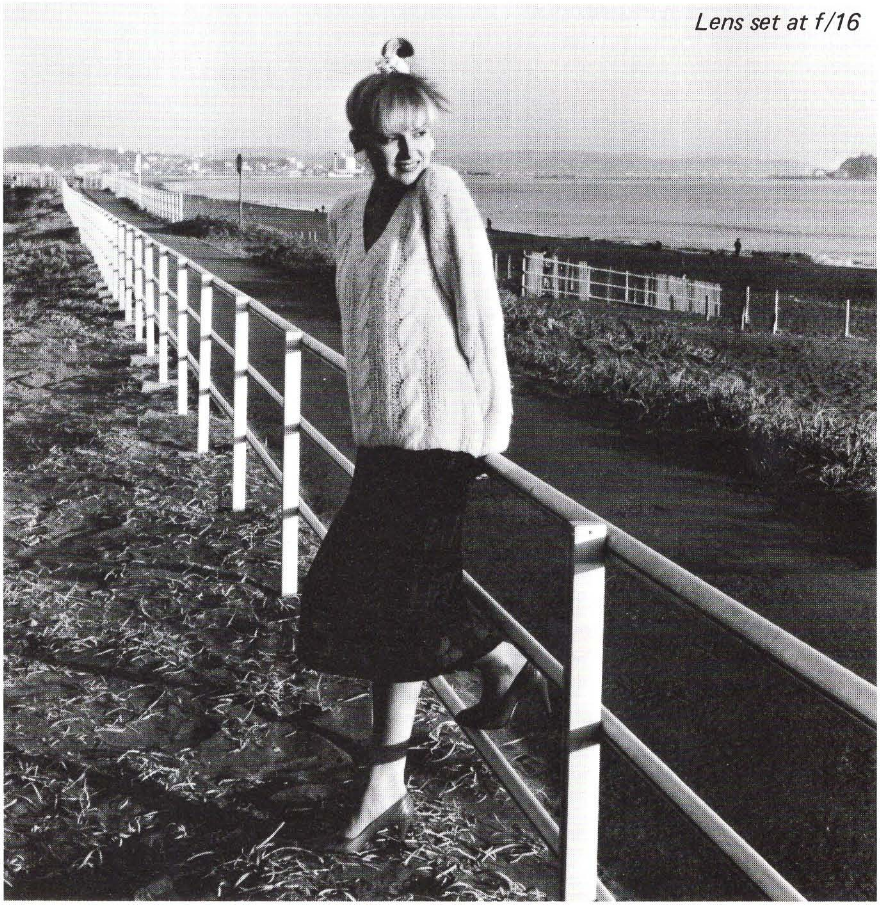


Self-Timer
The Nikon F3 features an electronic self-timer which provides a delay of exactly 10 seconds in shutter firing. After the self-timer lever is activated, depressing the shutter release button begins self-timer operation. Operation is then signaled by a blinking LED on the front of the camera next to the grip. For the first 8 seconds the LED blinks at 2Hz and then speeds up to 8Hz for the final two seconds as an indication that the picture will soon be taken. Timing is precise, because the delay is controlled by the quartz oscillator. To cancel the self-timer during operation or to resume normal picture-taking, the lever is simply returned to its original position.

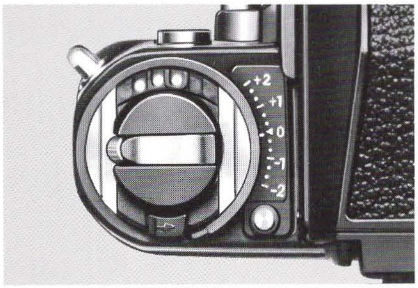


Depth-of-Field Preview Button
Located in virtually the same position as on the Nikon F and F2, this button provides a visual preview of which parts of the scene, from near to far, will be in sharp focus in the final photograph. The depth-of-field preview button is also used for stopped-down metering with non-AI Nikkor lenses having an automatic diaphragm. When the button is depressed, automatic aperture coupling lever(8) (see diagram V on page 30) moves downward. This in turn releases the spring-loaded aperture lever at the back of the lens mount to stop down the lens to the preselected aperture.

At wide apertures, the depth of field is very shallow with the main subject in focus.



But when the lens is stopped down to f/16, most objects from near to far are in sharp focus.



Accessory Shoe

The F3's accessory shoe allows direct mounting of the Nikon Speedlight SB-12. Three electrical contacts provide for synchronization of the flash unit, automatic through-the-lens flash output control, and ready-light indication in the viewfinder, plus auto switching to the proper synchronization speed of 1/80 sec. Two flash coupling adapters—the AS-3 and AS-4—are available, allowing either ISO- or Nikon F2-type direct-mounting electronic flash units to be attached.

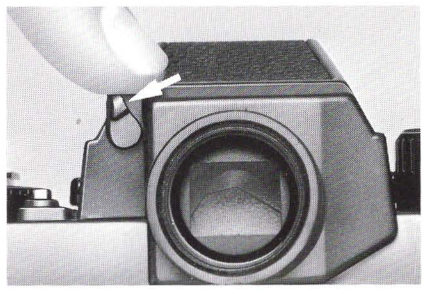
Sync Terminal

A separate sync terminal with a protective screw-in plastic cover is provided on the F3. It accepts all standard plug-in PC cords, plus is threaded for use with a Nikon screw-in PC cord. When using flashbulbs or an electronic flash without a contact in its mounting foot, it is necessary to use the sync terminal.

Frame Counter

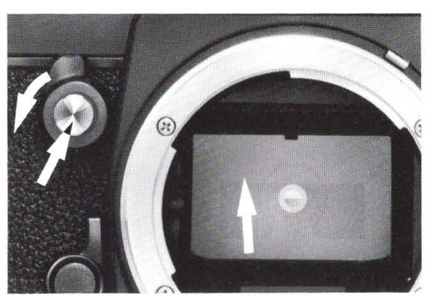
To keep track of the number of exposed frames on the roll, the F3's frame counter is graduated from two frames below 0 up to 40. Blue numerals appear every 5 frames (0, 5, 10, etc.) with dots in between. White marks at 12, 20, 24, and 36 indicate the number of frames available on most film cartridges.

To speed up film loading, the shutter automatically fires at 1/80 sec. until the frame counter reaches 1. This occurs with the camera on automatic or manually set to 1/80 sec. (X) and above. Therefore, when making blank shots, the photographer should set the shutter speed dial accordingly. It goes without saying that the "T" setting should not be used, as the shutter will remain locked open.



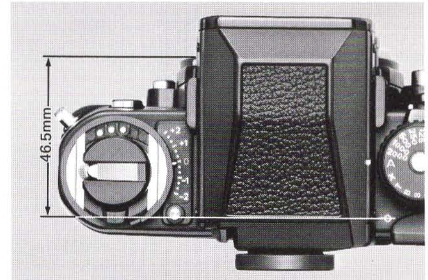
Eyepiece Shutter

To prevent stray light from entering the viewfinder from the rear and causing an erroneous automatic exposure meter reading, an eyepiece shutter is built into the Eyelevel Finder DE-2. When the photographer is unable to keep his eye at the viewfinder, such as when using the self-timer or a remote control device, the eyepiece shutter should be closed. As a visual reminder that it's closed, the eyepiece shutter blind is painted red.



Mirror Lock-Up Lever

To reduce vibration to the absolute minimum, such as when doing photomicrography, the mirror can be locked in the up position with the mirror lock-up lever. Also, to prevent damage to the mirror, it must be locked up out of the way before mounting either the Fisheye-Nikkor 6mm f/5.6 or the Fisheye-Nikkor OP 10mm f/5.6.



Film Plane Indicator

Certain specialized areas of photography, such as critical high-magnification photomacrography, require that the actual subject-to-film plane distance be measured. Therefore, a film plane indicator is engraved in white on the top deck just behind the shutter speed dial. This mark indicates the exact position of the film plane inside the camera. The distance between the film plane and the lens mounting flange is exactly 46.5mm as in all other Nikon SLR cameras.

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