HANDBOOK
OF
PILOT OPERATIONAL EQUIPMENT
FOR
MANNED SPACE FLIGHT

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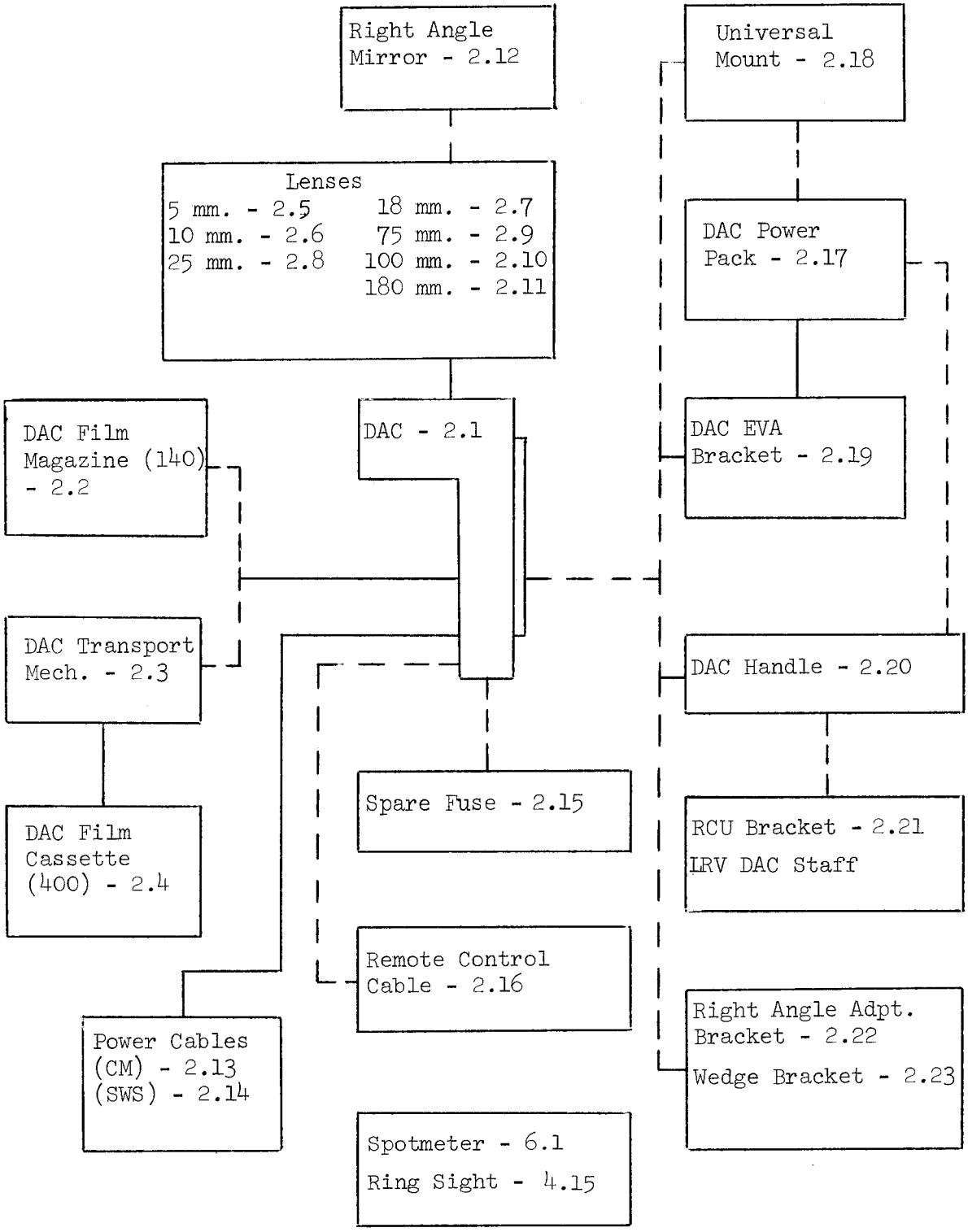
Houston, Texas
JUNE 1973

2.0 16 mm. Sequence Camera System



2.1 Data Acquisition Camera (DAC) (SEB33100100):

The 16 mm. Data Acquisition Camera (DAC) is used to obtain sequential photographic data during manned space flight missions. Unlike typical movie cameras, this unit has independent shutter speeds and framing rates. Furthermore, the automatic frame rates are lower than the common cine speeds to maximize film usage while maintaining the desired engineering data value. The DAC can be handheld or bracket mounted, can operate from spacecraft or portable battery power, and can accept various lenses and assorted accessories as described in the following sections of this handbook.

2.1.1 Significant Configurations:

Configuration	Purpose
-211	Skylab flight unit; 2 fps mode instead of 1 fps
-216	Skylab support unit; 2 fps mode instead of 1 fps
-217	Apollo CM and LM flight unit
-218	Apollo lunar surface flight unit; operate light hood incorporated

2.1.2 Characteristics:

- Manufactured by J. A. Maurer, Inc., Long Island City, New York 11101.
- Weight - 1.7 lbs (771 g.)
  Envelope - 6 x 3.75 x 2.4 in. (15.2 x 9.5 x 6.1 cm)
  Volume - 54 in^3 (885 cm^3)
- Power requirements: 28 $\pm$ 4 VDC at 0.6 amps nominal from spacecraft or DAC Power Pack (see 2.17). DAC incorporates self-resetting overload protection circuit and replaceable power line fuse (1.5 or 2.0 amp) (see 2.15).
- Sequencing frame rate settable to 1 (or 2), 6, 12, or 24 frames per second (fps) and time exposure.

Automatic Modes [1 (or 2), 6, and 12 fps] are initiated by depressing and releasing camera front button and continue uninterrupted even if sequencing rate is changed amoung automatic modes. Camera operation is stopped by depressing and releasing front button or by switching to the time exposure or 24 fps mode settings. Green operate light will flash at frame rate.

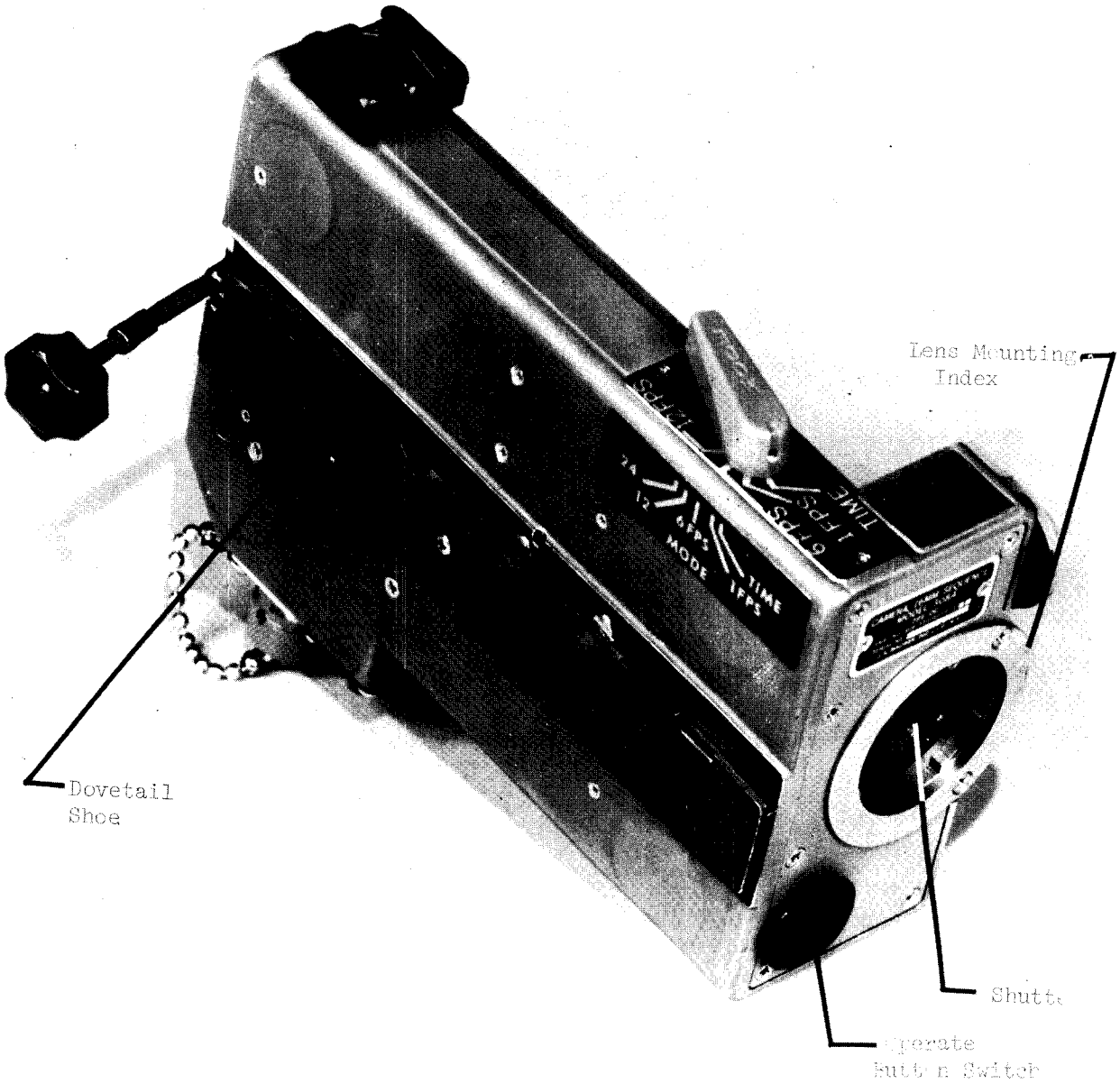


Figure 2.1-1 - Data Acquisition Camera
Back, Top, and Front
View

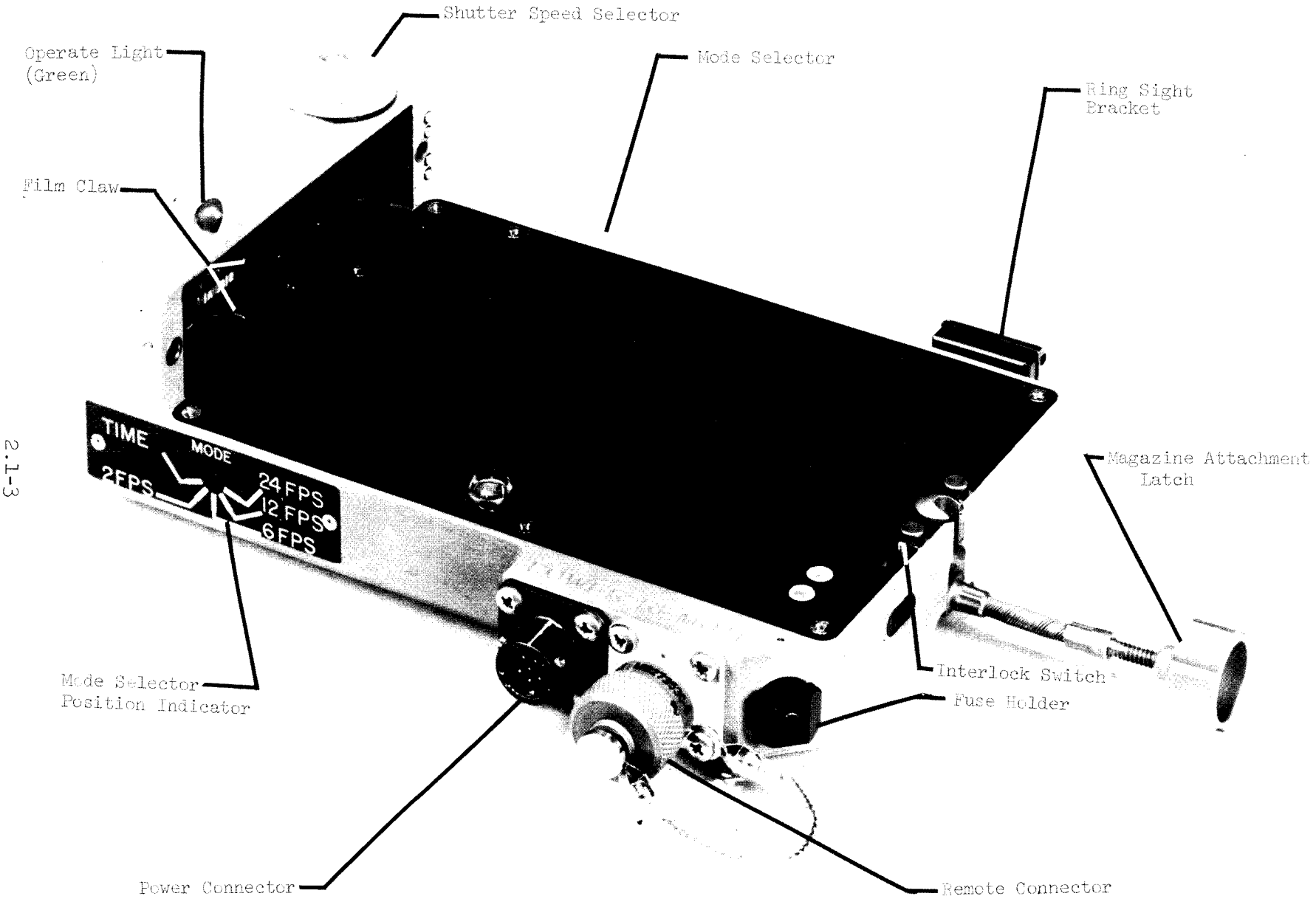


Figure 2.1-2 - Data Acquisition Camera
Rear View

24 fps operation starts when front button is depressed and stops when button is released. Green operate light illuminates almost constantly.

TIME exposure is started when front button is depressed and released only if (1) camera was previously stopped by front button method, (2) mode is set to TIME, and (3) shutter speed is set to 1/60 second. Time exposure is ended by depressing and releasing the front button. Green operate light will flash once as the shutter closes.

- Shutter speeds settable to 1/60 (±8%), 1/125 (± 8%), 1/250 (± 8%), 1/500 (± 10%), and 1/1000 (± 15%) second independently of frame rate.

- Accepts bayonet mount of lenses in four possible orientations. Orange index dot on camera front and on lens base indicate proper orientation for standard usage.

- Accepts DAC Film Magazine (140) (see 2.2) or DAC Transport Mechanism (see 2.3) which uses DAC Film Cassettes (400) (see 2.4).

- An accessory connector (rearmost) is provided for remote operation (ON/OFF and mode selection) with Remote Control Cable (see 2.16). Connector is Deutsch bayonet type UR40-8-7S.

- A shutter operation signal and a magazine identification pulse are available in the power connector for use as a telemetry data source.

- A dovetail mounting rail on the camera permits bracket mounting and the installation of the Universal Mount (see 2.18), the DAC EVA Bracket (see 2.19), or the DAC Handle (see 2.20).

- The accessory shoe accepts the Ring Sight (see 4.15) for precision aiming of long focal length lenses.

- Internal heaters are incorporated and thermostatically controlled to permit camera operation in a low temperature environment.

- The DAC has been successfully qualification tested for use in Skylab and Apollo vehicles, during EVA operations, and on the lunar surface.

- The DAC mean time to maintenance is 200 operating hours and has a life expectancy in excess of 1,000 hours.

2.2 DAC Film Magazine (140) (SEB33100125):

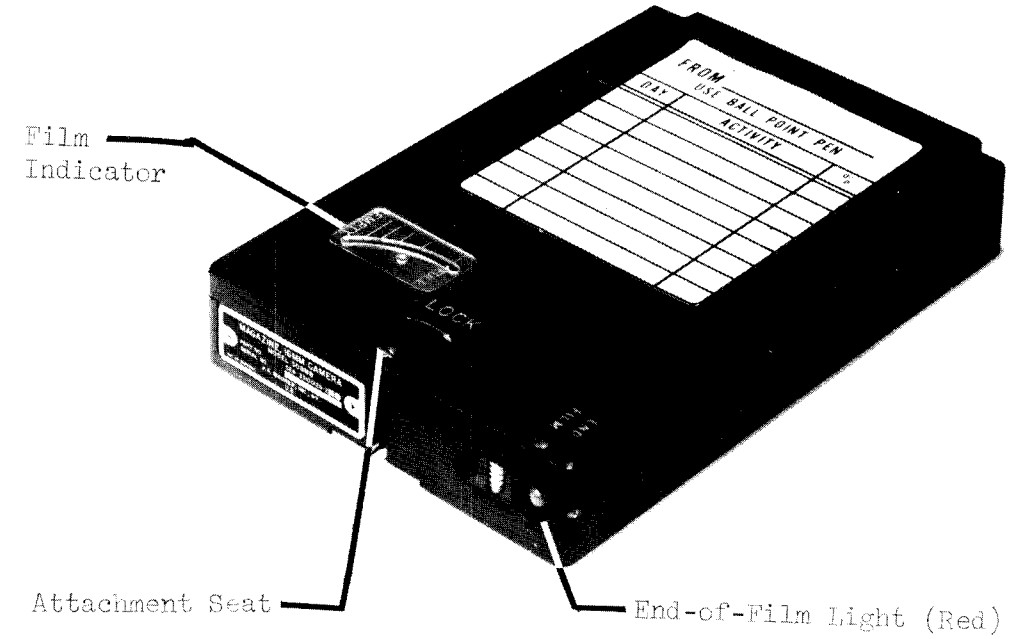
The 16 mm. DAC Film Magazine (140) is the original film magazine for the DAC system. The capacity of this magazine is limited to 140 feet of thin base 16 mm. film.

2.2.1 Significant Configurations:

Configuration	Purpose
-203 or -205	Apollo CM flight unit
-204	Apollo lunar surface flight unit; white thermal coating on lid
-206	Skylab flight unit

2.2.2 Characteristics:

- Manufactured by J. A. Maurer, Inc., Long Island City, New York 11101.
- Weight - 1.0 lb (454 g.) with film.
  Envelope - 3.6 x 5.4 x 0.9 in (9.2 x 13.7 x 0.23 cm).
  Volume - 17.5 in^3 (287 cm^3).
- Film capacity of 140 feet (42.7 meters) of thin base film (2.5 mil, 64 μm) provides maximum run durations of 93 min at 1 fps, 46 min at 2 fps, 16 min at 6 fps, 8 min at 12 fps, and 4 min at 24 fps.
- Magazine film must be loaded and unloaded in a photographic darkroom.
- Film usage indicator shows the gross amount of film remaining.
- The red light at the rear of the magazine illuminates when 6 feet (1.8 meter) of film remains. The light remains energized and the camera continues to run when the film supply is depleted.
- This film magazine has been qualified to the same levels as the DAC (see 2.1).



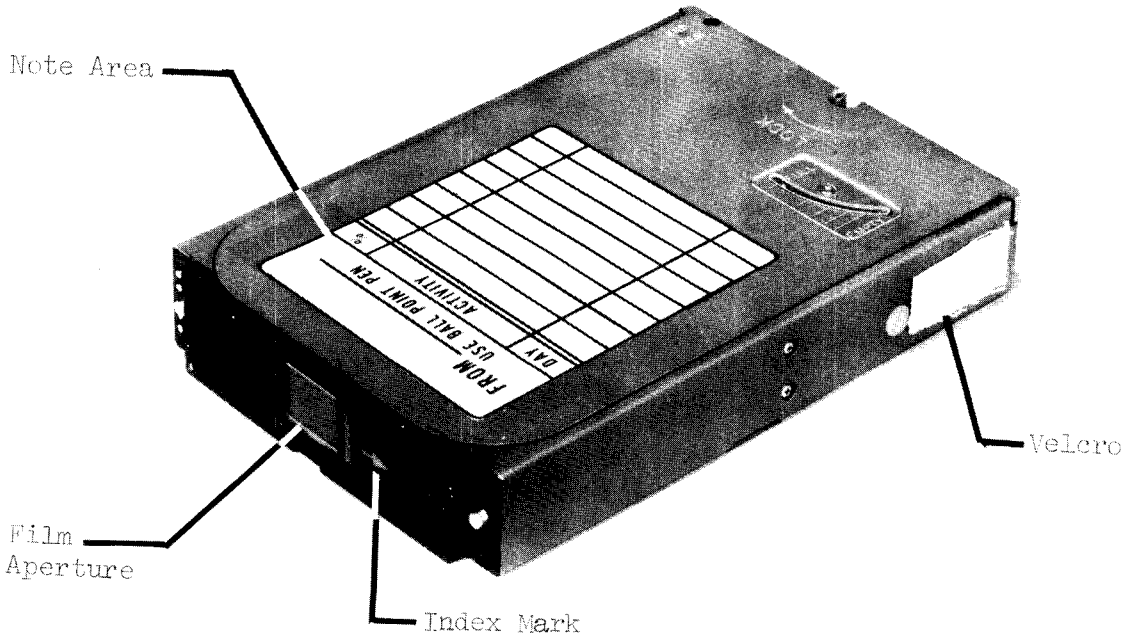


Figure 2.2-1 - DAC Film Magazine (140)

2.3 DAC Transport Mechanism (SEB33100278):

The DAC Transport Mechanism installs on the DAC like a film magazine and provides the threading and positioning for the film from the DAC Film Cassettes (see 2.4). The DAC Transport Mechanism is driven by and receives its framing synchronization from the DAC itself.

2.3.1 Significant Configurations:

Configuration	Purpose
-301	Skylab flight unit

2.3.2 Characteristics:

- Manufactured by J. A. Maurer, Inc., Long Island City, New York 11101.
- Weight - 2.0 lbs (908 g.).
  Envelope - 2.0 x 8.2 x 5.4 in (5.1 x 20.8 x 13.7 cm).
  Volume - 86.4 in^3 (1416 cm^3).
- Interfaces with DAC in the same way as the DAC Film Magazine (140) (see 2.2) providing film plane location, electrical interconnection, and slot for magazine attachment latch of DAC.
- Provides for attachment of two DAC Film Cassettes (400) (see 2.4) - one for film supply (toward camera) and one for film take-up. Attachment latches for supply cassette are marked with "S" and for take-up with "TU".
- A two position lever is provided for the selection of "THREAD" and "OPERATE" functions. An amber light illuminates when in the THREAD position.
- The red light at the rear of the mechanism illuminates when no film remains. The light remains energized and the DAC continues to run when the film supply is depleted.
- This transport mechanism has been qualification tested for use in the Skylab vehicles and during EVA operations.

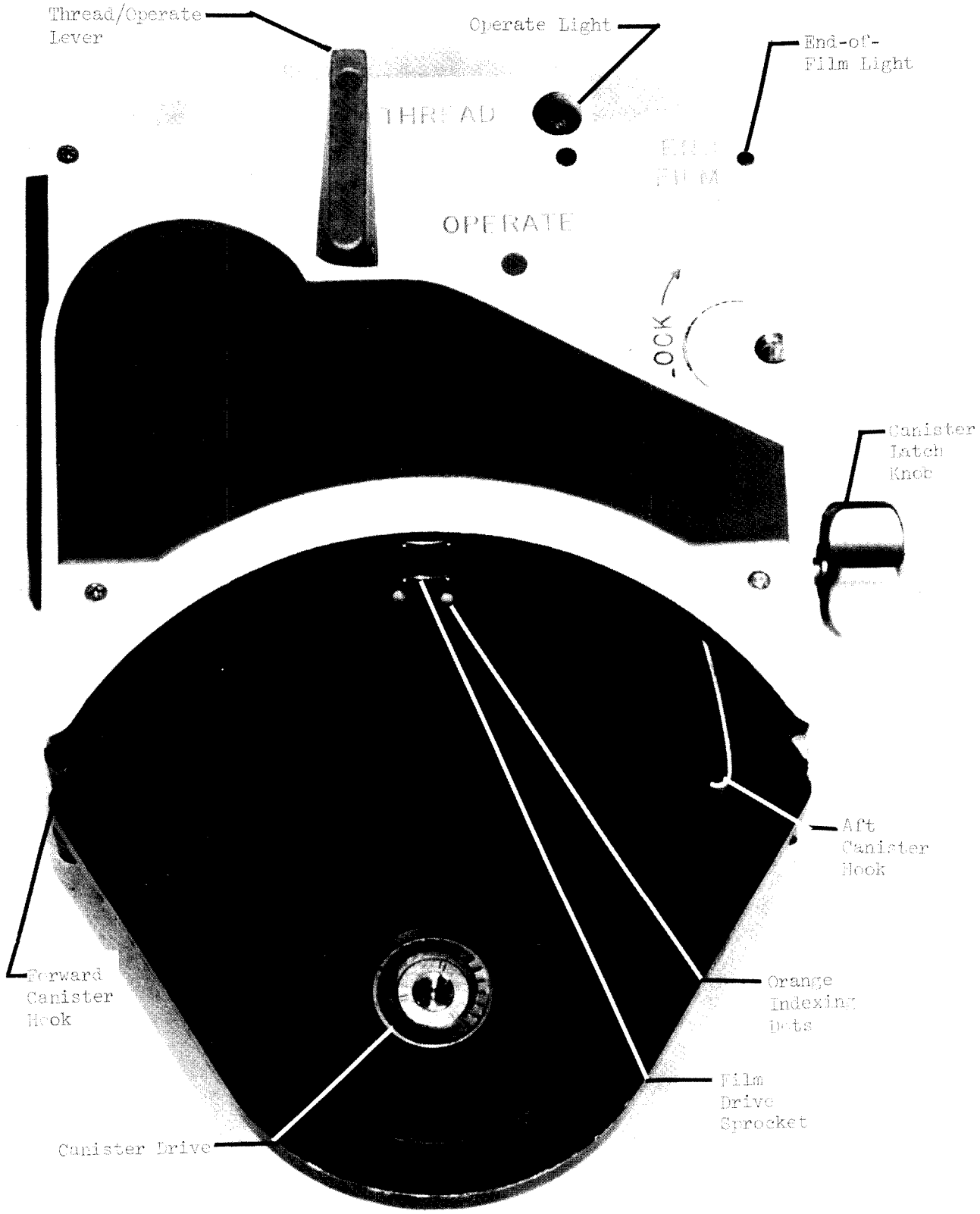


Figure 2.3-1 - DAC Transport Mechanism

2.4 DAC Film Cassette (400) (SEB33100279):

The DAC Film Cassette is the film container for the DAC Transport Mechanism (see 2.3). Two cassettes are required for transport operation - one for film supply and one for take-up. The cassettes are interchangeable and provide the largest film capacity for the DAC system - 400 feet of thin base 16 mm. film.

2.4.1 Significant Configurations:

Configuration	Purpose
-301	Skylab flight unit

2.4.2 Characteristics:

- Manufactured by J. A. Maurer, Inc., Long Island City, New York 11101.
- Weight with film - 1.2 lbs (545 g.)
  Weight without film - 0.7 lbs (318 g.).
  Envelope - 5.88 dia x 0.88 in (15.0 dia x 2.1 cm).
  Volume - 24.0 in^3 (392 cm^3).
- Film capacity of 400 feet (122 meters) of thin base film (2.5 mil, 64 μm) provides maximum run durations of 267 min at 1 fps, 134 min at 2 fps, 44 min at 6 fps, 22 min at 12 fps, and 11 min at 24 fps.
- Cassette film must be loaded and unloaded in a photographic darkroom.
- Attach to the DAC Transport Mechanism (see 2.3) for use as film supply and as film take-up.
- Film usage indicator has markings at every 10 percent of capacity showing the gross amount of film remaining.
- The DAC Film Cassette has been qualification tested for use in the Skylab vehicles and during EVA operations.

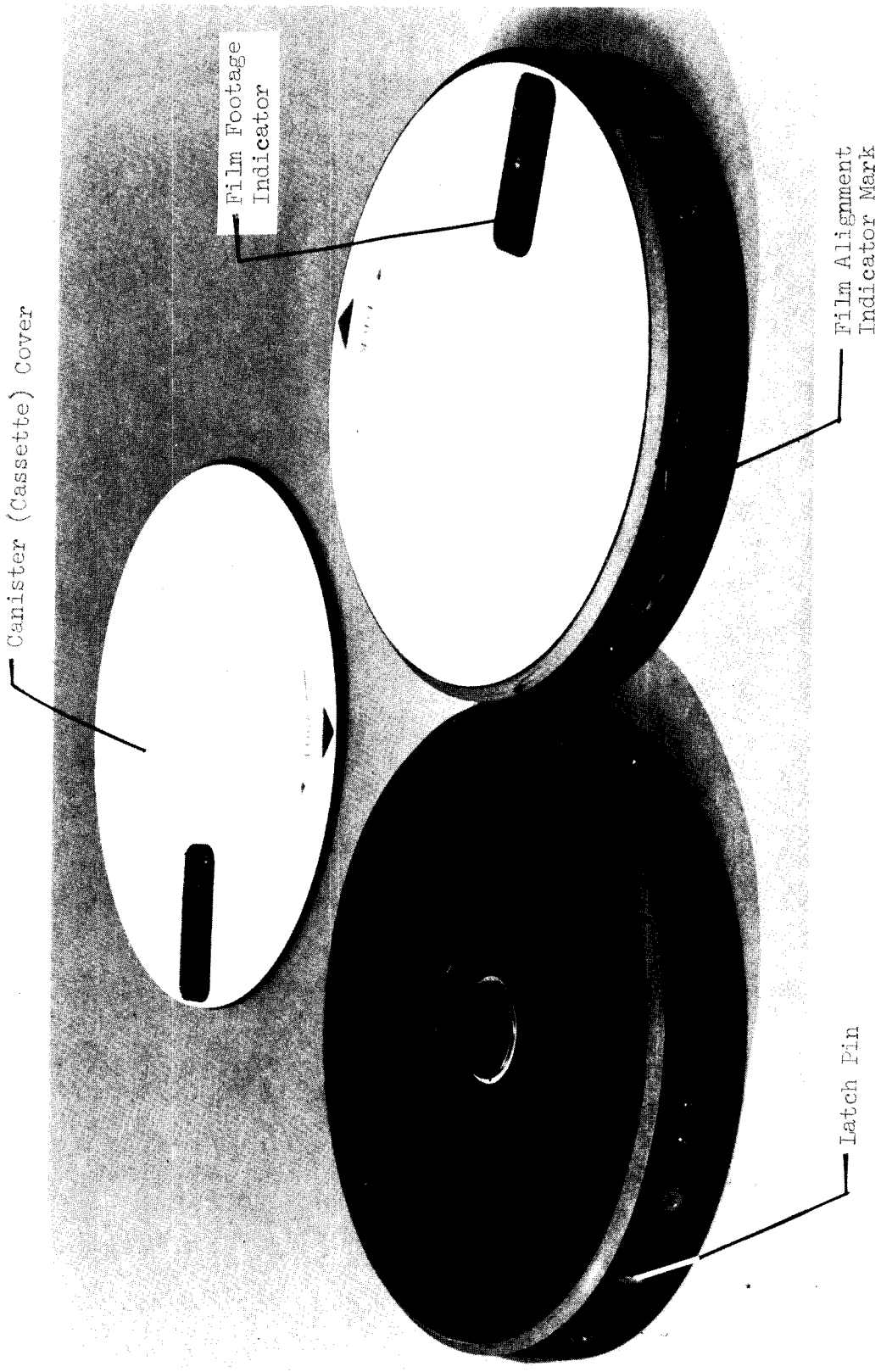


Figure 2.4-1 - DAC Film Cassette (400)

2.5 5 mm. Lens (SEB33100056):

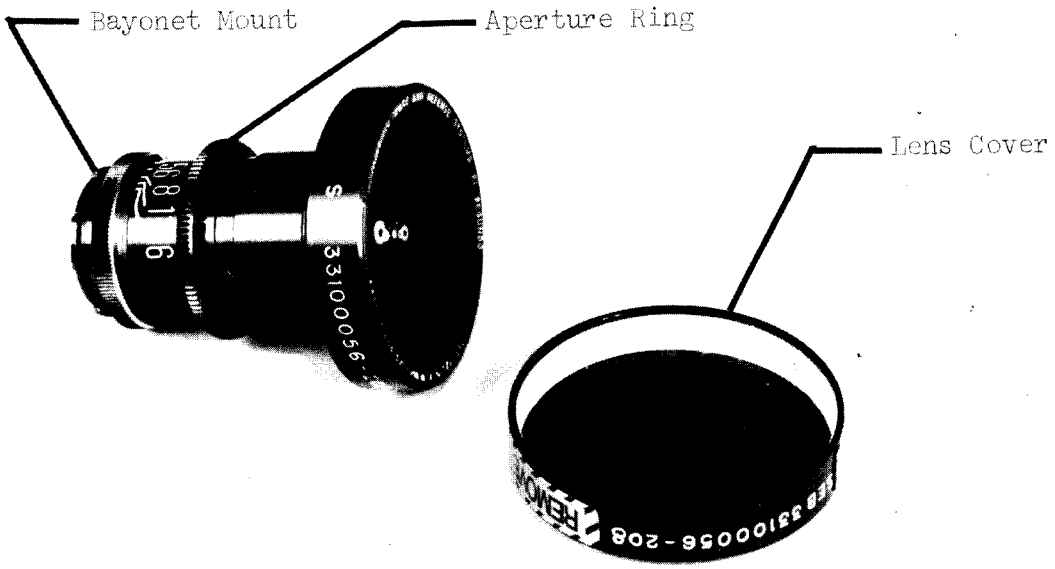
This is the widest field-of-view lens available for the DAC system. It is used primarily for interior photography when maximum area coverage is desired and where detail and geometrical fidelity are less important. Even though the barrel distortion effects of this lens are minimal for a lens of such short focal length, the effects are noticeable.

2.5.1 Significant Configurations:

Configuration	Purpose
-208	Apollo and Skylab flight unit

2.5.2 Characteristics:

- Manufactured by Fairchild Space and Defense Systems, Inc., El Segundo, California 90245.
- Weight with cover - 0.69 lbs. (313 g.).
  Envelope (less tab) - 2.14 dia. x 3.02 in. (5.34 dia x 7.67 cm.).
  Volume - 10.1 in.^{3} (178.0 cm.^{3}).
- Field-of-view - 117.5° x 80.2°; 160° diagonal.
- Focus is fixed and good from the front of the lens to infinity.
- Aperture - f/2.0 to f/16 with detents at each full-stop value. A sturdy tab is provided to assist in aperture ring setting and in lens installation and removal.
- Lens cover is part of lens assembly and protects front glass surface.
- This lens has been qualification tested for use in the Skylab and Apollo vehicles and during EVA operations.



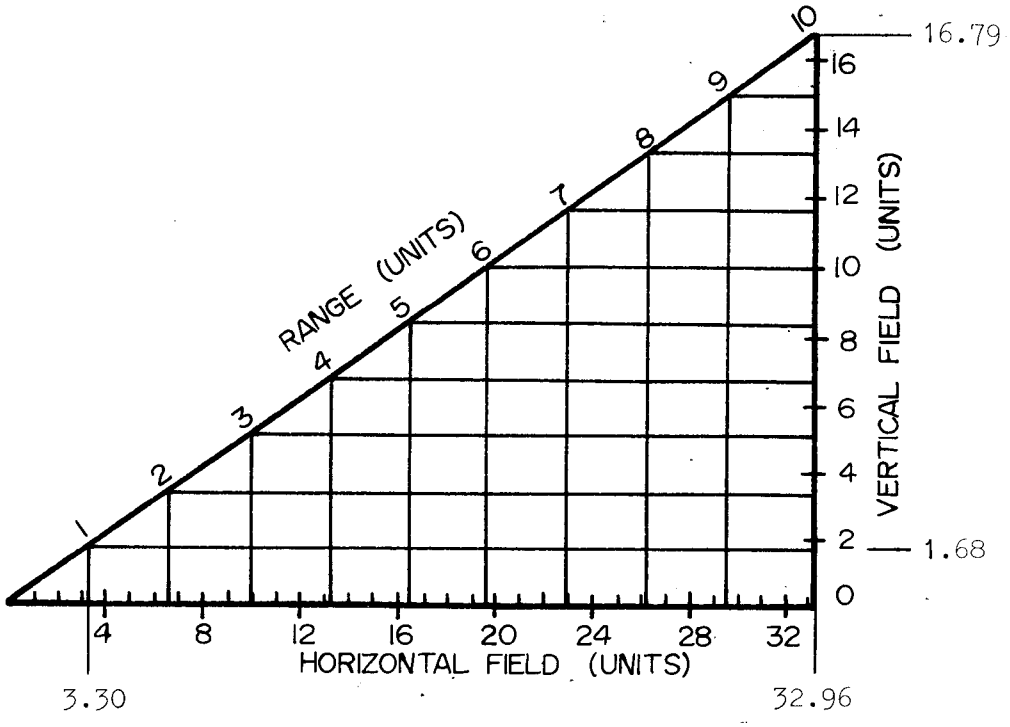


Figure 2.5-1 - 5 mm. Lens and Field-of-View Chart

2.6 10 mm. Lens (SEB33100010):

The 10 mm. Lens has a wide field-of-view, a large relative aperture, and very good resolution and distortion characteristics. The lens is most useful for interior vehicle photography where illumination is low and where moderate engineering detail is to be recorded. The low distortion property of this lens has made it well suited for recording EVA and lunar surface operations also.

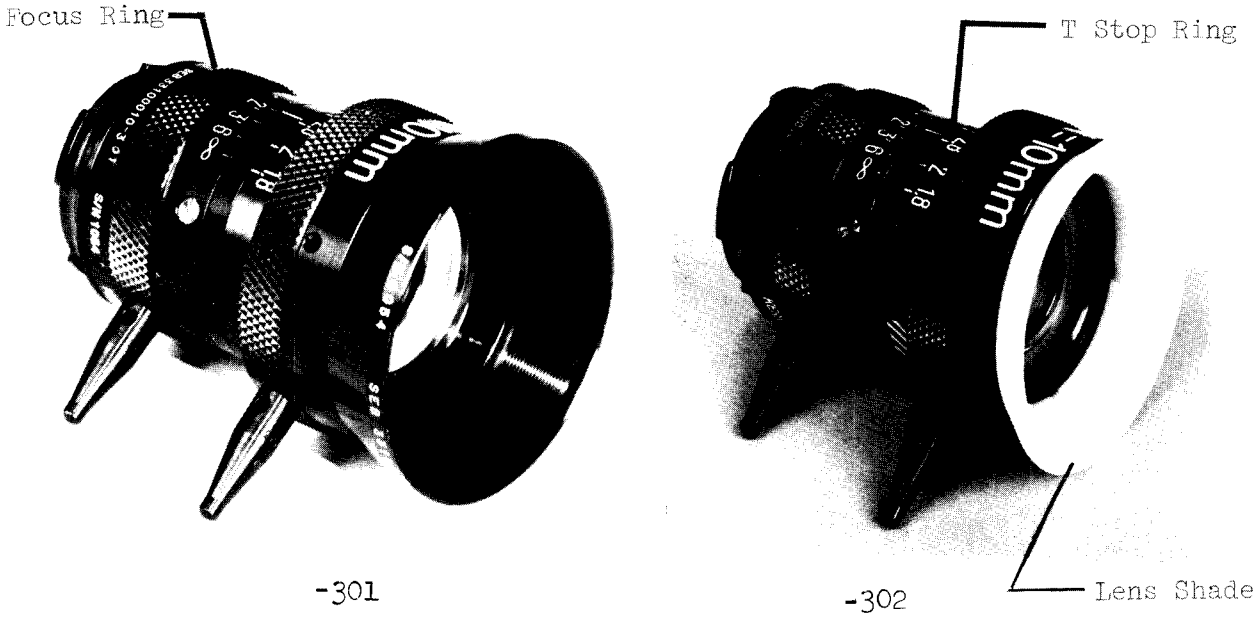
2.6.1 Significant Configurations:

Configuration	Purpose
-301	Skylab and Apollo CM flight unit
-302	Apollo LM flight unit; narrow teflon lens shade
-303	Apollo lunar surface unit; no focus tab and focus fixed at 6 feet with tape

2.6.2 Characteristics:

- Manufactured by Kern and Co. AG, Aarau, Switzerland, and distributed by Paillard, Inc., Linden, New Jersey 07036.
- Weight - 0.60 lbs. (272 g.).
  Envelope (less tabs) - 1.97 dia. x 2.03 in. (5.0 dia x 5.16 cm.)
  Volume - 6.18 $in.^3$ (101.3 $cm.^3$)
- Field-of-view - 54.9° x 41.1°; 65.2° diagonal.
- Focus range - 8 inches to infinity with detents and markings for 2 feet and infinity and with only markings for 8, 9, and 10 inches and for 1, 1.5, 3, and 6 feet. The 2 foot setting provides sharp focus to infinity for aperture settings for T/5.6 through T/22. At the closest focus setting, the subject should be 4.7 inches (11.9 cm.) from the lens front edge.
- Aperture - T/1.8 through T/22 with detents at each full stop value.
- Sturdy tabs are provided on the aperture and focus rings to assist in setting and in lens installation and removal.

- This lens has been qualification tested for use in the Skylab and Apollo vehicles, on the lunar surface, and during EVA operations.



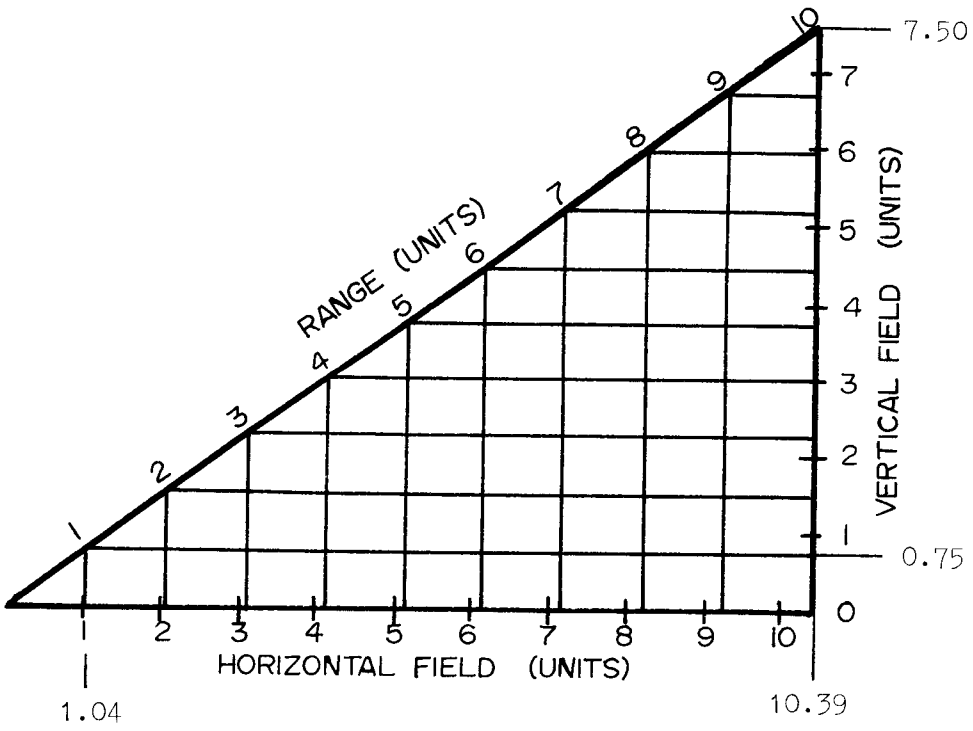


Figure 2.6-1 - 10 mm. Lens and Field-of-view Chart

2.7 18 mm. Lens (SEB33100018):

The 18 mm. Lens has the largest relative aperture of the DAC system and is the widest field-of-view lens that can be used with the Right Angle Mirror (see 2.12). The lens is especially useful for vehicle-to-vehicle docking and detailed interior photography.

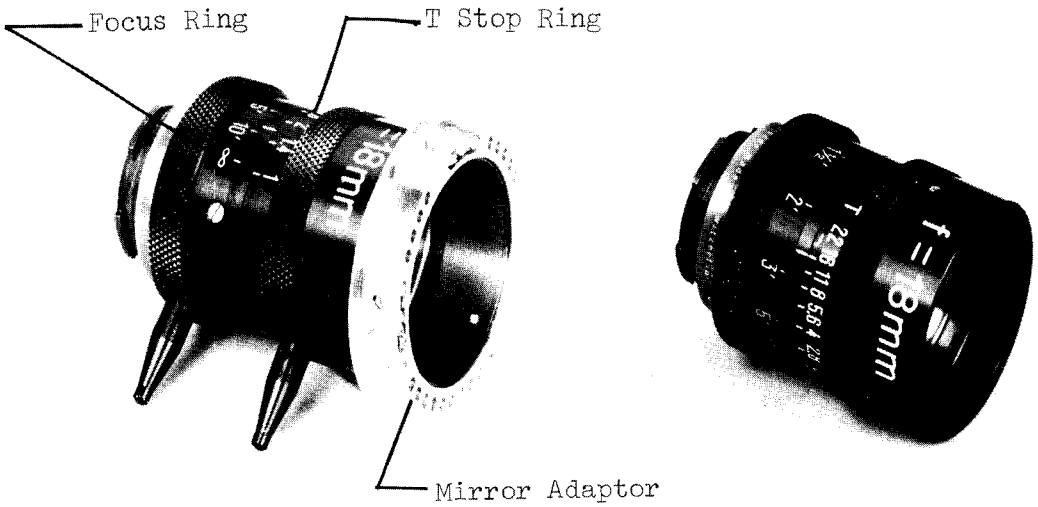
2.7.1 Significant Configurations:

Configuration	Purpose
-301	Apollo and Skylab flight unit; standard mirror interface
-302	Skylab Exp. T020 unit; no mirror interface and no control tabs
-303	Skylab Exp. M479 unit; rotated mirror interface and no control tabs

2.7.2 Characteristics:

- Manufactured by Kern and Co. AG, Aarau, Switzerland, and distributed by Paillard, Inc., Linden, New Jersey 07036.
- Weight - 0.80 lbs. (364 g.).
  Envelope (less tabs) - 2.14 dia x 2.60 in. (5.43 dia x 6.60 cm.).
  Volume - 9.36 $in.^3$ (153 $cm.^3$).
- Field-of-view - 32.6° x 23.4°; 39.2° diagonal.
- Focus range - 1 foot to infinity with detents and markings for 10 feet and infinity and with only markings for 1, 1.5, 2, 3, and 5 feet. The 10 foot setting provides sharp focus to infinity for aperture settings of T/4 through T/22. At the closest focus setting, the subject should be 8.9 inches (22.6 cm.) from the lens front edge.
- Aperture - T/1.0 through T/22 with detents at each full stop value.
- Sturdy tabs are provided on the aperture and focus rings to assist in setting and in lens installation and removal. (Except -302 and -303 configurations, see 2.7.1.)
- Accepts attachment of the Right Angle Mirror (see 2.7.1 and 2.12).

- This lens has been qualification tested for use in the Skylab and Apollo vehicles and during EVA operations.



-301 -302

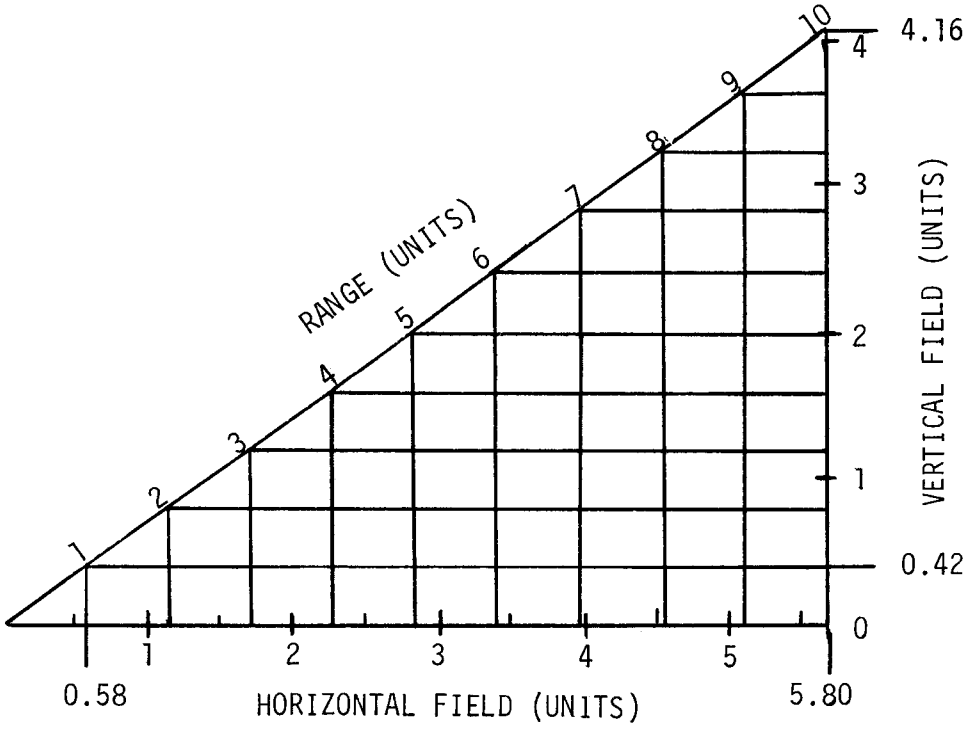


Figure 2.7-1 - 18 mm. Lens and Field-of-view Chart

2.8 25 mm. Lens (SEB33100054):

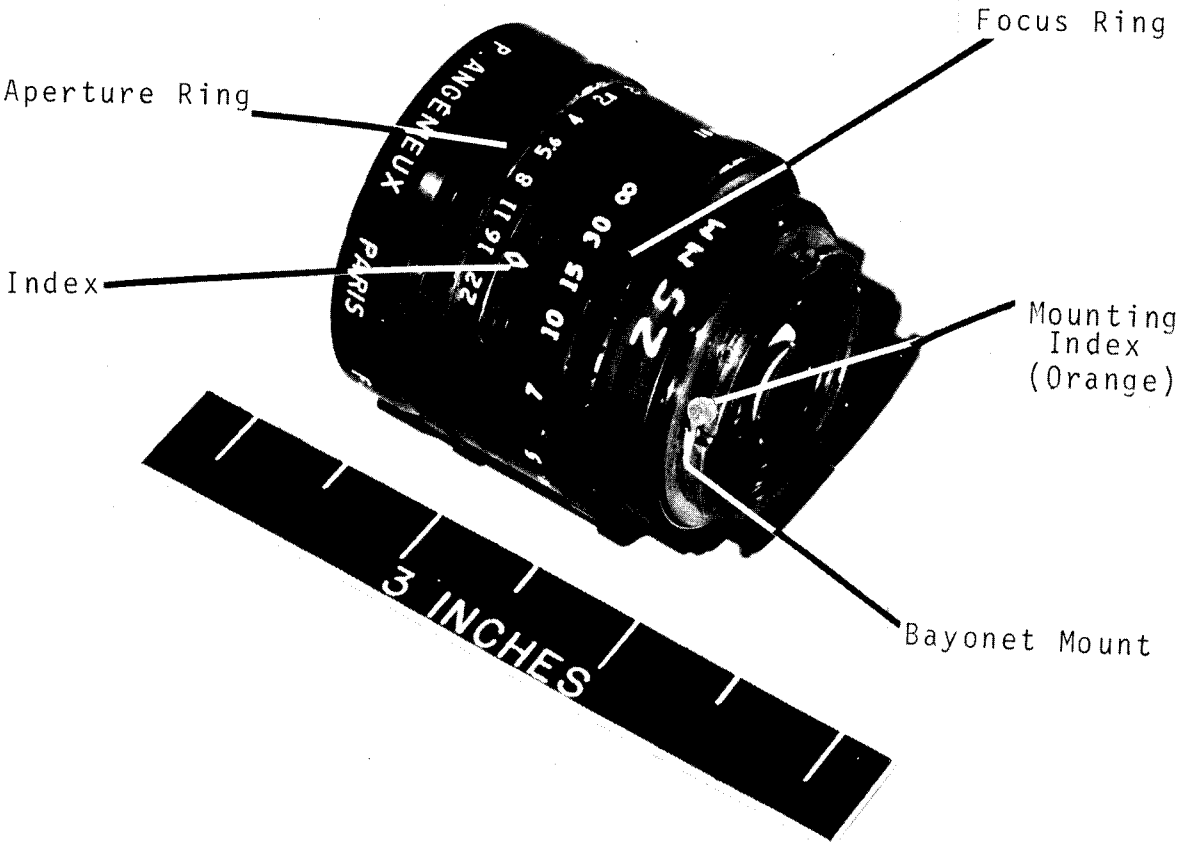
This focal length lens is the standard for 16 mm. photography providing the "normal" visual scene coverage. The large relative aperture of this lens is especially useful for dimly lighted photographic situations.

2.8.1 Significant Configurations:

Configuration	Purpose
-202	Basic flight unit; incroporated in Skylab Experiment T027 assembly.

2.8.2 Characteristics:

- Manufactured by P. Angenieux, Paris, France.
- Weight - 0.30 lbs. (136 g.).
  Envelope - 1.64 dia x 2.11 in. (4.17 dia x 5.30 cm.).
  Volume - 4.46 $in.^3$ (73.0 $cm.^3$).
- Field-of-view - 23.5° x 17.1°; 28.7° diagonal.
- Focus range - 18 inches to infinity with no detents provided. Focus is marked for 18, 21, 24, 27, 30, 36, and 42 inches and for 4, 5, 7, 10, 15, and 30 feet and for infinity.
- Aperture - f/0.95 (T/1.05) through f/22 with detents at each full stop value.
- This lens has been qualification tested for use in the Gemini and the Skylab vehicles.



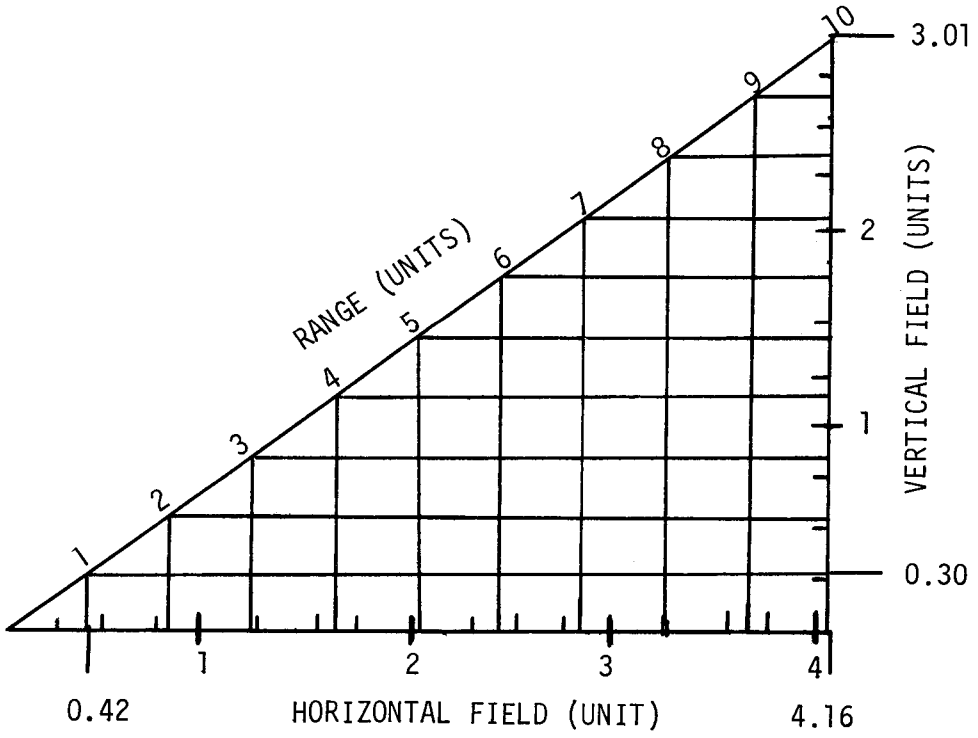


Figure 2.8-1 - 25 mm. Lens and Field-of-View Chart

2.9 75 mm. Lens (SEB33100019):

This moderate telephoto lens is used primarily for photographing distant objects. With the focal length and narrow field-of-view of this lens, bracket mounting and precise aiming are recommended.

2.9.1 Significant Configurations:

Configuration	Purpose
-302	Apollo and Skylab CM unit; standard usage
-303	Skylab Exp. M551-5 unit; extender for close focus incorporated and no control tabs

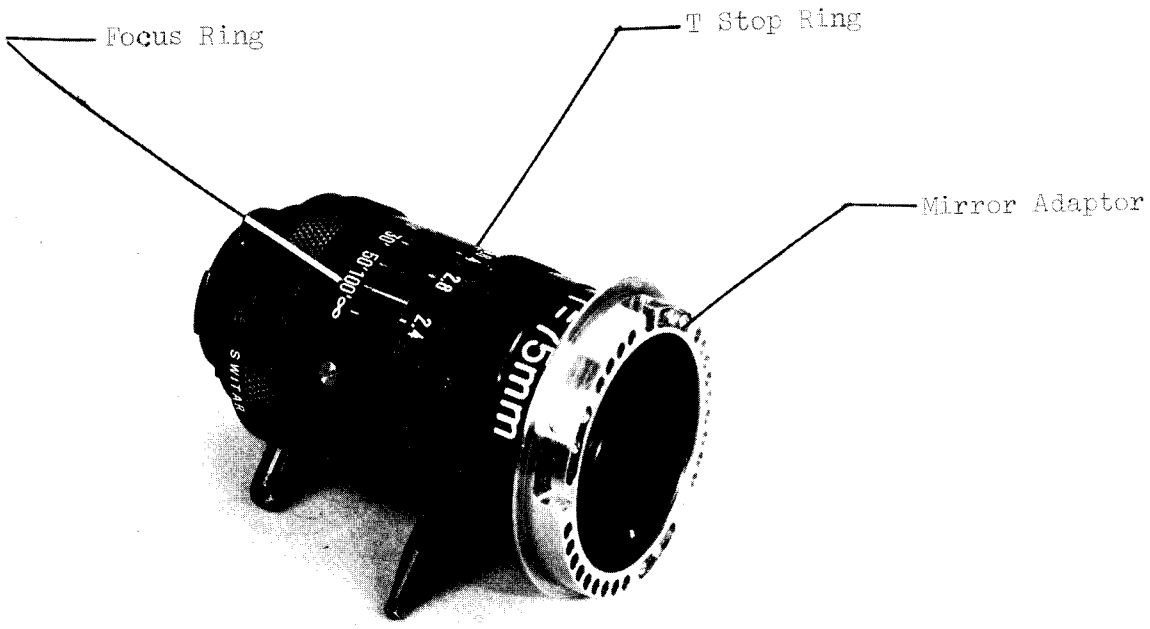
2.9.2 Characteristics:

- Manufactured by Kern and Co. AG, Aarau, Switzerland, and distributed by Paillard, Inc., Linden, New Jersey 07036.

- Weight (-302) - 0.85 lbs. (386 g.).
  (-303) - 0.90 lbs. (409 g.).
  Envelope (less tabs) (-302) - 2.14 dia x 3.53 in. (5.34 dia x 8.96 cm.).
  (-303) - 2.14 dia x 4.47 in. (5.34 dia x 11.35 cm.).
  Volume (-302) - 12.7 $in.^3$ (208 $cm.^3$).
  (-303) - 16.1 $in.^3$ (264 $cm.^3$).

- Field-of-view (-302) - 8.0° x 5.6°; 10.0° diagonal.
  (-303) - 6.0° x 4.4°; 7.4° diagonal.

- Focus range (-302) - 5 feet to infinity with detents and markings for 10 feet and infinity and with only markings for 5, 5.5, 6, 6.5, 7, 8, 9, 12, 15, 20, 30, 50, and 100 feet. The 10 foot setting provides sharp focus from 8.9 to 11.4 feet for T/8 and from 8.5 to 12.1 feet for T/11.
  (-303) - 13.4 to 14.9 inches from the film plane with detents at the 14.4 and the 14.9 inch ranges. The focus scale markings are unchanged from the -302 configuration; the incorporated extender of the -303 configuration produces the close-up focusing characteristics.



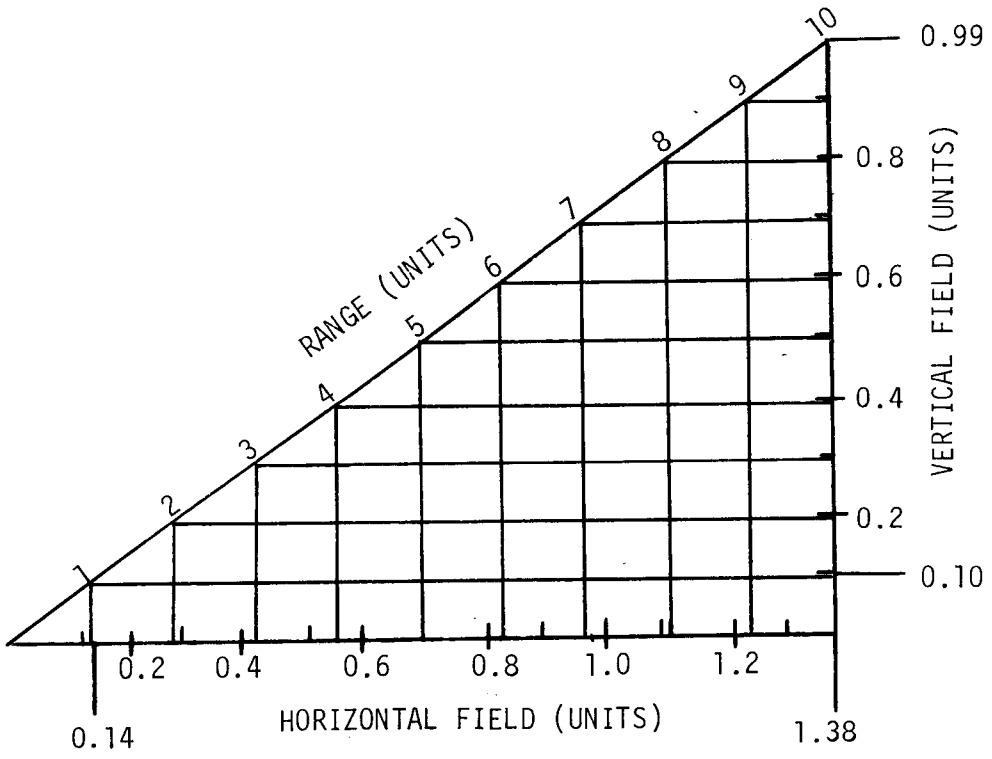


Figure 2.9-1 - 75 mm. Lens (-302) and Field-of-view Chart

- Aperture (-302) - T/2.4 through T/22 with detents at each full stop and at the T/2.4 setting.
  (-303) - marked the same as the -302 configuration; however, the relative aperture is reduced by 0.6 stop because of the lens extension. The marked aperture values are actually the aperture values as follows: T/2.4 is T/3.1, T/2.8 is T/3.6, T/4 is T/5.2, T/5.6 is T/7.3, T/8 is T/10.4, T/11 is T/14.3, T/16 is T/20.8, and T/22 is T/28.6.

- Sturdy tabs are provided (-302 only) on the aperture and focus rings to assist in setting and in lens installation and removal.

- Accept attachment of the Right Angle Mirror (see 2.12).

- This lens has been qualification tested for use in the Skylab and Apollo vehicles and during EVA operations.

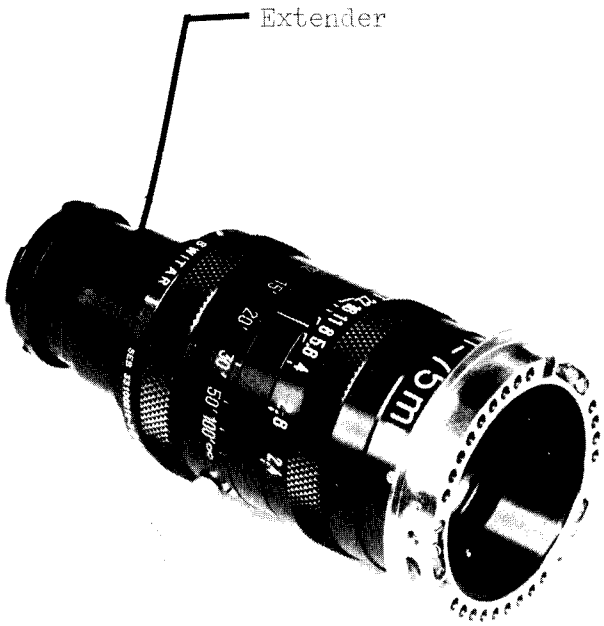


Figure 2.9-2 - 75 mm. Lens (-304) With Incorporated Extender For Close Focus

2.10 100 mm. Lens (SEB33100025):

The 100 mm. Lens is intended for distant object photography. With an extender tube incorporated on the rear of the lens, close range photography is made possible. The long focal length and narrow field-of-view of this lens necessitate bracket mounting and precise aiming. This is a commercial lens and will not be utilized after Skylab. B

2.10.1 Significant Configurations:

Configuration	Purpose
-202	Standard usage unit
-203	Skylab Exp. M551-5 unit; extender for close focus incorporated

2.10.2 Characteristics:

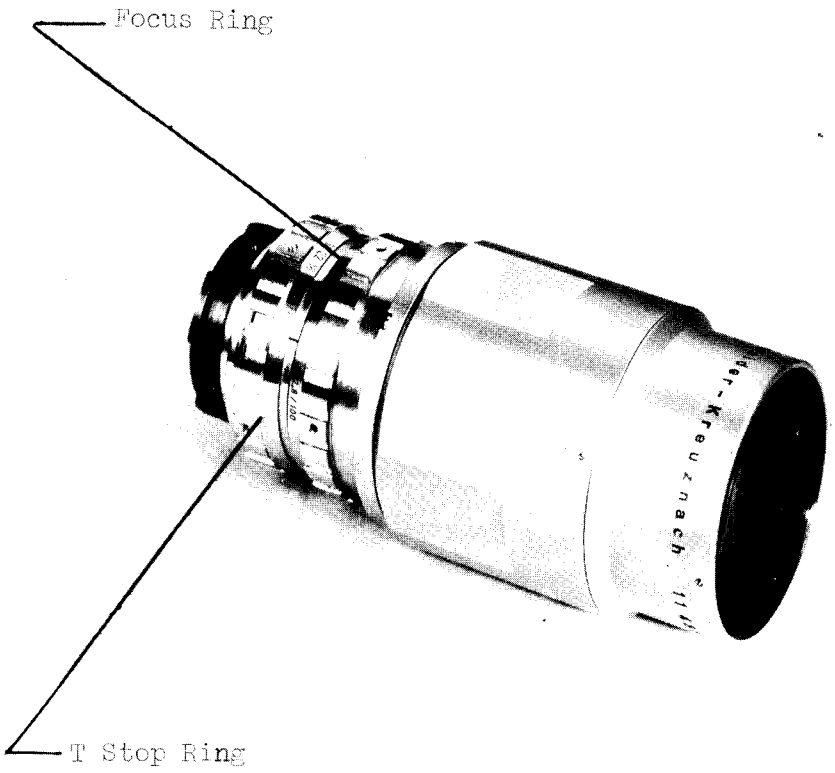
- Manufactured by Schneider Optische Werke, Kreuznach, W. Germany, and distributed by Burleigh Brooks, Inc., Englewood, New Jersey 07631.

- Weight (-202) - 1.12 lbs. (508 g.).
  (-203) - 1.22 lbs. (554 g.).
  Envelope (-202) - 2.14 dia x 4.40 in. (5.34 dia x 11.18 cm.).
  (-203) - 2.14 dia x 5.80 in. (5.34 dia x 14.72 cm.).
  Volume (-202) - 15.8 $in.^3$ (259 $cm.^3$).
  (-203) - 20.1 $in.^3$ (343 $cm.^3$).

- Field-of-view (-202) - 5.9° x 4.3°; 7.3° diagonal.
  (-203) - 4.3° x 3.1°; 5.4° diagonal.

- Focus range (-202) - 5 feet to infinity with no detented settings. Focus is marked for 6, 6.5, 7, 7.5, 8, 8.5, 9, 10, 11, 12, 14, 16, 18, 20, 25, 30, 40, 50, and 100 feet and for infinity.
  (-203) - 20.0 to 21.7 inches from the film plane. The focus scale markings are unchanged from the -202 configuration; the incorporated extender of the -203 configuration produces the close-up focusing characteristics. Focus is locked at proper distance for experiments. B

- Aperture (-202) - f/2.8 through f/32 with no detents.
  (-203) - marked the same as the -202 configuration; however, the relative aperture is reduced by 0.7 stop because of the lens extension. The marked aperture values are actually the aperture values as follows: f/2.8 is f/3.8, f/4 is f/5.4, f/5.6 is f/7.6, f/8 is f/10.8, f/11 is f/15, f/16 is f/21, f/22 is f/30, and f/32 is f/43.



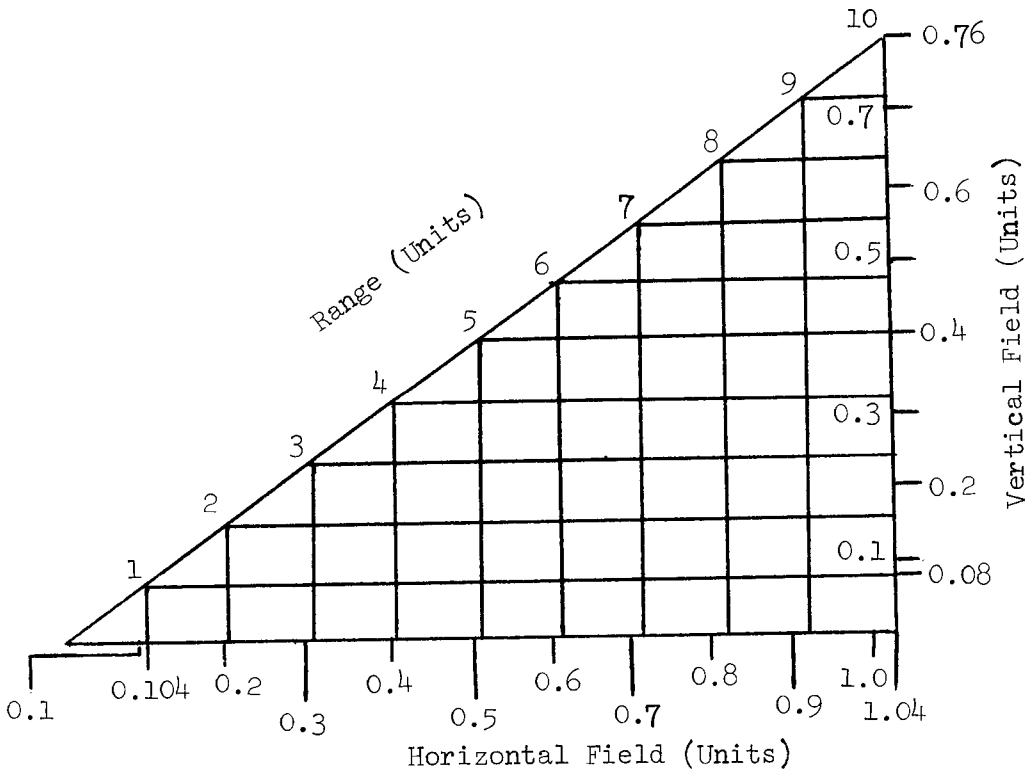


Figure 2.10-1 - 100 mm. Lens (-202) and Field-of-view Chart

- Accepts attachment of the Right Angle Mirror (see 2.12).
- This lens has been qualification tested for use in the Skylab and Apollo vehicles

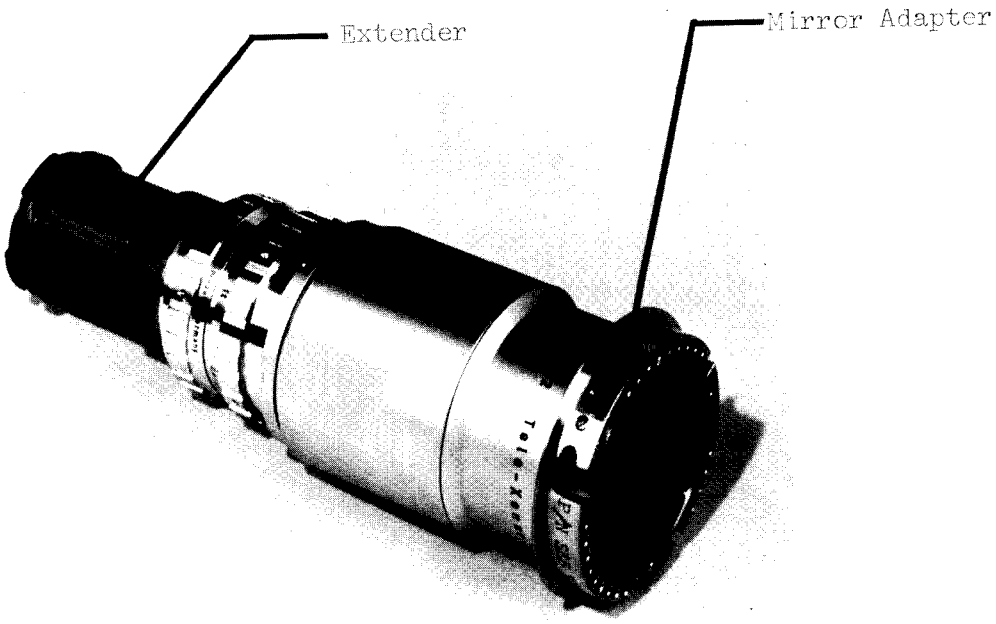


Figure 2.10-2 - 100 mm. Lens (-203) with Incorporated Extender for Close Focus

2.11 180 mm. Lens (SEB33100017):

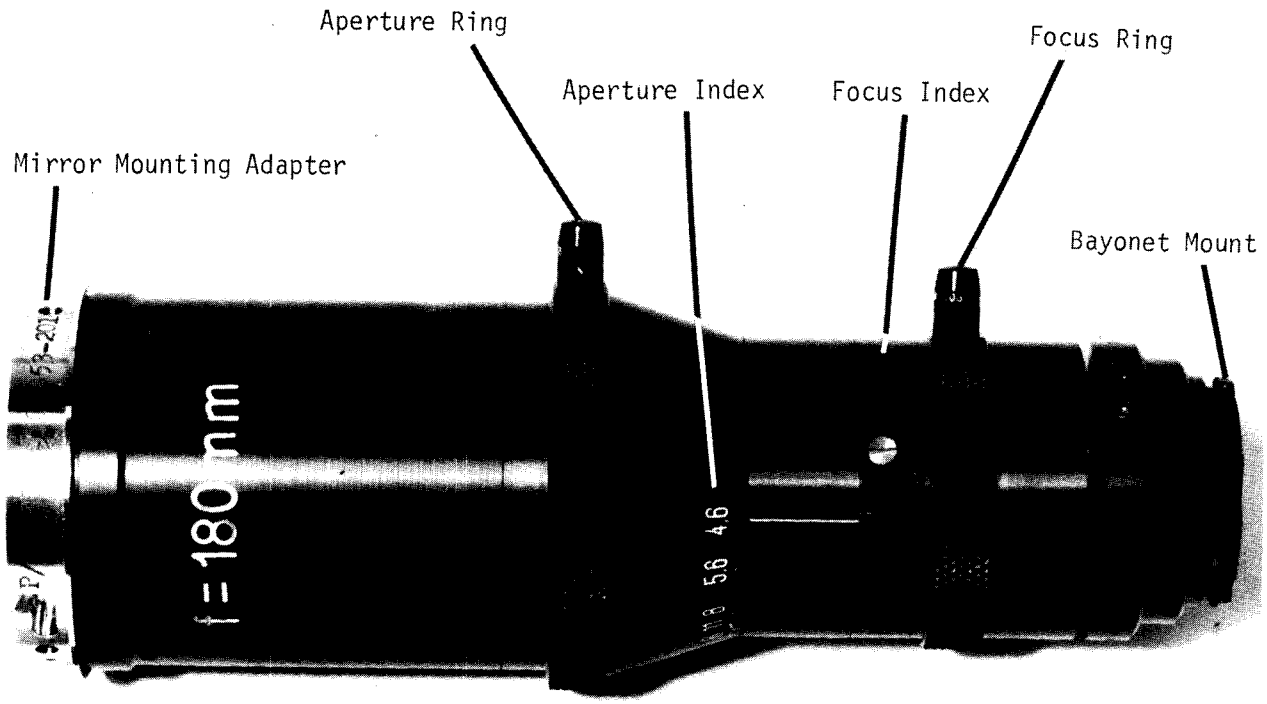
The 180 mm. Lens is the longest focal length lens available in the DAC system. Its primary use is for distant object photography. The very long focal length and narrow field-of-view of this lens necessitate bracket mounting and precise aiming.

2.11.1 Significant Configurations:

Configuration	Purpose
-301	Basic flight unit - not currently in use

2.11.2 Characteristics:

- Manufactured by Kern and Co. AG, Aarau, Switzerland, and distributed by Paillard, Inc., Linden, New Jersey 07036.
- Weight - 1.36 lbs. (618 g.).
  Envelope (less tabs) - 2.14 dia x 6.53 in (5.34 dia x 16.60 cm.).
  Volume - 23.5 $in.^3$ (385 $cm.^3$).
- Field-of-view - 3.3° x 2.4°; 4.1° diagonal.
- Focus range - 15 feet to infinity with no detented settings. Focus is marked for 15, 16, 18, 20, 25, 30, 35, 40, 50, 70, 100, and 200 feet and for infinity.
- Aperture - T/4.6 to %/32 with a detent at each full stop and at the T/4.6 setting.
- Sturdy tabs are provided on the aperture and focus rings to assist in setting and in lens installation and removal.
- Accepts attachement of the Right Angle Mirror (see 2.12).
- This lens has been qualification tested for use in the Skylab and Apollo vehicles and during EVA operations.



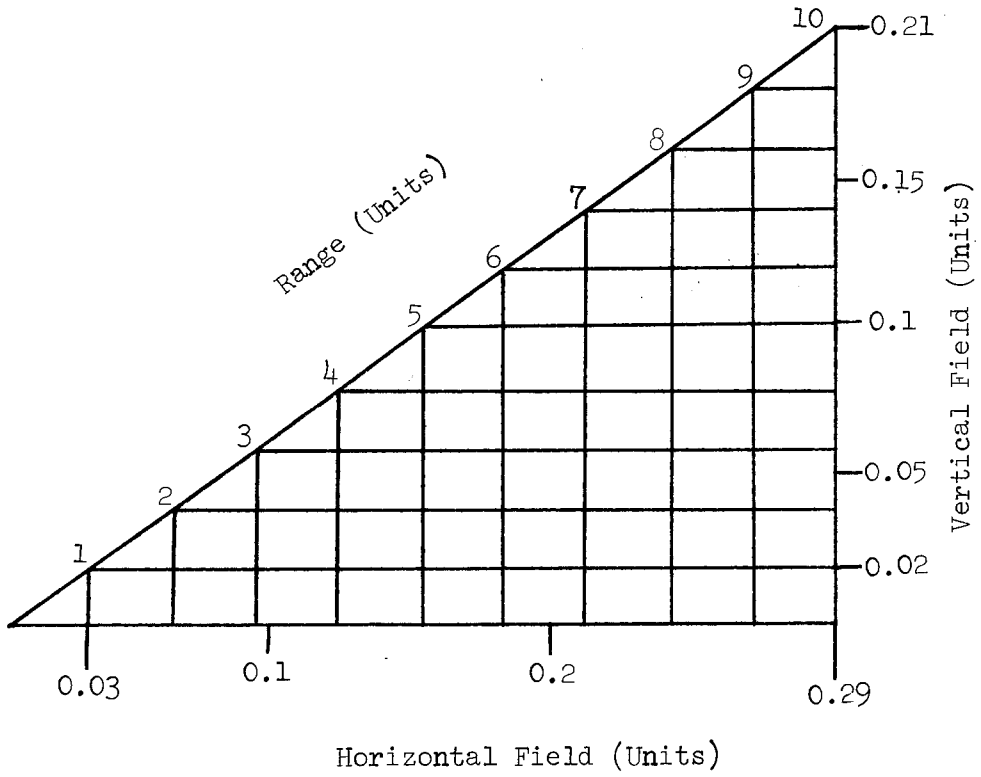


Figure 2.11-1 - 180 mm. Lens and Field-of-view Chart

2.12 Right Angle Mirror (SEB33100051):

The Right Angle Mirror assembly bayonet mounts onto the front of several of the DAC lenses for photographic coverage at a right angle to the lens optical axis.

2.12.1 Significant Configuration:

Configuration	Purpose
-205	Apollo and Skylab flight unit

2.12.2 Characteristics:

- Manufactured by Technical Services Division, NASA MSC, Houston, Texas 77058.
- Weight - 0.16 lbs. (72.6 g.).
  Envelope - 2.14 dia x 2.2 in. (5.34 dia x 5.59 cm.).
  Volume - 7.92 $in.^3$ (130 $cm.^3$).
- Mirror is a front surface polished glass plate, silvered for maximum optical reflectance and protected by an aluminum with silicone monoxide coating.
- Bayonet mounting is indexed and installs on the lens in only one orientation. Can be installed on the 18 mm. Lens (see 2.7), 75 mm. Lens (see 2.9), 100 mm. Lens (see 2.10), and 180 mm. Lens (see 2.11).
- The Right Angle Mirror has been qualified for use in the Skylab and Apollo vehicles.

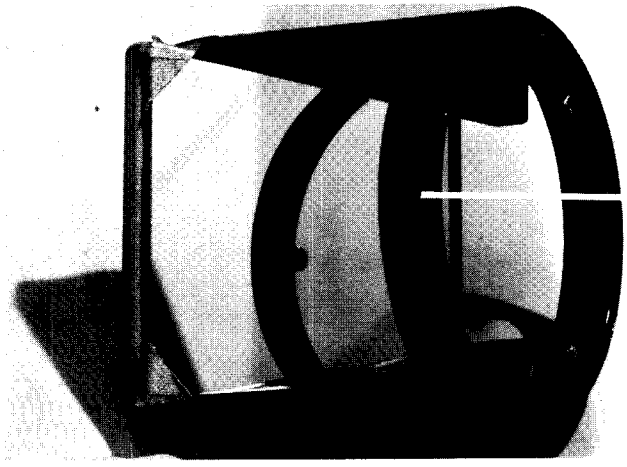


Figure 2.12-1 - Right Angle Mirror

2.13 DAC Power Cable (CM) (SEB33100038):

This cable is used in the CM to provide spacecraft power to the DAC.

2.13.1 Significant Configurations:

Configuration	Purpose
-301	CM flight unit for Apollo and Skylab missions

2.13.2 Characteristics:

- Manufactured by Technical Services Division, NASA MSC, Houston, Texas 77058.
- Weight - 0.23 lbs (104.3 g.).
  Length - 108 ± 4 in. (9 ± 0.3 ft.) (274 ± 10 cm.).
- Connects DAC to CM Panels 15, 16, and 100.
- This three wire cable includes a Bendix type JT06P-8-6S bayonet connector on the DAC end and a Deutsch type 127-3-9P push-pull connector on the CM end.
- This cable has been qualified for use in the Skylab and Apollo vehicles.

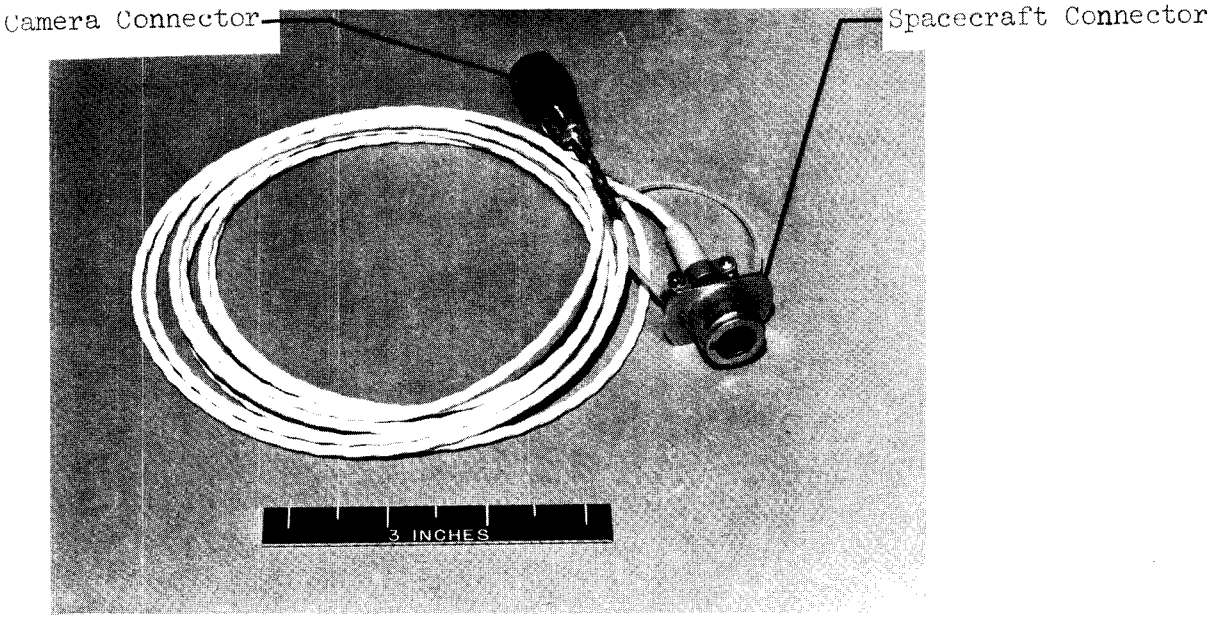


Figure 2.13-1 - DAC Power Cable (CM)

2.14 DAC Power Cable (SWS) (SEC33100567):

This cable is used in the Skylab OWS and MDA to provide power to the DAC.

2.14.1 Significant Configurations:

Configuration	Purpose
-303	Skylab flight unit

2.14.2 Characteristics:

- Manufactured by Technical Services Division, NASA MSC, Houston, Texas 77058.
- Weight - 1.0 lbs. (454 g.).
  Length - $180 \pm \frac{6}{0}$ in. ($15 \pm \frac{0.5}{0.0}$ ft.) ($457 \pm \frac{15}{0}$ cm.).
- Connects the DAC to the OWS utility outlets.
- This three wire shielded cable includes a Bendix type JT06P-8-6S bayonet connector on the DAC end and a Bendix type ZG6E1511-98-PA zero g connector on the SWS end.
- This cable has been qualified for use in the Skylab vehicles.

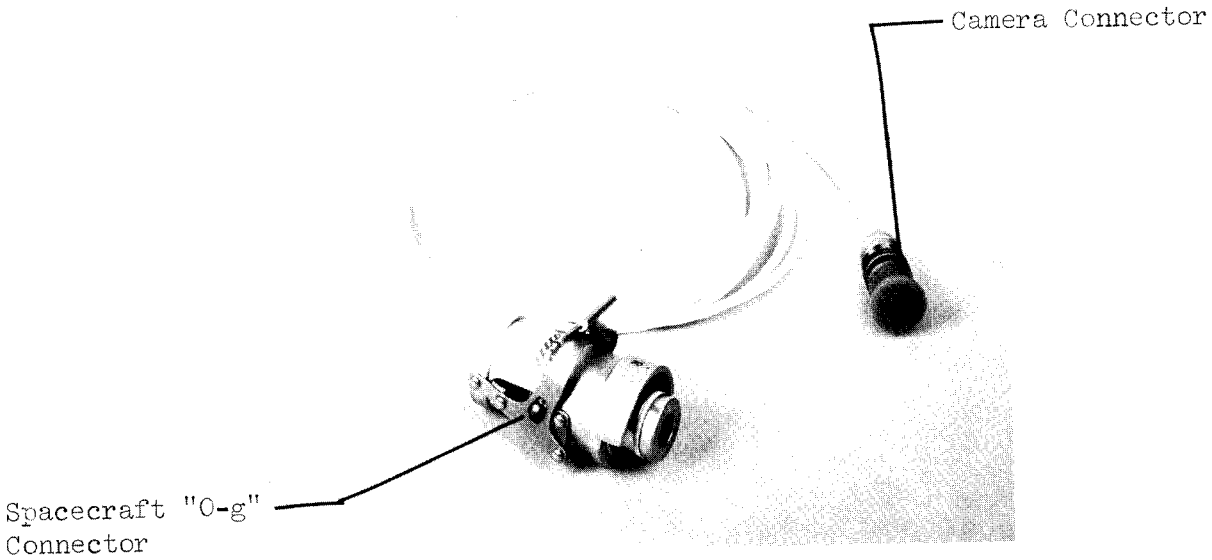


Figure 2.14-1 - DAC Power Cable (SWS)

2.15 DAC Spare Fuse Assembly (SEB33100266):

The Spare Fuse Assembly includes a replacement power line fuse for the DAC and a fuse pin protector in a small teflon bag.

2.15.1 Significant Configurations:

Configuration	Purpose
-301	Apollo and Skylab flight unit

2.15.2 Characteristics:

- The assembly is prepared by the Flight Crew Integration Division, NASA MSC, Houston, Texas 77058. The actual fuse is provided by J. A. Maurer, Inc., Long Island City, New York 11101.
- Weight - 0.01 lbs. (4.5 g.).
  Envelope - 1.7 x 1.2 x 0.5 in. (4.3 x 3.0 x 1.3 cm.).
  Volume - 1.02 in.^{3} (16.7 cm.^{3}).
- The fuse rating can be either 1.5 or 2.0 amp. with standard opening characteristics. There is no visible indication of fuse opening.
- The DAC Spare Fuse Assembly has been qualified for use in the Apollo and Skylab vehicles.

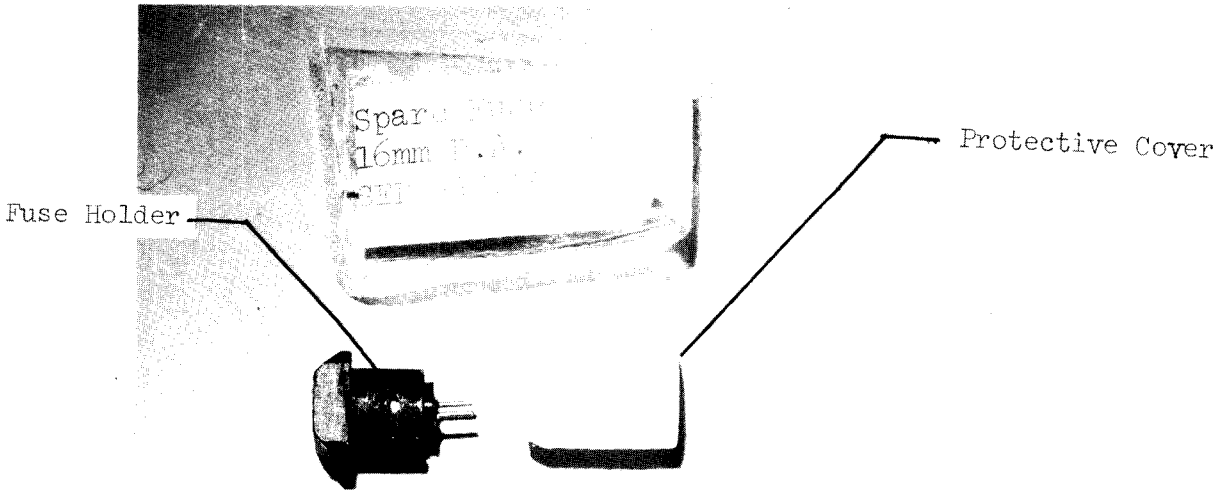


Figure 2.15-1 - DAC Spare Fuse Assembly

2.16 Remote Control Cable (SEB33100020):

This cable provides for remote operation of the DAC and Hasselblad cameras.

2.16.1 Significant Configurations:

Configuration	Purpose
-301	Apollo CM; indicator light in cable button
-302	Apollo LM; indicator light in cable button
-303	Apollo; without indicator light
-305	Skylab flight unit

2.16.2 Characteristics:

- Manufactured by J. A. Maurer, Inc., Long Island City, New York 11101.

Configuration	Weight	Length
-301	1.0 lbs. (454 g.)	120 ± 2 in. (304 ± 5 cm.).
-302	1.4 lbs. (636 g.)	168 ± 2 in. (426 ± 5 cm.).
-303	0.7 lbs. (318 g.)	48 ± 2 in. (122 ± 5 cm.).
-305	1.3 lbs. (591 g.)	240^{+6}_{-0} in. (609^{+15}_{-0} cm.).

- Cable incorporates a Deutsch type UR46-8-7P bayonet connector for attachment to the DAC or the Hasselblad camera accessory connector.

- For DAC control, the camera operation can be started and stopped and the camera sequencing modes can be selected as follows:

Configuration	Sequencing Modes
-301	1, 6, 12, and 24 fps
-302	1, 6, 12, and 24 fps
-303	Time, 1, 6, 12, and 24 fps
-305	Time, 2, 6, 12, and 24 fps

Remote mode selection is independent of camera mode selector switch setting. The camera operating mode is

determined by which operate button is used to start the sequencing. DAC automatic operation can be stopped by depressing and releasing either operate button.

- For Hasselblad camera control, only camera actuation can be triggered with the cable button. Remote mode selector setting has no effect in this case.

- The cable configurations -301 and -302 incorporate an indicator lamp under the operate button. This lamp flashes at the selected sequencing rate. The lamp operation capability requires some wiring modifications in the DAC itself and eliminates the TIME mode.

- The Remote Control Cables are qualified for use in the Apollo and Skylab vehicles.

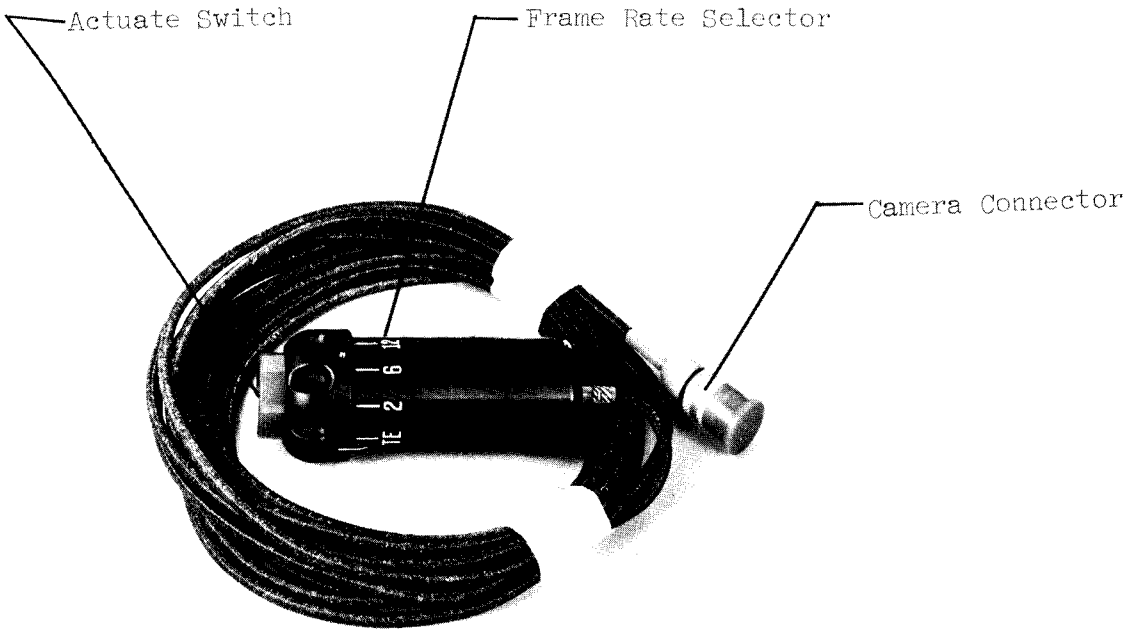


Figure 2.16-1 - Remote Control Cable (-305)

2.17 DAC Power Pack (SEB33100304):

The power pack is a self-contained, nickel cadmium battery power unit for the DAC system. It is used primarily during EVA photographic operations.

2.17.1 Significant Configurations:

Configuration	Purpose
-303	Apollo lunar surface unit; one mounting rail
-305	Skylab flight unit; two mounting rails

2.17.2 Characteristics:

- Manufactured by Technical Services Division, NASA MSC, Houston, Texas 77058.

- Weight (-303) - 4.2 lbs. (1908 g.).
  (-305) - 4.3 lbs. (1954 g.).
  Envelope (less cable)(-303) - 6.1 x 4.5 x 2.5 in. (15.5 x 11.4 x 6.4 cm.).
  (-305) - 6.1 x 4.5 x 2.7 in. (15.5 x 11.4 x 6.9 cm.).
  Volume (-303) - 68.6 $in.^3$ (1122 $cm.^3$).
  (-305) - 74.1 $in.^3$ (1213 $cm.^3$).

- Power source is 24 rechargeable nickel cadmium batteries type 1.2 SCL per Gould-National Batteries, Inc., Alkaline Battery Division, St. Paul, Minnesota 55114. The batteries are potted and enclosed in a sealed stainless steel assembly. The nominal open circuit voltage is 32.0 VDC with 1.1 amp. hours capacity. The number of film magazines that can be powered by a DAC Power Pack varies with DAC sequencing rate and length of time from Power Pack charging as follows:

	DAC Magazine (140)				DAC Cassette (400)		
	15	30	60	Shelf Life (Days)	15	30	60
1 fps	1.5	1.2	1.1		0.5	0.4	0.3
2 fps	2.5	2	2		1.0	0.7	0.6
6 fps	7	6	5		2.0	2	1.7
12 fps	13	10	9		4.7	4	3.5
24 fps	22	18	16		9	8	7

- Incorporated cable connects to DAC power connector (forward-most). Cable connector is a Bendix JT06A-8-6S bayonet type. The -303 pack connector incorporates a metal tab assembly to assist EVA gloved connection of cable to DAC. The total cable/connector length is 7.5 ± 0.5 in. (19.05 ± 1.3 cm.).

- The mounting rail of the -303 configuration attaches the pack to the DAC Handle (see 2.20). One mounting rail of the -305 configuration attaches to the DAC EVA Bracket (see 2.19) and the other to the Universal Mount (see 2.18).

- The Power Pack has been qualification tested for use in the Apollo and Skylab vehicles and during EVA operations.

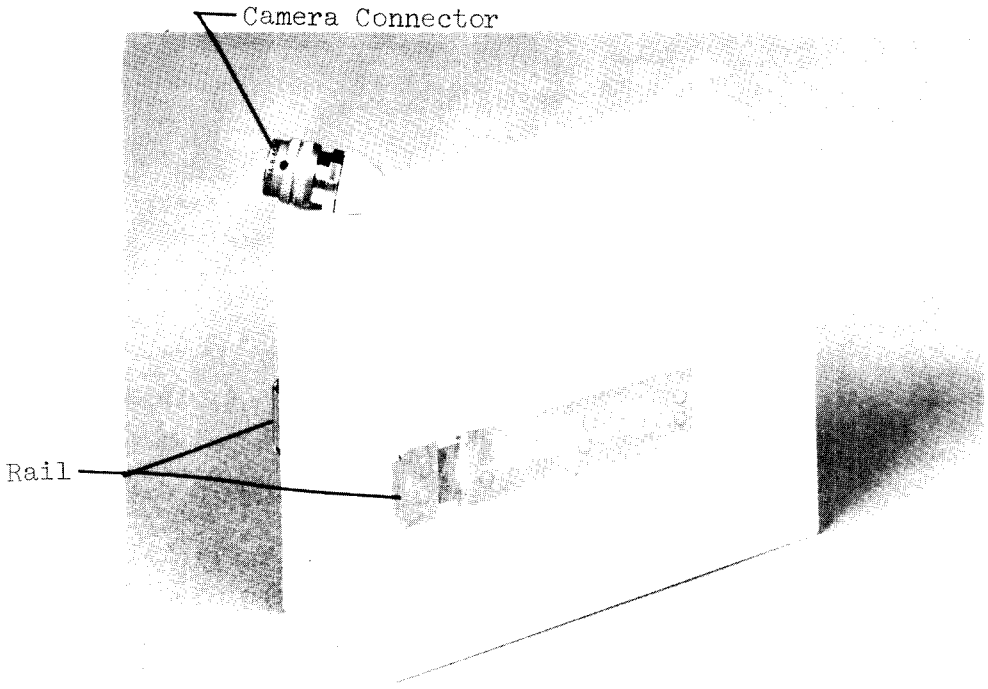


Figure 2.17-1 - DAC Power Pack (-305)

2.18 Universal Mount (SEC39106239):

As the name implies, the Universal Mount (UM) can be used to mount many different items in the Skylab SWS operations. For photographic operations, the UM can be used to mount the DAC, the High Intensity Light, and the 35 mm. Nikon camera (see 3.1).

2.18.1 Significant Configurations:

Configuration	Purpose
-301	Basic Skylab unit
B -302	Skylab EVA unit - high trunion torque

2.18.2 Characteristics:

- Manufactured by Technical Services Division, NASA MSC, Houston, Texas 77058.
- Weight - 1.8 lbs. (817 g.).
  Envelope - 11.65 x 4.35 x 4.70 in. (29.6 x 11.1 x 11.9 cm.).
  Volume - 238 $in.^3$ (3900 $cm.^3$).
- UM base is attachable to the SWS floor grid and hand rails with single hand operation. The attachment can be locked securely.
- The mounting rail of the DAC, High Intensity Light, 35 mm. Nikon Camera (see 2.1), etc., slides into the rear of the UM shoe. The rail is automatically locked into the shoe upon full insertion. Depression of the lock button on the UM shoe releases the rail for item removal.
- The UM provides X, Y, and Z axis positioning of hardware item through 360^{o} each axis with scale markings every 2^{o}.
- The UM has been qualification tested for use in the Skylab vehicles and during EVA operations.

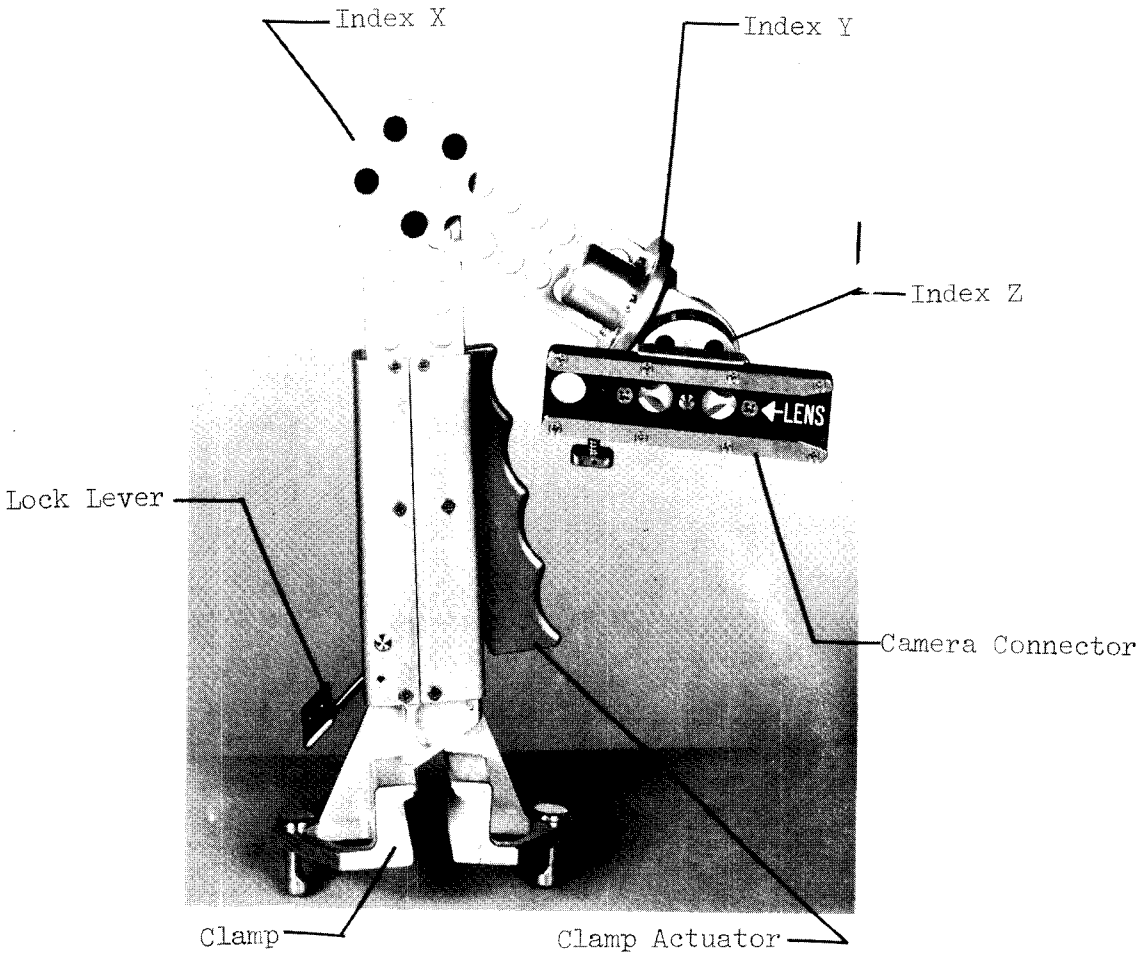


Figure 2.18-1 - Universal Mount

2.19 DAC EVA Bracket (SEC33100006):

This bracket provides the interconnection between the DAC and the DAC Power Pack for Skylab EVA operations.

2.19.1 Significant Configurations:

Configuration	Purpose
-301	Basic Skylab unit

2.19.2 Characteristics:

- Manufactured by J. A. Maurer, Inc., Long Island City, New York 11101.
- Weight - 0.4 lbs. (173 g.).
  Envelope - 4.75 x 1.93 x 0.62 in. (12.1 x 4.9 x 1.6 cm.).
  Volume - 5.7 $in.^3$ (93 $cm.^3$).
- The mounting rails of the DAC and the DAC Power Pack (see 2.17) slide into the rear of the EVA Bracket shoes. Automatic locking is provided upon full insertion of rails.
- The lock release lever on the bracket front is pressed toward the unit to be unlocked and removed.

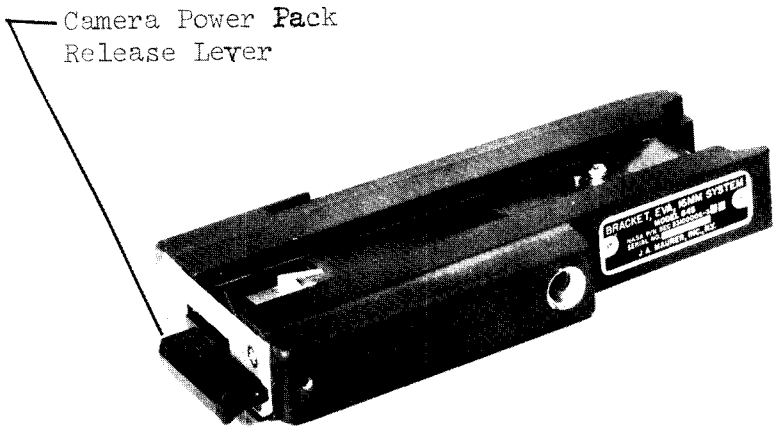


Figure 2.19-1 - DAC EVA Bracket

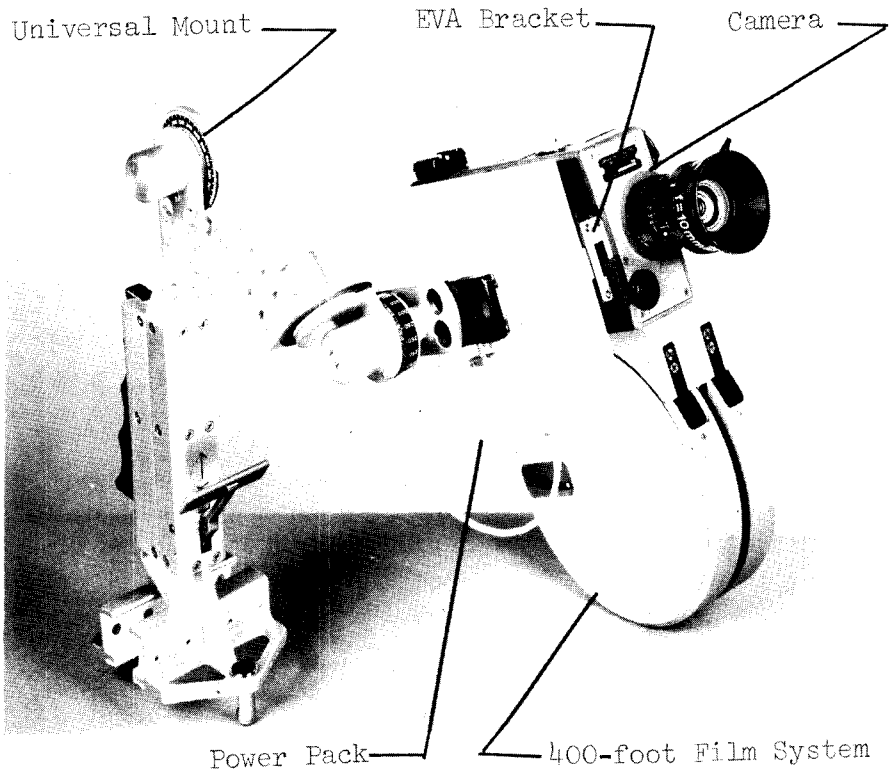


Figure 2.19-2 - Skylab DAC EVA·Assembly

2.20 DAC Handle (SEB33100303):

The DAC Handle provides control of DAC operation and interconnects the DAC, the DAC Power Pack, the DAC RCU Bracket, and the LRV DAC Staff (SEB33100733).

2.20.1 Significant Configurations:

Configuration	Purpose
-301	Basic unit; no DAC Staff interface
-302	Apollo lunar surface unit; incorporates DAC Staff interface

2.20.2 Characteristics:

- Manufactured by J. A. Maurer, Inc., Long Island City, New York 11101.

- Weight (-301) - 1.1 lbs. (500 g.).
  (-302) - 1.5 lbs. (682 g.).
  Envelope (less cable) (-301) - 9.55 x 4.78 x 1.25 in. (24.3 x 12.2 x 3.2 cm.).
  (-302) - 9.55 x 4.78 x 3.15 in. (24.3 x 12.2 x 8.0 cm.)
  Volume (-301) - 57.1 in.^{3} (936 cm.^{3}).
  (-302) - 144.0 in.^{3} (2359 cm.^{3}).

- Handle cable connects to the DAC accessory connector (rearmost). Cable connector is a Deutch UR46-8-7P bayonet type. The total cable/connector length is 9.0 $\pm$ 0.5 in. (22.9 $\pm$ 1.3 cm.).

- The mode selector at the handle base can be used for selecting any sequencing mode of the DAC. Handle mode selection controls camera operation only when handle trigger is used to start the camera. DAC automatic operation can be stopped by depressing and releasing either the handle trigger or the camera operate button.

- Mounting slides are provided for the attachment of the DAC, the DAC Power Pack (see 2.17), and the DAC RCU Bracket (see 2.21).

- The LRV DAC Staff interface incorporated on the -302 configuration can be rotated 120° for elevation pointing control and can be firmly locked in position by the operator.

- The DAC Handle has been qualification tested for use in the Apollo and Skylab vehicles and during EVA operations.

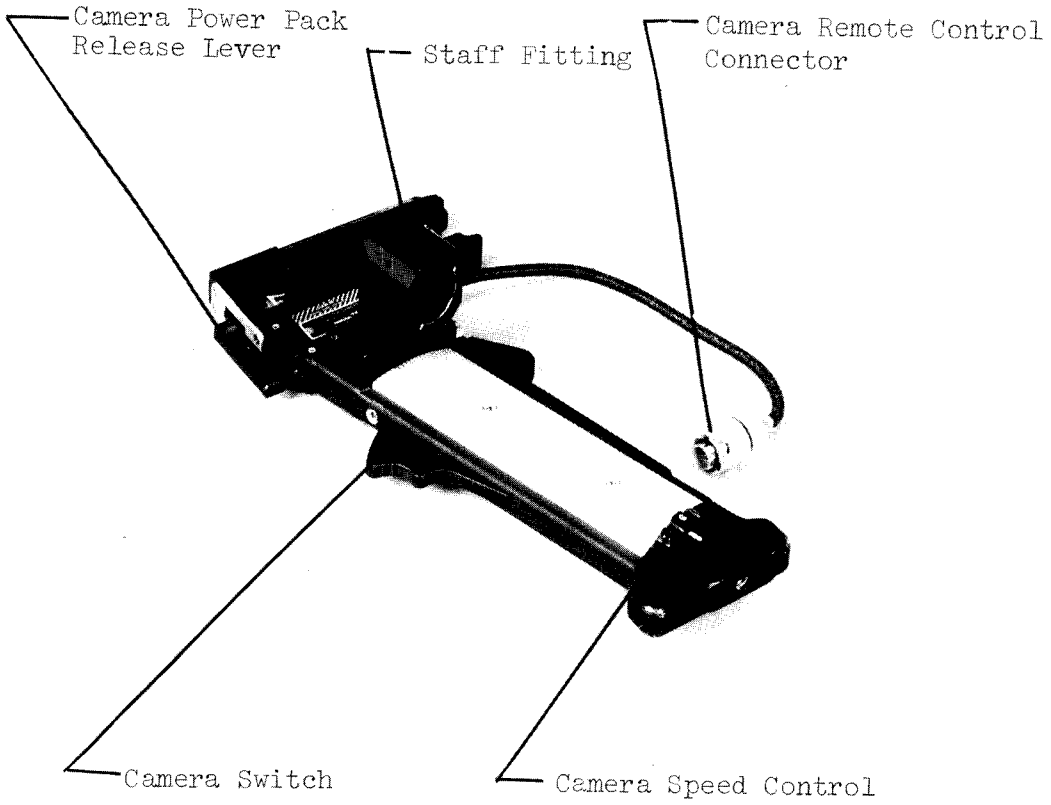


Figure 2.20-1 - DAC Handle

2.21 DAC RCU Bracket (SEB33100396):

This bracket provides for attachment of the DAC system to the remote control unit, RCU, on the astronaut's chest during lunar surface EVA operations.

2.21.1 Significant Configurations:

Configuration	Purpose
-301	Basic unit and Apollo lunar surface unit

2.21.2 Characteristics:

- Manufactured by J. A. Maurer, Inc., Long Island City, New York 11101.
- Weight - 0.3 lbs. (137 g.).
  Envelope - 6.56 x 4.00 x 1.68 in (16.7 x 10.2 x 4.3 cm.).
  Volume - 44.1 $in.^3$ (723 $cm.^3$).
- DAC RCU Bracket slides and locks into the top rear of the DAC Handle (see 2.20).
- A shoe slide on the rear of this bracket slides and locks onto the foot provided on the front of the RCU on the astronaut's chest.
- The locking levers are enlarged to facilitate gloved EVA operation.
- The DAC RCU Bracket has been qualification tested for use during EVA operations.

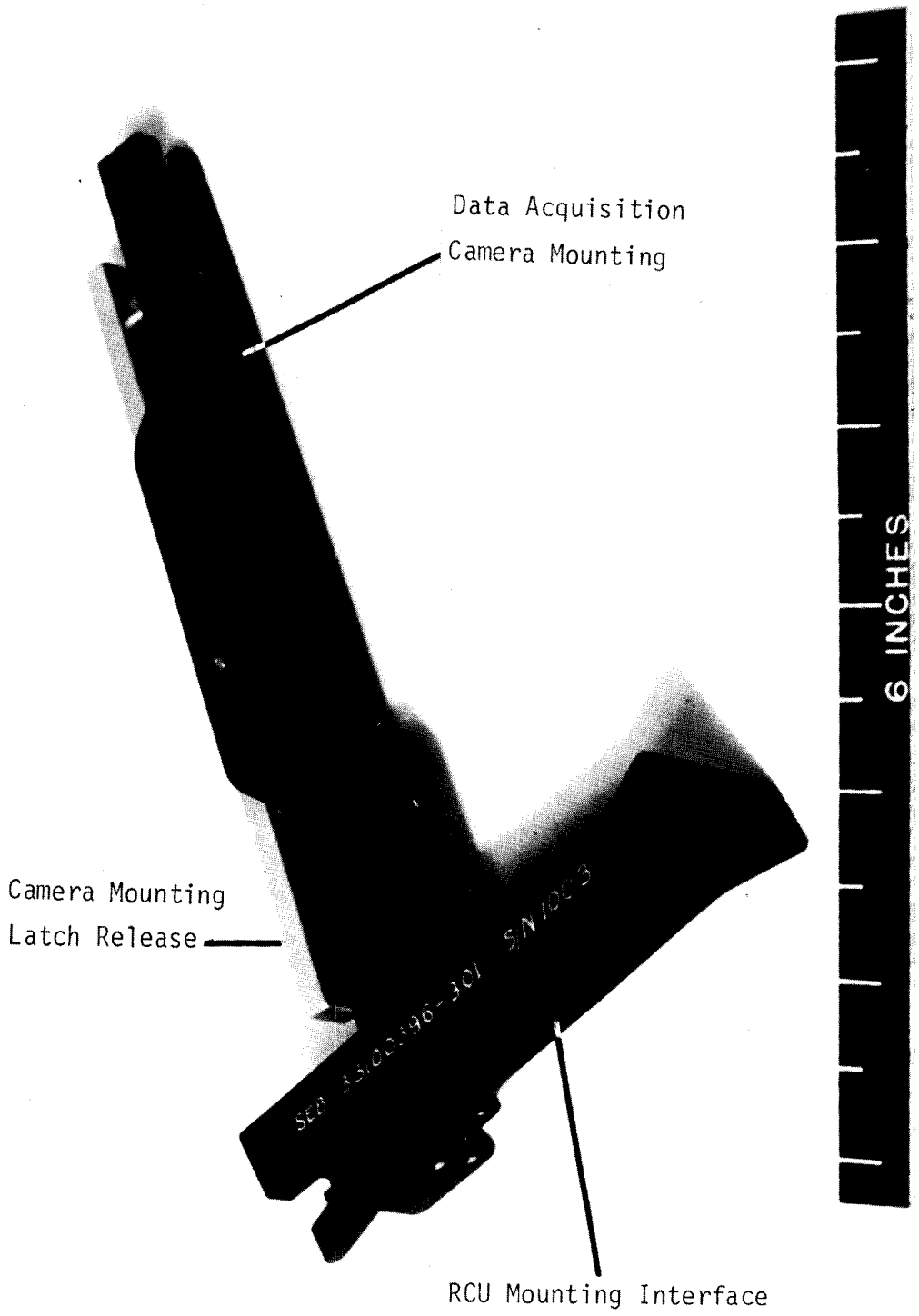


Figure 2.21-1 - DAC RCU Bracket

2.22 DAC Right Angle Adapter Bracket (SEB33100277):

This bracket connects the DAC to the LM Utility Light Clamp. When the Utility Light Clamp is attached to the LM Crash Bar for out-the-window photography of lunar surface operations, the DAC Right Angle Adapter Bracket provides the 90^{o} rotation of the DAC required for properly oriented photography.

2.22.1 Significant Configurations:

Configuration	Purpose
-303	Apollo flight unit

2.22.2 Characteristics:

- Manufactured by Technical Services Division, NASA MSC, Houston, Texas 77058.
- Weight - 0.7 lbs. (318 g.).
  Envelope - 4.0 x 2.5 x 1.63 in. (10.2 x 6.4 x 4.1 cm.).
  Volume - 16.3 $in.^3$ (267 $cm.^3$).
- The mounting rail of the DAC slides into the rear of the bracket shoe. Automatic locking is provided upon full insertion of the DAC rail. A lock release button is provided on the bracket top.
- A thumb knob is provided on the bracket side for tightening the DAC/bracket interface to eliminate play.
- The short rail on the bracket bottom interfaces with the LM Utility Light Clamp or with any other shoe designed to accept the DAC mounting rail.
- This bracket has been qualified for use in the Apollo vehicles.

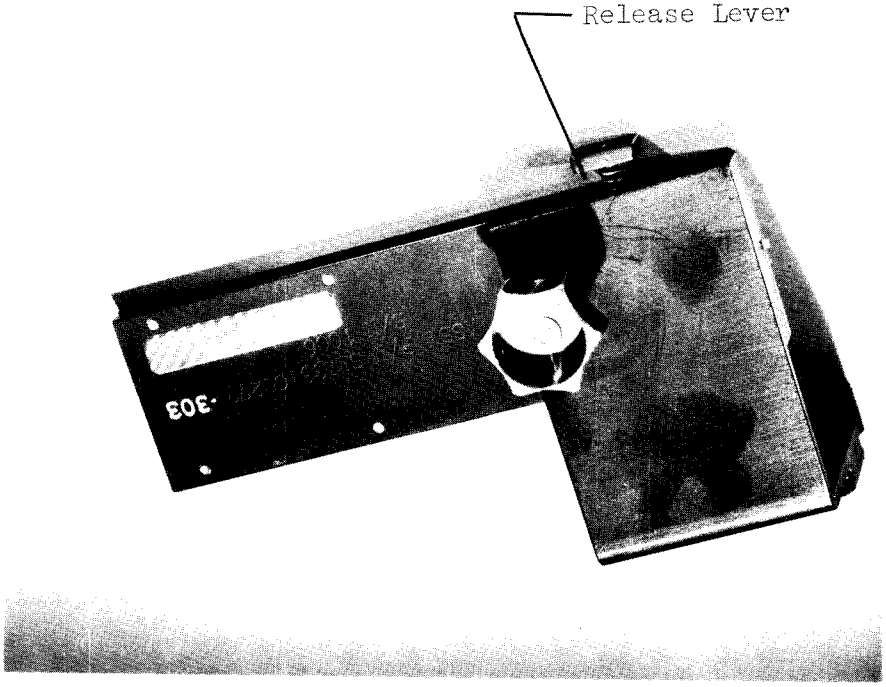


Figure 2.22-1 - DAC Right Angle Adapter Bracket

2.23 DAC Wedge Bracket (SEB33100564):

The DAC Wedge Bracket connects the DAC with the LM DAC Mount above the RH window to provide an increased photographic view of the lunar surface during powered descent and ascent.

2.23.1 Significant Configurations:

Configuration	Purpose
-301	Apollo flight unit

2.23.2 Characteristics:

- Manufactured by Technical Services Division, NASA MSC, Houston, Texas 77058.
- Weight - 0.7 lbs. (318 g.).
  Envelope - 5.4 x 3.0 x 4.2 in. (13.7 x 7.6 x 10.7 cm.).
  Volume - 68.0 in.^{3} (1,114 cm.^{3}).
- The Wedge Bracket slides into the LM DAC window mount the same as the DAC. The DAC slides into the shoe of the Wedge Bracket and is locked with the slide lock provided on the bracket.
- The LM Window mount with and without the DAC Wedge Bracket provides the following camera pointing angles in LM coordinates:

	Pitch	Yaw
Without wedge	59° Down	8° Right
With wedge	42° Down	3° Right

- The Wedge Bracket is qualified for use in the Apollo vehicles.

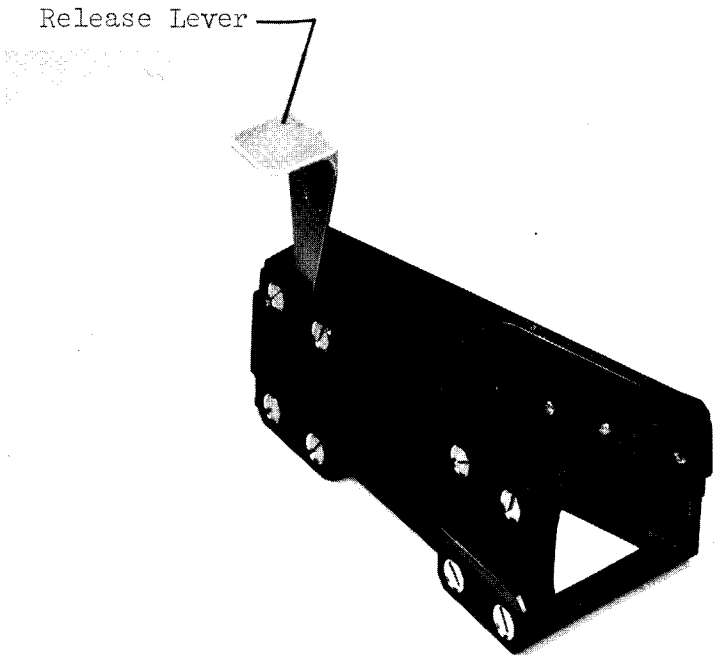


Figure 2.23-1 - DAC Wedge Bracket