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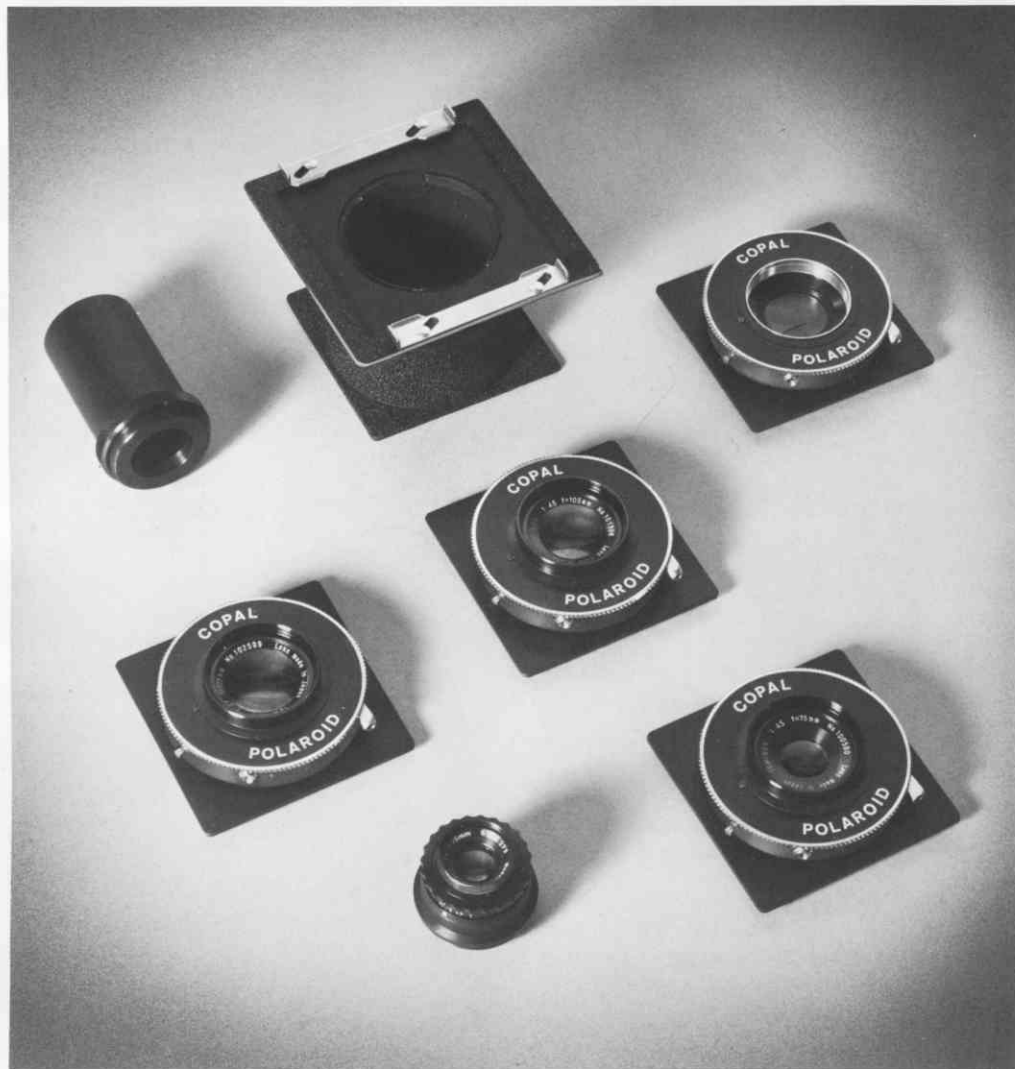
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# How to use the lenses and lens accessories of the Polaroid MP-3 Land Camera



Polaroid MP-3 System

## Introduction

The Polaroid MP-3 Land Camera is a versatile industrial camera. It enables you to photograph both flat copy and solid objects with ease and speed.

With the range of lenses and lens accessories available for the MP-3 the reproduction ratio (the ratio of size of reproduction to size of original) can be varied from extreme reduction in size to a magnification of about ten times life size (10:1 or 10x).

This booklet tells you what kind of job each lens and accessory is designed to do, and how they should be used.

### There are four lenses for the MP-3

1. 5 in. (127mm) 4-element lens, f/4.7 to f/45, in self-cocking shutter with automatic "pre-set" aperture. Shutter speeds of 1 sec. to 1/125 sec. and "B" setting. Built in "X" flash synchronization. 3¼ in. sq. lens board.
2. 4 in. (105mm) 4-element lens, f/4.5 to f/32. All other features as on 5 in. lens.
3. 3 in. (75mm) 4-element lens, f/4.5 to f/22. All other features as on 5 in. lens.
4. 35mm, 5-element macro lens, f/4 to f/16. Built in iris diaphragm. To be used with special lenseless shutter (see next section).



## Accessories for the MP-3 lenses

The following accessories add to the versatility of the MP-3 lenses:

**1. Lensless shutter #219:** This can be purchased as a separate accessory. It is self-cocking and has speeds of from 1 sec. to 1/125 sec. and "X" flash synchronization. It is mounted in a 3 $\frac{1}{4}$  in. sq. lens board.

This shutter has two uses:

- a. It is used with the 35mm lens for macrophotography.
- b. It is used in the MP-3 without a camera lens for photomicrography.

**2. Light baffle tube #219:** This is provided together with the lensless shutter. It is used only for photomicrography. The tube is screwed into the lensless shutter, and the microscope tube containing the photo-eyepiece is positioned inside the light baffle tube.

**3. Adjustable bellows extension unit:** This is provided with each 35mm lens. The unit goes between the 35mm lens and lensless shutter assembly and the camera bellows, thus providing a considerably lengthened bellows extension. It enables photographic magnifications of up to 10 times life size to be achieved.

This unit can also be purchased as a separate item, if it is desired to use it only with the 3 in. lens (see MACROPHOTOGRAPHY, page 6).

For full details on the use of the above accessories, see the booklets HOW TO USE THE POLAROID MP-3 LAND CAMERA FOR PHOTOMICROGRAPHY and HOW TO USE THE POLAROID MP-3 LAND CAMERA FOR MACROPHOTOGRAPHY, both available from Polaroid Corporation.



## Flash synchronization

When using electronic flash, any shutter speed setting can be used.

If the shutter speed is set fast enough to prevent the available light level on the baseboard from affecting the film, the movement stopping ability is determined by the flash duration (about 1/1000 sec.), and not by the shutter speed.

When using flash bulbs, the fastest shutter speed that should be used is 1/30 sec. If you use a faster speed, you will lose some of the light output of the bulb.

You cannot stop fast motion with the use of flash bulbs.

## Choosing the right lens for the job

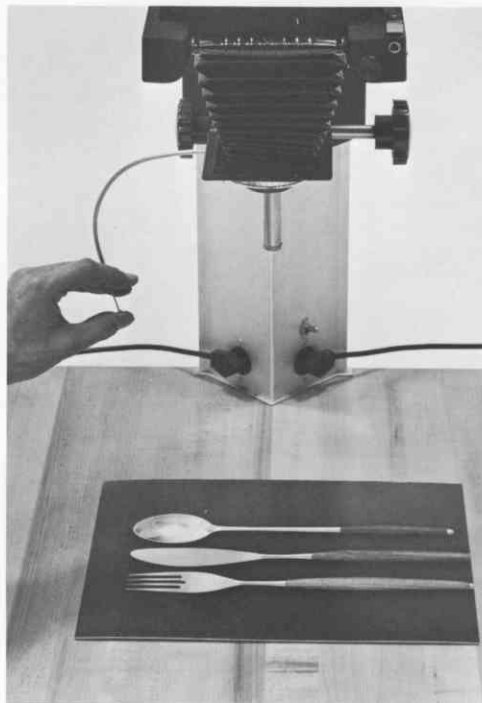
For the purpose of selecting the right lens, we can divide photography with the MP-3 into two basic types. These involve general copying, where the original flat copy or solid object is reduced in size to a greater or lesser degree, and macrophotography, where the original is reproduced life size or larger.

### 1. General copying—reduction in size:

Virtually all of this work should be done with the 5 in. lens, which is capable of making reproductions of up to life size. The 4 in. and 3 in. lenses should not be used for general copying with 4 x 5 in. or 3 1/4 x 4 1/4 in. films. If they are, the edges and corners of the pictures may be less sharp and darker than they should be. This is not due to any shortcomings in your lenses, but to basic optical facts.

Only in macrophotography, where an extra long bellows extension is used, will the 4 in. and 3 in. lenses cover the entire area of 4 x 5 in. and 3 1/4 x 4 1/4 in. films satisfactorily.

When working with 4 x 5 in. or 3 1/4 x 4 1/4 in. film, the 5 in. lens is capable of taking in the entire area of the MP-3 baseboard that is evenly illuminated, so that there is never any need for a different lens. Only when working on 35mm film, or other miniature formats, need the lenses of shorter focal lengths be used for the purpose of covering a larger area on the baseboard.



**An exception:** One of the shorter lenses could be used in the very rare case where you are attempting to reproduce an original at an extremely reduced size. If, with the camera at the top of the column, the 5 in. lens does not give sufficient reduction, then the 4 in. or the 3 in. lens should

be used instead. See the table showing the greatest reduction possible with each lens, on this page.

When doing the above, be sure to place the reduced image in the center of the picture area, because that is where the lens will give its best possible quality.

**Approximate maximum copy area on the MP-3 baseboard\* for each film size (in inches)**

Film size	4 x 5 in.		3½ x 4¼ in.		35 mm	
Camera model	Standard	XL	Standard	XL	Standard	XL
5 in. lens	16 x 20**	20 x 24**	15 x 20**	18 x 24**	5 x 8	8 x 12
4 in. lens	Not recommended***		Not recommended***		6½ x 10	10 x 15
3 in. lens	Not recommended***		Not recommended***		10 x 15	14 x 20

\* The copy area can be greatly increased by rotating the MP-3 camera head through 90 degrees and mounting the material to be photographed on a wall (See below).

\*\* This is also the maximum area that is evenly illuminated by the lights of this camera model.

\*\*\* See GENERAL COPYING — REDUCTION IN SIZE, on page 4.

**Extra large originals:** The camera head of the MP-3 can be rotated through 90°, enabling material of almost unlimited size to be copied by fixing it to a wall and photographing it there. Here again, always use the 5 in. lens with 4 x 5 in. or 3½ x 4¼ in. film. Do not be tempted to use a shorter lens to enable you to get closer to the original material, or to enable you to cover an even larger area of the wall. If you do, the edges and corners of your pictures will be less sharp and darker than they should be.

The right hand light arm of the MP-3 must be removed and the original must be lit by other lighting. It is essential that the lighting over the entire area to be copied be absolutely even, and that the lights themselves are not permitted to throw reflections toward the camera lens.

**How far you can reduce the size of the original:** The higher the camera on the column, the greater will be the reduction in size of the original in the finished picture with any specific lens. For any specific height of camera above the baseboard, the reduction is increased as the lens focal length is decreased. Thus, the smallest possible reproduction ratio (about 6%) is achieved with the camera at the top of the column of the Model XL camera and

with the 3 in. lens. (The 35mm lens cannot be focused for a reduced image in the MP-3.)

Never try to reduce an original that is larger than 16 x 20 in. on the MP-3 Standard baseboard, or one larger than 20 x 24 in. on the MP-3 XL baseboard. Beyond those areas the lighting will no longer be entirely even.

To reduce larger material, attach it to a wall and use the MP-3 horizontally, as described above.

**Approximate greatest reduction (in % of original size) possible with each lens and camera model**

MP-3 Lens		
	Standard	XL
5 in.	18%	10%
4 in.	14%	8%
3 in.	12%	6%

**2. Macrophotography—reproduction life size or larger:** The table below shows the reproduction ratio range that it is possible to achieve with each of the MP-3 camera lenses.



Lens and accessories	Reproduction ratio range
5 in. (127 mm) lens	up to life size (1:1)
4 in. (105mm) lens	up to 1.5:1 magnification
3 in. (75mm) lens	up to 2:1 magnification
3 in. (75mm) lens with bellows extension unit*	2:1 to 4:1 magnification
35mm lens with lensless shutter**	2:1 to 6:1 magnification
35mm lens with lensless shutter** and bellows extension unit	6:1 to about 10:1

\* Do not go smaller than the 2:1 reproduction ratio with this combination. If you do, your image will not cover the entire picture area.

Always extend the camera bellows first, leaving the bellows extension unit at its shortest setting. Only when the camera bellows have been extended fully should you start extending the extension unit to get extra lens to film distance.

\*\* The adjustable diaphragm of the lensless shutter, if it has one, should always be set to wide open, to avoid vignetting. Adjust the lens aperture on the 35mm lens itself.

## General macrophotography technique

Macrophotography demands special focusing techniques. Also, the long camera bellows extensions used in macro work require the exposure to be increased by a specific amount beyond that indicated by an exposure meter, or by a table which does not allow for the necessary exposure compensation. For full information you are advised to read the special booklet, HOW TO USE THE POLAROID MP-3 LAND CAMERA FOR MACROPHOTOGRAPHY, available from your nearest Polaroid office.

The table, EXPOSURE GUIDE FOR MP-3 CAMERA AND POLAROID LAND FILMS, which is also available from your Polaroid office, enables you to compute the correct exposure for any reproduction size.

## f-numbers

Each lens has an f-number scale. On the 5 in. lens, for example, this extends from  $f/4.7$  to  $f/45$ . The f-number setting controls the size of the aperture in the lens through which light is permitted to travel to the film. It is thus partly responsible for the amount of exposure given to the film.

The lowest f-number signifies the largest lens opening and the highest f-number stands for the smallest opening. Thus, at  $f/4.7$  the lens is wide open. A specific f-number setting lets through half the light of the next lower setting and double the light of the next higher setting.

Therefore, it is possible to use one of a series of shutter speed and lens aperture combinations, each of which give effectively the same exposure to the film. For example, the following will all give the film approximately the same exposure:

1/15 sec. at  $f/22$

1/30 sec. at  $f/16$

1/60 sec. at  $f/11$

1/125 sec. at  $f/8$

The f-number setting has an important effect on the depth of field, which is discussed in the next section.



## Depth of field

Depth of field is the distance range, behind and in front of the point of sharpest focus on the object, within which the lens records the object with acceptable sharpness.

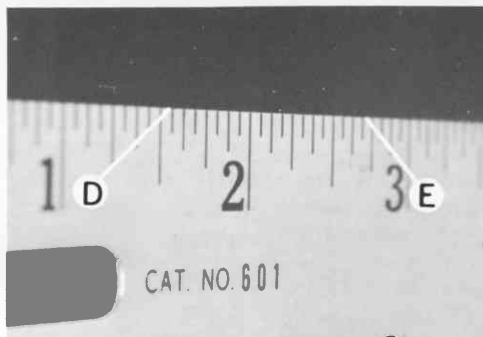
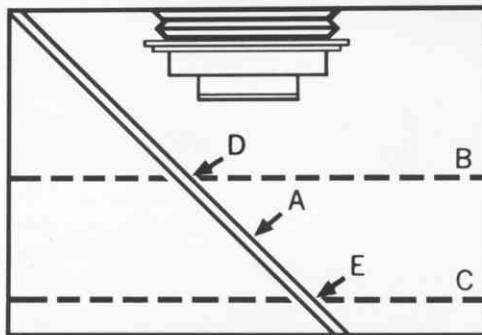
Suppose the camera is focused sharply on the point (A) of a ruler, which is tilted at an angle to the lens, as shown. The range of acceptable sharpness will extend a little beyond (A) on both sides. If, at a specific f-number, it extends from the plane (B) to the plane (C), then the depth of field on the ruler will cover the distance from (D) to (E).

In general photography, the depth of field extends roughly one third its total distance toward the camera lens from the point of sharpest focus, and two thirds the distance on the far side of the point of sharpest focus. However, in macrophotography, the depth generally extends an equal distance on both sides of the point of sharpest focus. To make the greatest possible use of the depth of field available, these facts should be remembered when focusing the camera.

The more you close down the lens aperture (to a higher f-number setting), the greater will the depth of field become. Thus, an exposure of 1/15 sec. at  $f/22$  will give greater depth of field than one of 1/125 sec. at  $f/8$ .

**Depth is most limited in macrophotography:** Depth of field is dependent not only on the f-number, but also on the reproduction ratio. When using any specific f-number setting, the depth of field will decrease as the image magnification is increased. In the macro range, depth of field is always extremely limited.

From the above it will be clear that it is always advisable in macro work to use the smallest possible lens aperture. While this is particularly important in the photography of solid objects, it is also advisable when photographing flat copy. The greater the depth of field, the less chance there is of the picture being partially or totally unsharp because (1) the original was not lying entirely horizontally, or (2) the focusing had not been done quite accurately, or (3) the original had



buckled and lifted a little after focusing, or a combination of two or more of these.

**A shorter focal length lens will not give you greater depth of field:** If you have some general photographic knowledge, you may be tempted to use the shortest possible lens in order to get the greatest possible depth of field. However, this will not help, but will only make your operating conditions more cramped and difficult. Remember that in macrophotography, where a specific magnification of the original is aimed for, depth of field is NOT dependent on the focal length of the lens, but only on the f-number and on the reproduction ratio. For example, at a 2:1 reproduction ratio and an f-number setting of  $f/16$ , the depth of field will always be the same, no matter which lens is used.

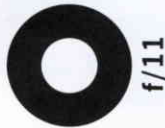
## How f-number settings affect depth of field and exposure



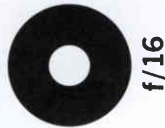
f/5.6



f/8



f/11



f/16



f/22

### Depth of field

Increases as you close down the lens aperture



Decreases as you open up the lens aperture



### Amount of light reaching the film

Is halved each time you close down the lens aperture by one f-number setting



Is doubled each time you open up the lens aperture by one f-number setting



By halving the amount of light permitted to pass through the lens, and at the same time doubling the exposure time, one of a series of shutter speed / lens aperture combinations can be used to give the same effective exposure to the film. Thus:

1/125 sec.  
at  
f/5.6

=

1/60 sec.  
at  
f/8

=

1/30 sec.  
at  
f/11

=

1/15 sec.  
at  
f/16

=

1/8 sec.  
at  
f/22

## Focusing

It is advisable to focus the camera with the lens set to its largest aperture. This will give you the brightest possible image on the ground glass. Also, as you close the lens down any possible visual error in focusing is eliminated by the gain in depth of field.

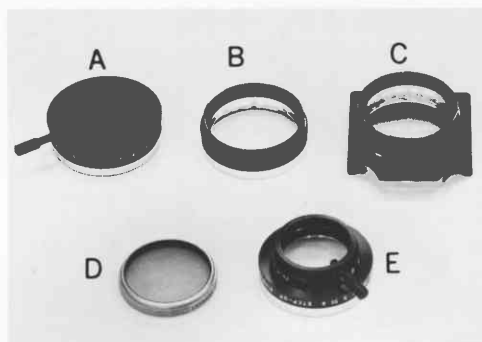
Lenses which are marked PRE-SET on the side of the mount are automatically opened to their widest aperture when you press the "shutter open" arm of the MP-3. On other lenses the aperture must be opened manually.

## How to attach filters

On the right are shown the more common methods of attaching filters to the MP-3 lenses.

All the 5-in., 4-in. and 3-in. lenses and some of the 35mm lenses for the MP-3 have an outer lens mount diameter of 42mm. Sections (A) to (D) below apply to these.

Some of the 35mm lenses have a smaller front lens mount, of diameter 27mm. Section (E) applies to these.



**A.** Series 6 adapter ring for lens with 42mm lens mount diameter. The ring is attached to the lens by the set screw. Takes glass filters in the size Series 6.

**B.** Series 6 adapter ring of the slip-on type, for lens with 42mm lens mount diameter. Takes glass filters in the size Series 6.

Series 6 adapter rings of the screw-in type (39mm dia.) are also available. These screw into the thread on the inner face of the lens mount. To be sure you get exactly the right size, take the lens with you to the dealer, when purchasing such a ring.

**C.** 2 in. sq. gelatin filter frame holder. Attached to the lens by a Series 6 adapter ring for 42mm dia. lens mount. The gelatin filter should be mounted in a filter frame before insertion into the holder.

**D.** Screw-in glass filter, screws into the

thread on the inner face of the lens mount. To be sure you get the exact right size, take the lens with you to the dealer when buying such a filter.

**E.** Series 5 adapter ring with set screw, for 35mm lens with 27mm lens mount diameter. Attached to this is a Series 5 to 6 Step-up ring. This device enables you to use filters of size Series 6 for this, as for all the other lenses.

**Other alternatives for the 35mm lens with 27 mm dia. lens mount:** The 2 in. sq. gelatin filter frame holder can be attached to the Series 5 to 6 Step-up ring and Series 5 adapter ring, for use on this lens.

It is possible to use glass filters of size Series 5 in the Series 5 adapter ring alone. You can also get screw-in filters, of the type described under (D), to fit the smaller lens. Series 5 adapter rings of the screw-in type can also be used. See Section (B).