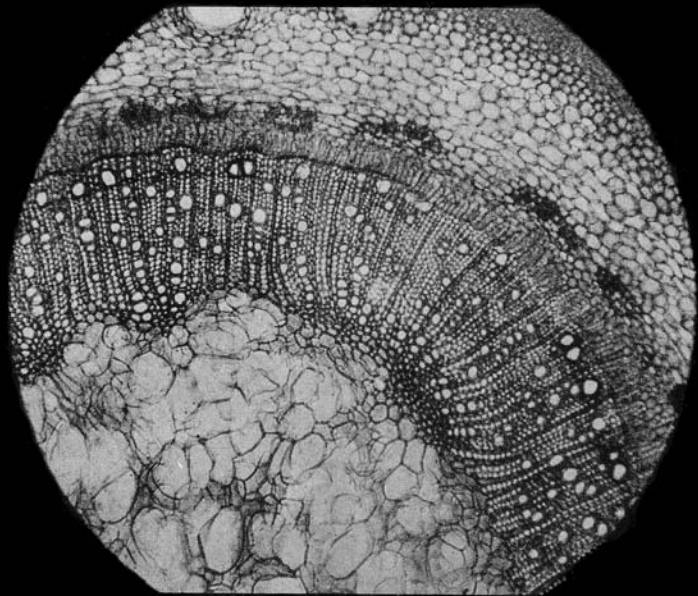


ASAHI PENTAX



Operating Manual for **Extension Tubes** **Bellows Unit**
 Copy Stand **Microscope Adapter**

NOTES

The Asahi Pentax cameras are identically same as the Honeywell Pentax cameras which are sold in the U.S.A. and Mexico through Honeywell Inc. This operating manual therefore applies also to the Honeywell Pentax cameras without any modification.

If you own a Spotmatic camera, you can disregard the exposure factors appearing in the latter portion of this manual. Since the Spotmatic's integral meter correctly reads your exposures through the taking lens (no matter what lens you use) and through whatever accessories you use on the lens or between the lens and the camera body, no exposure adjustments are required.

CLOSE-UPS

With the standard lens on your Asahi Pentax SP, SV or S1a, you can take photographs as close as 1.5' (45cm) from the lens. Photographs of subjects closer than these minimum distances can be easily taken with the Asahi Pentax by the use of the extension tubes or the bellows unit inserted between the lens and the camera body, thus extending the lens forward from the camera body.

The object distance for copying to a given scale is given in the equation:-

$$u = \frac{F (M+1)}{M}$$

where u = Distance of object from lens

F = Focal length of lens

M = Scale of reproduction

The scale of reproduction is always the ratio of image size/object size. If the image is smaller than the object, the scale of reproduction will be a reduction. For instance, if the object is four times as large as the image, the scale of reproduction is 0.25, or 1/4 or 1:4. If the image is larger than the object, the scale of reproduction is greater than 1, and represents a magnification. For instance, if the image is twice as large as the object, this is expressed as magnification 2:1, or 2/1, or 2.

Example: The object distance for copying on a scale of 0.5 (a reduction of 1:2) with a 55mm lens is:

$$\frac{55 (0.5 + 1)}{0.5} = 165\text{mm}$$

The extension of the lens beyond the infinity setting is given by the equation:-

$$d = FM$$

Where d = Focusing extension beyond infinity setting

F = Focal length of lens

M = Scale of reproduction

For example, when copying on a scale of 0.5 with a 55mm lens, the focusing extension beyond the infinity setting is:-

$$55\text{mm} \times 0.5 = 27.5\text{mm}$$

At such close quarters, the object distance is measured from the front node of the lens. For a single lens, this is approximately one-third the actual thickness of the lens behind the front surface. In practice, it is not possible to guarantee sharp focus from calculation and measurement. The final adjustment is done by inspecting the image on the ground glass of the camera.

The scale of reproduction at any object distance can be found from the equation:-

$$M = \frac{F}{u - F}$$

Where M = Scale of reproduction

F = Focal length of lens

u = Object distance from lens

So for an object 220mm away from a 55mm lens, the scale of reproduction is:-

$$\frac{55}{220 - 55} = 0.33 \text{ or } 1:3$$

i.e., the image is one-third the size of the object.

The scale of reproduction obtainable with the camera lens fully extended with extension tubes and/or bellows unit is:-

$$M = \frac{d}{F}$$

Where M = Scale of reproduction

d = Focusing extension beyond infinity setting

F = Focal length of lens

If your Asahi Pentax lens is extended with the bellows unit by 55mm, the same length as the focal length of the lens, the scale of reproduction will be 1:1, which is a life-size reproduction.

DEPTH OF FIELD. As the camera gets closer to the subject, the zone of sharpness shrinks closer and closer to the actual focused distance. The effect can be compensated for—up to a point—by stopping down the lens, but at close distance a very narrow zone of sharp focus must be accepted as inevitable. As the depth of field decreases, depth of focus increases.

EXPOSURE. Where the camera extension is increased (by bellows or extension tubes), the marked lens aperture has to be increased in proportion to the increased lens-film distance, requiring extra exposure. In addition, a further exposure increase is necessary with near shots because the shadow areas become more important when they are seen close at hand.

When comparatively long camera extensions are used for taking close-ups, the relative lens aperture (f number) must be multiplied by a correction factor to give the correct value for calculating exposure. This correction factor depends on the scale of reproduction:-

True f number = nominal f number $\times$ (M + 1) where M is the scale of reproduction.

When the scale is smaller than 0.1 (reduction more than 1:10), the error in the f number is less 10 per cent (one-fifth of a stop) and can be ignored.

THE SUBJECTS. Subjects for close-up photography must be as nearly as possible in one plane if they are to be sharp because the depth of field at short distances is very small. On the other hand, the depth of focus increases and the image on the ground glass changes only very slowly from sharp to unsharp during focusing.

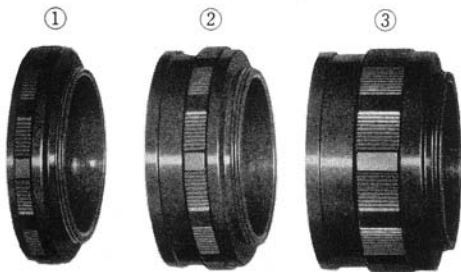
(The foregoing paragraphs are excerpts from The Focal Encyclopedia of Photography, pages 196 - 198, published by the FOCAL PRESS, London, U.K. Some sentences were modified to suit this booklet.)

EXTENSION TUBE SET

This extension tube set is for Asahi Pentax SP's, SV's and S1a's fully automatic standard lenses and can also be used with wide-angle and telephoto Takumar lenses. The extension tube set consists of three tubes, each numbered #1, #2 and #3. The following shows the thickness of these tubes.

RING #1 = 9.5mm RING #2 = 19mm RING #3 = 28.5mm

You can use these extension tubes with the semi-automatic lenses called "Auto-Takumar", BUT when using these extension tubes with a semi-automatic Auto-Takumar lens, be sure that the automatic diaphragm mechanism of the lens is not cocked. To make it sure, depress the diaphragm activating pin on the rear side of the lens before screwing it to the extension tube. Remember that when using



the extension tube #1 with the Auto-Takumar 55mm f/2 or f/2.2 lens, there is a very short range of distance that can not be covered. (The length of the helicoidal extension of the semi-automatic 55mm f/2 and f/2.2 lens is 7.5mm, and therefore, if this lens is set at its minimum distance scale, it is helicoidally extended by 7.5mm. If you insert the extension tube #1, which is 9.5mm thick, between the semi-automatic 55mm lens and the camera body, the lens is extended by 9.5mm if it is set at infinity without its own helicoidal extension. The gap of 2mm beyond the lens helicoidal extension of 7.5mm can not be covered.) If this does not cause you inconvenience, you can use these extension tubes with the semi-automatic 55mm lenses, provided the diaphragm is not cocked before you screw the lens to the extension tube.



EXTENSION TUBE CLOSE-UP TABLES

NOTE:

When using these extension tubes with a fully automatic lens, turn the preview lever of the lens to "Manual" so that the diaphragm can be adjusted manually.

Super-Takumar

28mm f/3.5

(Distance scale set at 0.4m)

Extension tube combination	Subject size		Film-to-subject distance		Magnification	Exposure factor
	cm	inches	cm	inches		
Not used	39.9 × 26.6	15.72 × 10.48	40.11	15.80	0.09	× 1.1
1	8.5 × 5.7	3.35 × 2.25	16.19	6.38	0.42	× 1.6
2	4.8 × 3.2	1.89 × 1.26	14.17	5.58	0.76	× 2.3
3	3.3 × 2.2	1.30 × 0.87	13.97	5.50	1.09	× 3.0
1 + 3	2.5 × 1.7	0.99 × 0.67	14.31	5.64	1.42	× 3.8
2 + 3	2.0 × 1.4	0.79 × 0.55	14.88	5.86	1.76	× 4.7
1 + 2 + 3	1.7 × 1.1	0.67 × 0.43	15.57	6.13	2.09	× 5.7

Super-Takumar 35mm f/3.5

(Distance scale set at 0.45m)

Extension tube combination	Subject size		Film-to-subject distance		Magnification	Exposure factor
	cm	inches	cm	inches		
Not used	37.8 × 25.2	14.9 × 9.9	45.0	17.7	0.10	× 1.2
1	9.8 × 6.5	3.9 × 2.6	18.7	7.4	0.37	× 1.6
2	5.6 × 3.8	2.2 × 1.5	15.6	6.2	0.64	× 2.2
3	4.0 × 2.6	1.58 × 1.02	14.9	5.89	0.91	× 2.9
1 + 3	3.0 × 2.0	0.18 × 0.79	14.98	5.90	1.18	× 3.6
2 + 3	2.5 × 1.7	0.99 × 0.67	15.38	6.06	1.45	× 4.4
1 + 2 + 3	2.1 × 1.4	0.83 × 0.55	15.95	6.28	1.72	× 5.3

Super-Takumar 35mm f/2

(Distance scale set at 0.45m)

Extension tube combination	Subject size		Film-to-subject distance		Magnification	Exposure factor
	cm	inches	cm	inches		
Not used	36.2 × 24.1	14.26 × 9.49	45.09	17.77	0.10	× 1.2
1	9.8 × 6.5	3.86 × 2.56	20.01	7.88	0.37	× 1.6
2	5.7 × 3.8	2.25 × 1.50	16.89	6.65	0.63	× 2.1
3	4.0 × 2.7	1.58 × 1.06	16.18	6.37	0.90	× 2.7
1 + 3	3.1 × 2.1	1.22 × 0.83	16.23	6.39	1.17	× 3.4
2 + 3	2.5 × 1.7	0.99 × 0.67	16.61	6.54	1.44	× 4.1
1 + 2 + 3	2.1 × 1.4	0.83 × 0.55	17.17	6.76	1.71	× 4.9

Super-Takumar 50mm f/1.4

(Distance scale set at 0.45m)

Extension tube combination	Subject size		Film-to-subject distance		Magnification	Exposure factor
	cm	inches	cm	inches		
Not used	25.0 × 16.7	9.85 × 6.58	45.02	17.74	0.14	× 1.2
1	10.8 × 7.2	4.26 × 2.84	26.15	10.30	0.33	× 1.6
2	6.9 × 4.6	2.72 × 1.81	21.63	8.52	0.52	× 1.9
3	5.1 × 3.4	2.01 × 1.34	20.02	7.89	0.71	× 2.3
1 + 3	4.0 × 2.7	1.49 × 1.06	19.48	7.68	0.90	× 2.8
2 + 3	3.3 × 2.2	1.30 × 0.87	19.46	7.67	1.09	× 3.3
1 + 2 + 3	2.8 × 1.9	1.10 × 0.75	19.72	7.77	1.28	× 3.8

Super-Takumar 55mm f/1.8

(Distance scale set at 0.45m)

Extension tube combination	Subject size		Film-to-subject distance		Magnification	Exposure factor
	cm	inches	cm	inches		
Not used	21.2 × 14.2	8.35 × 5.59	45.02	17.74	0.17	× 1.4
1	10.7 × 7.1	4.22 × 2.80	29.34	11.56	0.34	× 1.7
2	7.1 × 4.8	2.80 × 1.89	24.69	9.73	0.50	× 2.2
3	5.4 × 3.6	2.13 × 1.42	22.83	8.99	0.67	× 2.7
1 + 3	4.3 × 2.9	1.69 × 1.14	22.10	8.71	0.84	× 3.2
2 + 3	3.6 × 2.4	1.42 × 0.95	21.92	8.64	1.01	× 3.8
1 + 2 + 3	3.1 × 2.0	1.22 × 0.79	22.06	8.69	1.17	× 4.5

Super-Takumar 85mm f/1.9

(Distance scale set at 0.85m)

Extension tube combination	Subject size		Film-to-subject distance		Magnification	Exposure factor
	cm	inches	cm	inches		
Not used	28.6 × 19.1	11.27 × 7.53	85.02	33.49	0.13	× 1.4
1	15.1 × 10.1	5.95 × 3.98	54.22	21.36	0.24	× 1.7
2	10.3 × 6.9	4.06 × 2.72	43.75	17.24	0.35	× 2.1
3	7.8 × 5.2	3.07 × 2.05	38.81	15.29	0.46	× 2.6
1 + 3	6.3 × 4.2	2.48 × 1.65	36.17	14.25	0.57	× 3.1
2 + 3	5.3 × 3.5	2.09 × 1.38	34.71	13.68	0.69	× 3.6
1 + 2 + 3	4.5 × 3.0	1.77 × 1.18	33.92	13.36	0.80	× 4.2

Takumar 105mm f/2.8

(Distance scale set at 1.2m)

Extension tube combination	Subject size		Film-to-subject distance		Magnification	Exposure factor
	cm	inches	cm	inches		
Not used	33.2 × 22.1	13.08 × 8.71	120.05	47.30	0.11	× 1.3
1	18.1 × 12.1	7.13 × 4.77	76.92	30.31	0.20	× 1.7
2	12.4 × 8.3	4.89 × 3.27	61.36	24.18	0.29	× 2.0
3	9.5 × 6.3	3.74 × 2.48	53.66	21.14	0.38	× 2.4
1 + 3	7.7 × 5.1	3.03 × 2.01	49.29	19.42	0.47	× 2.8
2 + 3	6.4 × 4.3	2.52 × 1.69	46.64	18.38	0.56	× 3.3
1 + 2 + 3	5.5 × 3.7	2.17 × 1.46	44.99	17.72	0.65	× 3.8

EXTENSION TUBE CLOSE-UP TABLES

Super-Takumar
105mm f/2.8

(Distance scale set at 1.2m)

Extension tube combination	Subject size		Film-to-subject distance		Magnification	Exposure factor
	cm	inches	cm	inches		
Not used	33.2 × 22.1	13.08 × 8.71	120.05	47.30	0.11	× 1.4
1	18.1 × 12.1	7.13 × 4.77	76.92	30.31	0.20	× 1.7
2	12.4 × 8.3	4.89 × 3.27	61.36	24.18	0.29	× 2.0
3	9.5 × 6.3	3.74 × 2.48	53.66	21.14	0.38	× 2.4
1 + 3	7.7 × 5.1	3.03 × 2.01	49.29	19.42	0.47	× 2.9
2 + 3	6.4 × 4.3	2.52 × 1.69	46.64	18.38	0.56	× 3.4
1 + 2 + 3	5.5 × 3.7	2.17 × 1.46	44.99	17.72	0.65	× 3.9

Super-Takumar
135mm f/3.5

(Distance scale set at 1.5m)

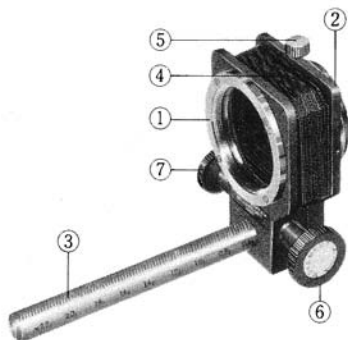
Extension tube combination	Subject size		Film-to-subject distance		Magnification	Exposure factor
	cm	inches	cm	inches		
Not used	45.5 × 30.4	17.93 × 11.8	200.01	78.80	0.08	× 1.3
1	24.1 × 16.1	9.49 × 6.34	120.51	47.48	0.15	× 1.6
2	16.4 × 10.9	6.46 × 4.29	92.53	36.46	0.22	× 1.9
3	12.4 × 8.3	4.89 × 3.27	78.58	30.96	0.29	× 2.2
1 + 3	10.0 × 6.7	3.94 × 2.64	70.45	27.76	0.36	× 2.5
2 + 3	8.4 × 5.6	3.31 × 2.21	65.28	25.72	0.43	× 2.9
1 + 2 + 3	7.2 × 4.8	2.84 × 1.89	61.83	24.36	0.50	× 3.3

BELLOWS UNIT

While the largest magnification you get with all the three extension tubes with a 55mm lens is approximately life-size, you can continuously get magnification from 0.62 to 2.45 with the bellows unit with the same 55mm lens. This is the most convenient feature of the bellows unit.

The major operating parts of the bellows unit are as follows:

- (1) Lens mount
- (2) Thread to camera body
- (3) Scale rod
- (4) Bellows
- (5) Bellows-to-camera clamp screw
- (6) Extension "Movement" knob
- (7) Bellows clamp knob



HOW TO MOUNT

1. Remove the lens from your camera body. Tighten the clamp screw⁵.
2. Screw the thread² to the lens mount of the camera, loosen the clamp screw⁵, turn the bellows unit around so that the scale rod³ is down and the clamp screw⁵ up. Then tighten the screw.
3. Screw the lens to the mount¹ of the bellows unit.
4. When using a tripod, it is preferable to set the tripod to the tripod socket of the bellows unit instead of the socket of the camera body to keep the equipment well balanced. For close-up works, it is extremely necessary to mount the equipment on a good tripod to prevent camera movement.



SCALE ROD

One side of the scale rod³ marked $f=55\text{mm}$ shows the magnification numbers for use with a 55mm lens. When the bellows are extended as far as the calibration of 1.0, the subject will be closed up on the film plane in its life size.

The other side of the scale rod marked $f=58\text{mm}$ shows the magnification numbers for use with a 58mm lens. Some of the earlier Pentax models had a 58mm standard lens.

When using a fully automatic Takumar lens, turn the preview lever to 'Manual' so that the diaphragm can be adjusted manually. When using a semi-automatic lens, depress the diaphragm activating pin on the rear side of the lens before screwing the semi-automatic lens to the bellows unit.

BELLOWS UNIT CLOSE-UP TABLES

(Distance scale set at ∞)

Super-Takumar
55mm f/1.8

Bellows extension		Subject size		Film-to-subject distance		Magnification	Exposure factor
	cm	cm	inches	cm	inches		
When shortest ↓ When longest	3.41	6.0×4.0	2.4×1.6	23.4	9.2	0.6	× 2.5
	4.54	4.5×3.0	1.8×1.2	22.2	8.7	0.8	× 3.1
	5.68	3.6×2.4	1.4×0.9	21.9	8.6	1.0	× 3.8
	6.82	3.0×2.0	1.2×0.8	22.1	8.7	1.2	× 4.6
	7.95	2.6×1.7	1.0×0.7	22.6	8.9	1.4	× 5.4
	9.09	2.3×1.5	0.9×0.6	23.2	9.1	1.6	× 6.3
	10.22	2.0×1.3	0.8×0.5	23.9	9.4	1.8	× 7.3
	11.36	1.8×1.2	0.7×0.5	24.8	9.8	2.0	× 8.4
	12.50	1.6×1.1	0.6×0.4	25.6	10.1	2.2	× 9.5
	13.63	1.5×1.0	0.6×0.4	26.6	10.5	2.4	× 10.7

(Distance scale set at ∞)

Super-Takumar
50mm f/1.4

Bellows extension		Subject size		Film-to-subject distance		Magnification	Exposure factor
	cm	cm	inches	cm	inches		
When shortest ↓ When longest	3.02	6.0×4.0	2.4×1.6	20.8	8.2	0.6	× 2.1
	4.03	4.5×3.0	1.8×1.2	19.7	7.8	0.8	× 2.5
	5.03	3.6×2.4	1.4×0.9	19.4	7.6	1.0	× 3.0
	6.04	3.0×2.0	1.2×0.8	19.6	7.7	1.2	× 3.6
	7.05	2.6×1.7	1.0×0.7	20.0	7.9	1.4	× 4.1
	8.05	2.3×1.5	0.9×0.6	20.6	8.1	1.6	× 4.8
	9.06	2.0×1.3	0.8×0.5	21.2	8.4	1.8	× 5.4
	10.1	1.8×1.2	0.7×0.5	21.9	8.6	2.0	× 6.1
	11.1	1.6×1.1	0.6×0.4	22.7	8.9	2.2	× 6.9
	12.1	1.5×1.0	0.6×0.4	23.5	9.3	2.4	× 7.7
When longest	13.1	1.4×0.9	0.6×0.4	24.4	9.6	2.6	× 8.5
	13.6	1.3×0.9	0.5×0.4	24.8	9.8	2.7	× 9.0

Super-Takumar
35mm f/2

(Distance scale set at ∞)

Bellows extension		Subject size		Film-to-subject distance		Magnification	Exposure factor
When shortest ↓ When longest	cm	cm	inches	cm	inches		
	3.20	4.0 × 2.7	1.6 × 1.1	16.2	6.4	0.9	× 2.7
	3.55	3.6 × 2.4	1.4 × 0.9	16.1	6.3	1.0	× 2.9
	4.97	2.6 × 1.7	1.0 × 0.7	16.5	6.5	1.4	× 4.0
	6.39	2.0 × 1.3	0.8 × 0.5	17.4	6.9	1.8	× 5.2
	7.81	1.6 × 1.1	0.6 × 0.4	18.5	7.3	2.2	× 6.6
	9.23	1.4 × 9.0	0.6 × 0.4	19.6	7.7	2.6	× 8.2
	10.65	1.2 × 8.0	0.5 × 0.4	20.9	8.2	3.0	× 9.9
	12.1	1.1 × 7.0	0.4 × 0.3	22.2	8.7	3.4	× 11.8
	13.5	9.0 × 6.0	0.4 × 0.2	23.5	9.3	3.8	× 13.8

Super-Takumar
35mm f/3.5

(Distance scale set at ∞)

Bellows extension		Subject size		Film-to-subject distance		Magnification	Exposure factor
When shortest ↓ When longest	cm	cm	inches	cm	inches		
	3.15	4.0 × 2.7	1.6 × 1.1	14.9	5.9	0.9	× 2.8
	3.50	3.6 × 2.4	1.4 × 0.9	14.9	5.9	1.0	× 3.1
	4.90	2.6 × 1.7	1.0 × 0.7	15.3	6.0	1.4	× 4.3
	6.30	2.0 × 1.3	0.8 × 0.5	16.1	6.3	1.8	× 5.6
	7.70	1.6 × 1.1	0.6 × 0.4	17.2	6.7	2.2	× 7.1
	9.10	1.4 × 9.0	0.6 × 0.4	18.3	7.2	2.6	× 8.9
	10.50	1.2 × 8.0	0.5 × 0.3	19.6	7.7	3.0	× 10.8
	11.90	1.1 × 7.0	0.4 × 0.3	20.8	8.2	3.4	× 12.8
	13.30	9.0 × 6.0	0.4 × 0.2	22.1	8.7	3.8	× 15.1
	13.65	9.0 × 6.0	0.4 × 0.2	22.4	8.8	3.9	× 15.7

(Distance scale set at ∞)

**Super-
Takumar
28mm f/3.5**

Bellows extension		Subject size		Film-to-subject distance		Magnification	Exposure factor
When shortest ↓	cm	cm	inches	cm	inches		
	2.85	3.6 × 2.4	1.4 × 0.9	14.0	5.5	1.0	× 2.8
	3.99	2.6 × 1.7	1.0 × 0.7	14.3	5.6	1.4	× 3.7
	5.13	2.0 × 1.3	0.8 × 0.5	15.0	5.9	1.8	× 4.8
	6.27	1.6 × 1.1	0.6 × 0.4	15.8	6.2	2.2	× 6.0
	7.41	1.4 × 9.0	0.6 × 0.4	16.8	6.6	2.6	× 7.4
	8.55	1.2 × 8.0	0.5 × 0.3	17.8	7.0	3.0	× 8.9
	9.69	1.1 × 7.0	0.4 × 0.3	18.8	7.4	3.4	× 10.6
	10.83	9.0 × 6.0	0.4 × 0.2	19.8	7.8	3.8	× 12.4
	11.97	9.0 × 6.0	0.4 × 0.2	20.9	8.2	4.2	× 14.3
When longest	13.11	8.0 × 5.0	0.3 × 0.2	22.0	8.7	4.6	× 16.4
	13.68	8.0 × 5.0	0.3 × 0.2	22.5	8.9	4.8	× 17.5

(Distance scale set at ∞)

**Super-
Takumar
85mm f/1.9**

Bellows extension		Subject size		Film-to-subject distance		Magnification	Exposure factor
When shortest ↓	cm	cm	inches	cm	inches		
	3.40	9.0 × 6.0	0.4 × 0.2	41.1	16.2	0.4	× 2.3
	5.09	6.0 × 4.0	0.2 × 0.2	35.8	14.1	0.6	× 3.2
	6.79	4.5 × 3.0	1.8 × 1.2	33.9	13.4	0.8	× 4.2
	8.49	3.6 × 2.4	1.4 × 0.9	33.5	13.2	1.0	× 5.3
	10.13	3.0 × 2.0	1.2 × 0.8	33.8	13.3	1.2	× 6.6
When longest	11.88	2.6 × 1.7	1.0 × 0.7	34.5	13.6	1.4	× 8.0
	13.58	2.3 × 1.5	0.9 × 0.6	35.4	13.9	1.6	× 9.5

**Super-
Takumar
105mm f/2.8**

(Distance scale set at ∞)

Bellows extension		Subject size		Film-to-subject distance		Magnification	Exposure factor
	cm	cm	inches	cm	inches		
When	3.15	12.0 × 8.0	4.7 × 0.3	60.2	23.7	0.3	× 2.1
shortest	4.20	9.0 × 6.0	0.4 × 0.2	52.5	20.7	0.4	× 2.5
	6.30	6.0 × 4.0	0.2 × 0.2	45.8	18.0	0.6	× 3.6
	8.40	4.5 × 3.0	1.8 × 1.2	43.6	17.2	0.8	× 4.8
	10.50	3.6 × 2.4	1.4 × 0.9	43.0	16.9	1.0	× 6.2
When	12.60	3.0 × 2.0	1.2 × 0.8	43.4	17.1	1.2	× 7.7
longest	13.65	2.8 × 1.8	1.1 × 0.7	43.8	17.3	1.3	× 8.6

**Super-
Takumar
135mm f/3.5**

(Distance scale set at ∞)

Bellows extension		Subject size		Film-to-subject distance		Magnification	Exposure factor
	cm	cm	inches	cm	inches		
When	2.70	18.0 × 12.0	7.1 × 4.7	98.3	38.7	0.2	× 1.8
shortest	5.40	9.0 × 6.0	0.4 × 0.2	67.2	26.5	0.4	× 2.7
	8.10	6.0 × 4.0	0.2 × 0.2	58.7	23.1	0.6	× 3.9
When	10.80	4.5 × 3.0	1.8 × 1.2	55.8	22.0	0.8	× 5.3
longest	13.50	3.6 × 2.4	1.4 × 0.9	55.1	21.7	1.0	× 6.9

(Distance scale set at ∞)

**Bellows-
Takumar
100mm f/4**

Bellows extension		Subject size		Film-to-subject distance		Magnification	Exposure factor
When shortest ↓	cm	cm	inches	cm	inches		
	3.00	12.0 × 8.0	4.7 × 0.3	56.4	22.2	0.3	× 1.8
	4.99	7.2 × 4.8	2.8 × 1.9	45.1	17.7	0.5	× 2.5
	6.99	5.1 × 3.4	2.0 × 1.3	41.4	16.3	0.7	× 3.3
	8.99	4.0 × 2.6	0.2 × 1.0	40.2	15.8	0.9	× 4.2
When longest	9.99	3.6 × 2.4	1.4 × 0.9	40.1	15.8	1.0	× 4.6
	11.98	3.0 × 2.0	1.2 × 0.8	40.4	15.9	1.2	× 5.7
	13.98	2.6 × 1.7	1.0 × 0.7	41.2	16.2	1.4	× 6.8

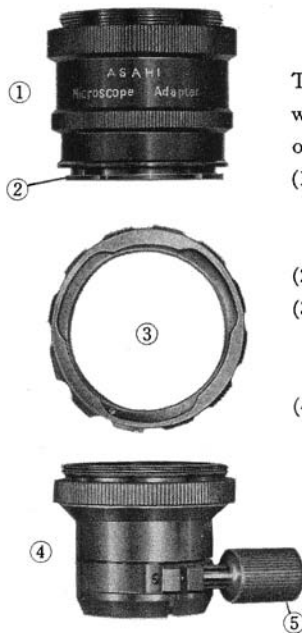
(Distance scale set at ∞)

**Macro-
Takumar
50mm f/4**

Bellows extension		Subject size		Film-to-subject distance		Magnification	Exposure factor
When shortest ↓	cm	cm	inches	cm	inches		
	3.10	6.0 × 4.0	0.24 × 0.16	22.1	8.71	0.6	× 2.7
	4.13	4.5 × 3.0	1.77 × 1.18	21.0	8.27	0.8	× 3.5
	5.16	3.6 × 2.4	1.42 × 0.95	20.7	8.16	1.0	× 4.4
	6.19	3.0 × 2.0	1.18 × 0.79	20.9	8.23	1.2	× 5.3
	7.22	2.6 × 1.7	1.02 × 0.67	21.3	8.39	1.4	× 6.4
	8.26	2.3 × 1.5	0.91 × 0.59	21.9	8.63	1.6	× 7.5
	9.29	2.0 × 1.3	0.79 × 0.51	22.6	8.90	1.8	× 8.8
	10.32	1.9 × 1.2	0.75 × 0.47	23.3	9.18	2.0	× 10.1
When longest	11.52	1.6 × 1.1	0.63 × 0.43	24.1	9.50	2.2	× 11.5
	12.38	1.5 × 1.0	0.59 × 0.39	25.0	9.85	2.4	× 13.0
	13.42	1.4 × 0.9	0.55 × 0.36	25.8	10.17	2.6	× 14.7



MICROSCOPE ADAPTER



The microscope adapter can be used with any microscope which has a tube of 25mm diameter. This adapter unit consists of the following parts.

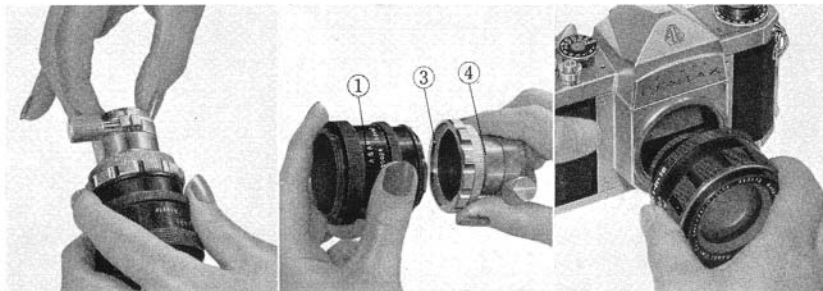
- (1) Adapter Main Tube. One end is threaded to be screwed to the lens mount of the camera body, and the other end is a bayonet².
- (2) Bayonet of the Adapter Main Tube.
- (3) Coupling Ring. One side is threaded where the thread of the Fastener Tube is screwed, and the other side is a bayonet to be engaged with the Bayonet².
- (4) Fastener Tube is to be adapted to the extension tube of the microscope.

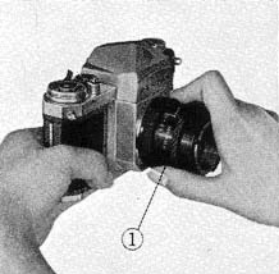


- (5) Fastening Knob.
- (6) Light Sealing Tube prevents interior reflection of light inside the extension tube of the microscope when the eyepiece of the microscope is not used.
- (7) Stopper. Fasten this stopper to the tube of the microscope above the barrel of the microscope to prevent falling down of the extension tube by the weight of the camera and the microscope adapter.

HOW TO MOUNT

1. Loosen the Knob⁵, and pull out the Light Sealing Tube⁶.
2. Disengage the Fastener Tube⁴.
3. Unscrew the lens from the camera.

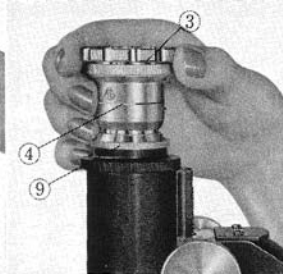




4. Screw the Adapter Main Tube¹ to the lens mount of the camera.



5. Pull out the eyepiece⁸ of the microscope.



6. Adapt the Fastener Tube⁴ with the Coupling Ring³ to the extension tube⁹ of the microscope.



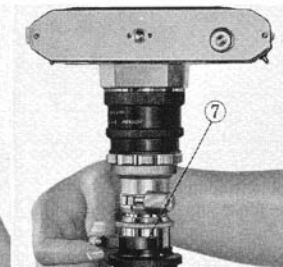
7. Insert the eyepiece⁸ or Light Sealing Tube⁶ into the Fastener Tube⁴.

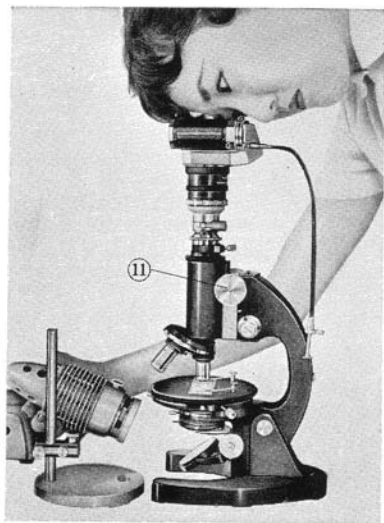
8. Loosen the Coupling Ring³ and then engage the bayonet² to the Coupling Ring.

9. Turn the camera body and the adapter set to the desired direction. Tighten the Fastening Knob⁵.

10. Lift the extension tube of the microscope, stop it at a desired calibration. Fasten the Stopper⁷.

11. Cable release is indispensable to prevent camera movement.





12. Looking through the finder of the camera, adjust the lamp and the position of the object.

NOTE: When using the microscope adapter with the Spotmatic, try to prevent light from coming in through the viewfinder, as it might affect its meter reading. Use the Asahi Pentax correction lens adapter to avoid the light which might come into the viewfinder.

MAGNIFICATION IN PHOTOMICROGRAPHY



13. Turn the knob of the microscope to achieve an accurate focus.

It is complicated to obtain the exact magnification ratio in photomicrography, however, it will be safe to say that when using an eyepiece of the microscope, the photographed magnification will be approximately $1/3$ of the magnification of the microscope. In photomicrography without using the eyepiece, the photographed magnification will be much larger than the magnification of the microscope, and depending upon a microscope used, the magnification sometimes becomes about $16\times$ of the magnification of the microscope when using a $10\times$ objective lens. If you use an extension tube set or a bellows unit between the camera body and the microscope adapter, the photographed magnification can be further increased. To get exact magnification, use an objective micrometer.



14. Adjust the shutter speed. Release the shutter.

EXPOSURE & FOCUSING

Since the lenses of conventional microscopes are not intended for taking photographs, it is very difficult to obtain high definition in photomicrography, and it is more difficult as the microscopic magnification increases. Some manufacturers offer special eyepieces for photomicrography, and these special eyepieces should be used to get sharp pictures.

When the illumination is not sufficient, or when the object has a poor light penetrability or reflection, the focusing will be difficult. Hence, it is necessary to use a lighting equipment with a transformer which can keep the illumination at a desired brightness to facilitate focusing. It is desirable to keep the lighting to such a brightness that the shutter may be released at a speed higher than 1/60 on an ASA100 (DIN 21/10) film.

Due to lack of comparable data concerning exposure in photomicrography, proper exposure should be obtained through trials at different exposures. It is advisable to take three pictures: one at an estimated exposure, another slightly longer, and the other slightly shorter. Remember what the proper exposure is at a given brightness.

COPY STAND

The combination of the extension tubes for copying a subject of a certain size will be easily known from the Close-up Tables appearing on pages 8~13.

As illumination over the subject, use two desk lamps with 100-watt or brighter bulbs placed on both sides of the copying base. The angle of illumination over the subject should be about 45°. For bright indoors, copying works may be accomplished with available light.

When using a copying film, be careful to give proper exposure since this kind of a film is said to have a narrow exposure latitude. For an ASA 25 (DIN 15/10) film, the standard exposure is f8 and 1/2 second when using two 100-watt lamps. For a 55mm lens, the diaphragm should be closed down to f8 or f11 to gain depth of field. Use a cable release to prevent camera movement.

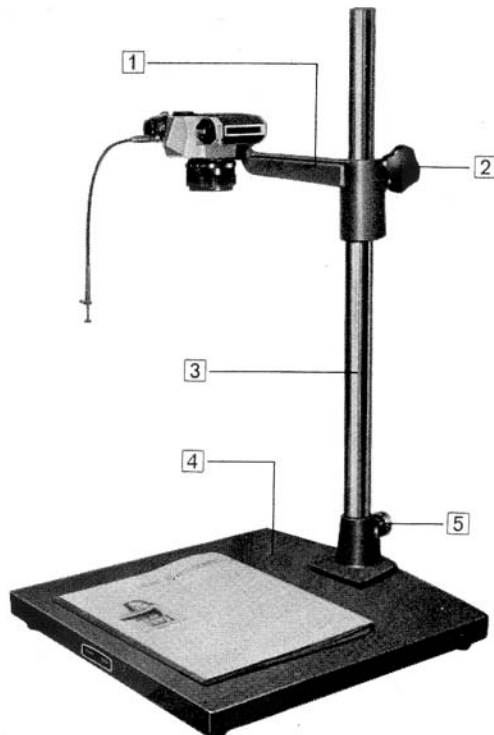
1 Arm.

2 Clamp.

3 Pole.

4 Base board.

5 Pole retainer screw.





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Printed in Japan