

The Olympus OM Way

FACTS AND FIGURES



L A Mannheim



BATTERY REQUIREMENTS

Equipment	No. of cells	Volts		Size desig.			Type	Maker's designations
		Each	Total	ASA	ANSI	IEC		
OM-2 and OM-10 camera	2	1.5	3	—	S-15	—	Silver* oxide	Mallory 10 L 14, Varta 7301, Rayovac RW 42 or 22, National (and Japanese) G-13, UCAR Eveready S-76 or EXP 76
OM-1 camera	1	1.35	1.35	—	M-20	MR-9	Mercury	Mallory PX-625, Eveready EPX-625, Varta 7002, National etc. H-D
Auto-Quick 310 and 300 flash	4	1.5	6	AA	L-40	LR-9	Alkali**	Mallory etc. Mn 1500, Eveready E91, Varta 7244, Japanese AM-3
Bounce flash grip for 310, 300	4	1.5	6	C	L-70	LR-14	Alkali**	Mallory etc. Mn 1400, Eveready E93, Varta 7233, Japanese AM-2
T20 flash	2	1.5	3	AA	L-40	LR-14	Alkali	Mallory etc. Mn 1500, Eveready E91, Varta 7244, Japanese AM-3
or	2	1.25	2.5	AA	K-40	LR-14	NC re-chargeable	Varta 500 RS, Saft VR0.5 AA, Eveready CH 500; CF 500
Motor drive 1	12	1.5	18	AA	L-40	LR-14	Alkali	Mallory etc. Mn 1500, Eveready E91, Varta 7244, Japanese AM-3
or	12	1.25	15	AA	K-40	LR-14	NC re-chargeable	Varta 500 RS, Saft VR0.5 AA, Eveready CH 500; CF 500
Winder 1	4	1.5	6	AA	L-40	LR-14	Alkali	Mallory etc. Mn 1500, Eveready E91, Varta 7244, Japanese AM-3
or	4	1.25	5	AA	K-40	LR-14	NC re-chargeable	Varta 500 RS, Saft VR0.5 AA, Eveready CH 500; CF 500
Recordata 1	3	1.5	4.5	—	S-15	—	Silver* oxide	Mallory 10 L 14, Varta 7301, Rayovac RW 42 or 22, National (Japanese) G-13, UCAR Eveready S-76 or EXP 76
Recordata 2	2	1.5	3	—	S-15	—	Silver oxide*	Mallory 10 L 14, Varta 7301, Rayovac RW 42 or 22, National (Japanese) G-13, UCAR Eveready S-76 or EXP 76

* Do not use mercury cells of same size but lower voltage (1.35 volts).

** Do not use rechargeable nickel-cadmium (NC) cells for this equipment.

Cell types and the number required in OM cameras and other battery-powered equipment. The maker's designations are the type numbers of main manufacturers; often other makers use similar type numbers. Where alkali and rechargeable NC cells are shown as alternatives, the alkali batteries generally have two to three times the capacity of the rechargeable cells. Ordinary zinc-carbon cells of the heavy duty type can be used in place of alkali cells, but have about the same capacity as rechargeable NC cells. Equivalent types of different makes of such zinc-carbon cells are too numerous to list; they are recommended as an emergency measure only.

INTERCHANGEABLE OM FOCUSING SCREENS

Characteristics	Screen types and compatibility codes												
	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8	1-9	1-10	1-11	1-12	1-13
Centre	p	pl	w	m	pw	pl	pe	f	s	m	c+c	c+c	w+p
Centre dia. mm	4	4	4	8	4	4	4	9	23	8	4	8	2.5/5
Outer area (all with Fresnel except*)	m	m	m	m	c	c	c	f	c*	m+g	f	c	m
<i>Lenses and applications</i>													
8 mm fisheye	E	H	E	E	E	—	—	H	—	E	—	—	E
16 mm fisheye	A	D	A	B	E	—	—	—	—	B	—	—	A
18-28 mm	A	B	A	B	E/H	K	—	—	—	A	—	—	A
35 mm shift	B	D	B	A	H	—	—	B	—	X	—	—	B
35 mm other	A	B	A	A	E	H	—	B	—	A	—	—	A
50-55 mm standard	A	B	A	A	E	H	—	B	—	A	—	—	A
85-135 mm tele	A	A	A	A	H	E	—	B	—	A	—	—	A
180 mm, 200 mm f4	B	A	A	B	—	E	E	A	—	B	—	—	B
200 mm f5	D	A	B	B	—	H	E	A	—	B	—	—	D
300 mm f4.5	D	B	B	B	—	H	E	X	—	B	A	—	D
400-600 mm	D	B	D	B	—	—	E	X	—	B	A	—	D
1000	D	D	D	B	—	—	E	X	—	B	A	—	D
35-70 and 75-150 mm zoom	A	A	A	A	K	H	—	B	—	A	—	—	A
85-250 mm zoom	B	A	A	A	—	E	H	B	—	A	—	—	B
<i>Macro</i>													
20 and 38 mm	—	—	—	D	—	—	—	B	—	D	A	X	—
50 mm f3.5 (macro range)	A	A	B	B	K	H	—	A	—	B	—	—	A
80 mm	D	B	D	A	—	—	—	A	—	A	X	—	D
<i>Photomicrog.</i>													
<i>Astrophot.</i>	—	—	—	—	—	—	—	X	—	—	—	—	—
<i>Endoscopic phot.</i>	—	—	—	—	—	—	—	—	X	—	—	—	—

Main characteristics of the 13 screens available for the Olympus OM cameras and their suitability or compatibility with different lenses and applications.

c = Clear screen. c + c = Clear screen centre with crosshair pattern. f = Fine-grained matt surface. g = Grid. m = Standard matt surface. p = Standard microprism pattern. pe = Very low-profile microprism pattern for extra long tele lenses. pl = Low-profile microprism pattern for longer focus and smaller aperture lenses. pw = High-profile microprism pattern for wide-angle and wide-aperture lenses. s = Special condenser lens. w = Wedge range-finder (split-image).

The compatibility codes indicate:

- A = Screen compatible with lens or application, yields excellent and convenient focusing image. Meter measurements of screen image indicate correct exposures.
- B = Screen compatible with lens or application as A; acceptable rather than best possible screen. Meter measurements of screen images indicate correct exposures.
- D = Screen usable, usually subject to vignetting. Microprism or split image pattern blacks out if eye not accurately centred behind finder eyepiece. Meter measurements of screen image indicate correct exposures.
- E = Screen compatible with lens or application, yields clear and convenient focusing image but meter measurements of screen image do not indicate correct exposures (OM-1 or manual operation of OM-2) or not possible (with 8 mm fisheye). Despite wrong indication, automatic exposure with OM-2, controlled by silicon cells, is correct.
- H = Screen compatible with lens/application as E (incorrect exposure indication of screen image measurements) but not best screen available for the purpose.
- K = For emergency use only; screen usable but neither convenient nor yields correct exposure indication.
- X = Screen specially designed for this lens/application.
- = Unsuitable screen/lens combination.

OM SYSTEM LENSES

No.	Lens desig. (1)	Focal length	Max.—Min. aperture	Angle of View(2)			Nearest focus	
				Horiz.	Vert.	Diag.	Distance (film plane) m ft	
For use on camera								
1	Auto-Fisheye	8 mm	f2.8—22	180°	(circular image)		0.2	0.7
2	Auto-Fisheye	16 mm	f3.5—22			180°	0.2	0.7
3	MC Auto-W	18 mm	f3.5—16	90°	67°	100°	(4)0.25	0.8
4	G Auto-W	21 mm	f3.5—16	81°	59°	92°	0.2	0.7
5	MC Auto-W	21 mm	f2—16	81°	59°	92°	(4)0.2	0.7
6	H Auto-W	24 mm	f2.8—16	74°	53°	84°	0.25	0.8
7	MC Auto-W	24 mm	f2—16	74°	53°	84°	(4)0.25	0.8
8	G Auto-W	28 mm	f3.5—16	65°	46°	75°	0.3	1
9	MC Auto-W	28 mm	f2—16	65°	46°	75°	(4)0.3	1
10	G Auto-W	35 mm	f2.8—16	54°	38°	63°	0.3	1
11	Shift	35 mm	f2.8—22	54°	38°	63°(3)	0.3	1
12	MC Auto-W	35 mm	f2—16	54°	38°	63°	0.3	1
13	F Auto-S	50 mm	f1.8—16	40°	27°	47°	0.45	1.5
14	G Auto-S	50 mm	f1.4—16	40°	27°	47°	0.45	1.5
15	Auto-Macro	50 mm	f3.5—22	40°	27°	47°	(4)0.23	0.8
16	G Auto-S	55 mm	f1.2—16	36°	25°	43°	0.45	1.5
17	Auto-Zoom	35—70 mm	f3.6—22	54—29°	38—19°	63—34°	0.8	2.7
18	Auto-Zoom	75—150 mm	f4—22	27—14°	18—9°	32—16°	1.6	5.2
19	MC Auto-Zoom	85—250 mm	f5—32	24—8.2°	16—5.5°	29—10°	2.0	6.6
20	F Auto-T	85 mm	f2—16	24°	16°	29°	(4)0.85	2.8
21	E Auto-T	100 mm	f2.8—22	20°	14°	24°	1.0	3.3
22	E Auto-T	135 mm	f3.5—22	15°	10°	18°	1.5	4.9
23	E Auto-T	135 mm	f2.8—22	15°	10°	18°	1.5	4.9
24	MC Auto-T	180 mm	f2.8—32	11°	7.6°	14°	2.0	6.6
25	F Auto-T	200 mm	f5—32	10°	6.9°	12°	2.5	8.2
26	E Auto-T	200 mm	f4—32	10°	6.9°	12°	2.5	8.2
27	F Auto-T	300 mm	f4.5—32	6.9°	4.6°	8.3°	3.5	11.5
28	E Auto-T	400 mm	f6.3—32	5.2°	3.4°	6.2°	5	16.4
29	F Auto-T	600 mm	f6.5—32	3.4°	2.3°	4.1°	11	36
30	E Auto-T	1000 mm	f11—45	2.1°	1.4°	2.5°	30	100
For use on bellows only								
31	Macro	20 mm	f3.5—16	—	—	—	—	—
32	Macro	38 mm	f3.5—16	—	—	—	—	—
33	Macro	80 mm	f4—22	—	—	—	—	—

Data, setting parameters, construction etc. of lenses announced to date for the Olympus OM cameras. Most lenses are used directly on the camera and many can be used with extension tubes which—in the case of the long focus and tele lenses—also extended the near focusing limit. The macro lenses listed last in the table are usable only in conjunction with the Auto-bellows (or the bellows of the PMT-35 outfit). The 20 and 38 mm macro lenses have to be mounted via the PM-MTob adapter. All lenses with exception of these macro lenses and of the 35 mm shift lens are coupled with the aperture input for full-aperture metering with the OM cameras.

Numbered notes:

(1) All lenses are named Zuiko; this name precedes the codes beginning with 'Auto' but comes after the initial letter code. Thus the full designation of the lens entered as MC Auto-W is MC Zuiko Auto-W. *Auto* in all cases indicates automatic aperture coupling.

OM SYSTEM LENSES

No.	Nearest focus		No. of		Filter mount (screw)	Hood (7)	Length min. (8)	Max. dia. mm	Weight grams
			Elements	Groups					
	Scale								
	1:	×							
1	—	—	11	7	(5)	—	82	102	640
2	—	—	11	8	(5)	—	31	59	180
3	7.8	0.13	11	9	72 mm(6)	(6)	42	62	250
4	5.8	0.17	7	7	49 mm	49 mm S	31	59	180
5	5.8	0.17	11	9	55 mm	57 mm C	43	60	240
6	6.4	0.16	8	7	49 mm	49 mm S	31	59	180
7	6.4	0.16	10	8	55 mm	55 mm S	48	60	280
8	7.5	0.13	7	7	49 mm	49 mm S	31	59	180
9	7.5	0.13	9	8	49 mm	49 mm S	43	60	250
10	5.8	0.17	7	6	49 mm	51 mm C	33	59	180
11	5.8	0.17	8	7	49 mm	49 mm S	58	68	310
12	5.8	0.17	8	7	55 mm	55 mm S	42	60	240
13	6.7	0.15	6	5	49 mm	51 mm C	31	59	170
14	6.7	0.15	7	6	49 mm	51 mm C	36	60	230
15	2	0.5	5	4	49 mm	B	40	60	200
16	6.4	0.16	7	6	55 mm	57 mm C	47	65	310
17	20–10	0.05–0.10	10	8	55 mm	60 mm S	74	67	400
18	18–8.9	0.06–0.11	15	11	49 mm	BE	115	63	440
19	20–7.2	0.05–0.14	15	11	55 mm	BE	196	70	890
20	6.9	0.14	6	4	49 mm	49 mm S	46	60	260
21	8.1	0.12	5	5	49 mm	49 mm S	48	60	230
22	8.9	0.11	5	4	49 mm	BE	73	60	290
23	8.9	0.11	5	5	55 mm	BE	80	61	360
24	9.7	0.10	5	5	72 mm	BE	124	80	700
25	10	0.10	6	5	49 mm	BE	105	62	380
26	10	0.10	5	4	55 mm	BE	127	67	510
27	9.2	0.11	6	4	72 mm	BE	181	80	1100
28	10	0.10	5	5	72 mm	BE	255	80	1300
29	15	0.07	6	4	100 mm	BE	377	110	2800
30	27	0.04	5	5	100 mm	BE	662	110	4000
31	—	4.3–12.4	4	3	21 mm C	—	20	32	70
32	—	1.8–6.1	5	4	32 mm C	—	28	43	90
33	—	0.3–2.3	6	4	49 mm	—	46	59	200

The letter following this indicates the lens application: W = wide angle, S = standard, T = tele. Initial letters from E to J indicate the number of elements: E = 5, F = 6, G = 7 and so on. MC indicates a multi-coated lens.

(2) At infinity setting.

(3) When the shift is utilised, the lens covers various sections of an image circle amounting to altogether 83°.

(4) Floating elements for close-up performance correction.

(5) Filters built in.

(6) With 49-72 mm step-up ring; this also acts as lens hood.

(7) S = screw-in, C = clamp-on, B = built-in (lens sufficiently recessed not to need hood), BE = built-in extending hood. Filters are all screw-in except for the macro lenses.

(8) Measured from front of lens mount to camera mounting flange, lens set at infinity, i.e. this is the amount by which the lens protrudes from the camera.

FOCUSING ZONES

<i>Lens</i>	<i>Stop</i>	<i>Focus setting</i>	<i>Sharp zone (approx.)</i>	
			<i>metres</i>	<i>feet</i>
<i>Near zones</i>				
28 mm	<i>f</i> 5.6	6 ft to index	1.5–3	5–10
35 mm	<i>f</i> 5.6	3 m to index	2–6	7–20
50 mm	<i>f</i> 4	3 m to index	2.6–3.6	8.5–12
85 mm	<i>f</i> 8	3 m to index	2.7–3.3	9–11
100 mm	<i>f</i> 11	3 m to index	2.7–3.3	9–11
<i>Medium zones</i>				
50 mm	<i>f</i> 4	5 m to index	4–7	13–23
85 mm	<i>f</i> 8	5 m to index	4.3–6	14–20
100 mm	<i>f</i> 11	5 m to index	4.3–6	14–20
135 mm	<i>f</i> 16	10 m to index	7.9–13.6	25–45
<i>Far and extreme zones</i>				
24 mm	<i>f</i> 5.6	3 m to index	1.5–∞	1.5–∞
28 mm	<i>f</i> 5.6	6 ft to LH <i>f</i> 8	2.2–∞	7.2–∞
35 mm	<i>f</i> 5.6	3 m to LH <i>f</i> 4/8	3–∞	10–∞
50 mm	<i>f</i> 8	10 m to index	5–∞	16–∞
85 mm	<i>f</i> 11	10 m to LH <i>f</i> 8/16	10–∞	33–∞
100 mm	<i>f</i> 16	10 m to LH <i>f</i> 11	8–∞	25–∞
135 mm	<i>f</i> 16	30 m to index	15–∞	50–∞

The depth of field indicator of the different lenses helps you to select suitable zones of sharpness needed for various subjects. To save time for this however it is also useful to have a few commonly used zones at your fingertips. This table lists a selection of such zones for the lenses most likely to be used in candid snapshooting, sports etc.

The actual zone indicated is approximate, but to know where you are it is useful to have strictly repeatable scale settings. So for these zones set the indicated white metre figure or orange feet value of the distance scale either opposite the red focusing index or to one of the depth of field index lines. Thus '6 ft to index' means that you set the orange 6 on the feet scale opposite the red focusing index. Similarly, '10 m to LH *f*11' means that you set the white 10 on the metre scale opposite the left-hand *f*11 line of the depth of field scale. Occasionally a distance figure has to be set halfway between two depth index lines; e.g. 'LH *f*4/8' means that you set the distance figure in the gap between the left-hand *f*4 and *f*8 index lines.

FILM SPEEDS AND TYPES

<i>ASA</i>	<i>DIN</i>	<i>Film types</i>	
		<i>Black-and-white</i>	<i>Colour</i>
(2–10)	(4–11)	Special copying and extra slow	
12	12		
16	13		
20	14	Extra-fine grain films (negative)	Slow colour reversal film (slides)
25	15		
32	16		
40	17		
50	18	Fine grain negative, direct reversal films	Medium-speed negative and reversal films
64	19		
80	20		
100	21		
125	22	Medium to high-speed negative films	High-speed reversal films. High-speed negative films
160	23		
200	24		
250	25		
320	26	High to extreme-speed negative films, often with forced processing	Forced-processing reversal
400	27		
500	28		
640	29		
800	30		
1000	31		
1250	32		
1600	33		

The ASA speeds listed are those marked on the film speed setting control of the OM cameras (though not necessarily all models cover the full range). Corresponding DIN values—as used in parts of central Europe—are given alongside. Nowadays most films, even if rated in DIN speeds, also carry ASA figures.

When dealing with films of East European origin which may have GOST (Russian standard) film speeds, simply set the OM meter to the next higher ASA value. For instance for 90 GOST film set to 100 ASA.

The table also indicates the general speed range of different black-and-white and colour film types.

FILTERS FOR COLOUR

Filter	Colour temp. correct.			Exposure correct.		Uses
	Typically			X	EV	
	From K	To K	Approx. dkM			
UV: L39*	—	—	—	1	0	Absorbs ultraviolet, e.g. in mountain views (daylight film)
Skylight 1A*	—	—	—	1	0	Absorbs ultraviolet, stronger than L39. Outdoor views in shade, dull weather lit by blue skylight. Uncorrected electronic flash with daylight film
<i>Amber filters (lower colour temperature)</i>						
81A	3400	3200	+2	1¼	−⅓	Photoflood lighting with type B or K film. Also for stronger effect in same applications as No. 1A
81C or 81D A4*	3800 4200	3200 or 3400	+4 to +5	1¼	−⅓	AG1 flash bulbs (clear) with type A film or B or K film
86B			+6.7	2	−1	
85C			+8	2	−1	
85	5500	3400	+11	2	−1	Daylight or blue flash with type A film
85B	5500	3200	+13	2	−1	Daylight or blue flash or electronic flash with type B or K film
<i>Blue filters (raise colour temperature)</i>						
78C or 82A	3200	3400	−2	1¼	−⅓	Tungsten (3200K) light with type A film
82C, B4*	2800	3200	−4.5	1⅔	−⅔	Ordinary tungsten light (2800K) with type B or K film
80D	4200	5500	−5.5	1⅔	−⅔	AG1 clear flash with daylight film
78B	2800	3400	−6.7	2	−1	Ordinary (2800K) tungsten light with type A reversal film or negative colour film
80C			−8	2	−1	Tungsten light with negative colour films
80B	3400	5500	−11	3	−1½	Photoflood light with daylight reversal film
80A	3200	5500	−13	4	−2	Tungsten (3200K) light with daylight type reversal film

* Olympus filters

Apart from the UV and skylight filter, the filters listed are colour conversion filters to match different light sources to films of different colour balance. Some filters are also included for correction balancing when copying colour transparencies. The filter numbers—other than the Olympus filters marked with an asterisk (*)—are Wratten, or equivalent designations of other makes using the same numbering system.

FILTER FITTINGS AND AVAILABILITY

Filter size (screw)	Availability of Olympus filter types										Fits (Lenses)
	1A	L39 (UV)	A4 (81C)	B4 (82C)	Y48 (Y2)	O56 (O2)	R60 (R1)	ND2	ND4	Polarising	
55 mm	X	X	X	X	X	X	X	X	X	X	21 mm f2 24 mm f2 35 mm f2 55 mm f1.2 *35–70 mm f3.6 *85–250 mm f5 135 mm f2.8 200 mm f4
72 mm	X	X	—	—	X	X	X	—	—	—	18 mm f3.5 180 mm f2.8 300 mm f4.5 400 mm f6.3
100 mm	X	X	—	—	X	X	X	—	—	—	600 mm f6.5 1000 mm f11
49 mm	X	X	X	X	X	X	X	X	X	X	All other lenses <i>except</i> fisheye (have built-in turret) and 20 and 38 mm macro

X = available filters in size indicated

* Zoom lenses

Olympus filters are available in four sizes which between them cover all lenses of the OM system except the fisheye lenses (which have their own built-in filters) and the 20 and 38 mm macro lenses (not normally used with filters).

The table shows which filters are available in which size. All Olympus filters are available in the 49 and 55 mm sizes.

RECIPROCITY FAILURE CORRECTIONS

Nominal exposure (indicated or calculated)	Actual exposure required	Compensating override on OM-2
Shorter than ½ sec	As nominal	None
1 sec	1½ sec	+⅓
2 sec	3 sec	+⅔
4 sec	6–9 sec	+⅔ to +1
8 sec	12–20 sec	+⅔ to +1½
16 sec	30–65 sec	+1 to +2
30 sec*	100–250 sec	—

* For greater compensation switch to manual exposure control; OM-2 does not reliably time exposures longer than about 45–60 sec.

With longer exposure times the effective film speed drops and exposures need a longer time than the nominal time indicated by calculation or exposure metering. The actual correction for this so-called reciprocity failure varies from film to film, so consult the manufacturer's instruction literature. This table gives a rough guide to the magnitude of corrections to be expected. For automatic exposures with the OM-2 this can be allowed for by appropriate settings of the exposure compensating dial.

GUIDE NUMBERS AND FILM SPEEDS

<i>(m)</i>						ASA	Speed				<i>(ft)</i>					
25	32	40	50	64	80	100	125	160	200	250	320	400	500	640	800	
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
<i>(m)</i>						DIN	Speed				<i>(ft)</i>					
10	11	12	14	16	18	20	22	25	28	32	36	40	45	50	56	
11	12	14	16	18	20	22	25	28	32	36	40	45	50	56	64	
12	14	16	18	20	22	25	28	32	36	40	45	50	56	64	72	
14	16	18	20	22	25	28	32	36	40	45	50	56	64	72	80	
16	18	20	22	25	28	32	36	40	45	50	56	64	72	80	90	
18	20	22	25	28	32	36	40	45	50	56	64	72	80	90	100	
20	22	25	28	32	36	40	45	50	56	64	72	80	90	100	110	
22	25	28	32	36	40	45	50	56	64	72	80	90	100	110	125	
25	28	32	36	40	45	50	56	64	72	80	90	100	110	125	140	
28	32	36	40	45	50	56	64	72	80	90	100	110	125	140	160	
32	36	40	45	50	56	64	72	80	90	100	110	125	140	160	180	
36	40	45	50	56	64	72	80	90	100	110	125	140	160	180	200	
40	45	50	56	64	72	80	90	100	110	125	140	160	180	200	225	
45	50	56	64	72	80	90	100	110	125	140	160	180	200	225	250	
50	56	64	72	80	90	100	110	125	140	160	180	200	225	250	280	
56	64	72	80	90	100	110	125	140	160	180	200	225	250	280	320	
64	72	80	90	100	110	125	140	160	180	200	225	250	280	320	360	
72	80	90	100	110	125	140	160	180	200	225	250	280	320	360	400	
80	90	100	110	125	140	160	180	200	225	250	280	320	360	400	450	
90	100	110	125	140	160	180	200	225	250	280	320	360	400	450	500	
100	110	125	140	160	180	200	225	250	280	320	360	400	450	500	560	
110	125	140	160	180	200	225	250	280	320	360	400	450	500	560	640	
125	140	160	180	200	225	250	280	320	360	400	450	500	560	640	720	
140	160	180	200	225	250	280	320	360	400	450	500	560	640	720	800	
160	180	200	225	250	280	320	360	400	450	500	560	640	720	800	900	

The table shows equivalent guide numbers at different film speeds and is valid for metric or feet values. To find the equivalent of a known guide number for one speed in a different film speed, look up the known guide number in the appropriate ASA or DIN speed column. From that guide number trace horizontally across to the column of the new film speed value and read off the new guide number there.

All guide numbers follow the preferred guide number sequence recommended in ISO standards and now used by many electronic flash manufacturers in quoting guide numbers.

Example: If the guide number for a given flash is quoted as 32 at 100 ASA, what is the guide number with 250 ASA film? Trace down the 100 ASA column to 32, then trace horizontally across to the 250 ASA column: the new guide number shown there is 50.

The two bold columns in the table—headed *(m)* and *(ft)* at the top—can also serve as a ready reckoner to convert from metric to feet guide numbers or vice versa. To convert a metric guide number to feet, look up the metric value in the left-hand bold *(m)* column and trace across to the right-hand *(ft)* column. To convert from feet to metric, look up the guide number in the *ft* column and trace to the left to the corresponding value in the *m* column.

Example: 36 metric (left-hand column) = 110 in feet (right column). This conversion is approximate but with an average error not exceeding 3%.

QUICK AUTO 310 AND 300 OPERATING MODES

Camera		Flash connection	Uses (3)	Mode (4) for selector setting on flash unit			
Model	Meter switching (1)	(2)		TTL AUTO	MANUAL High	MANUAL Low	AUTO
<i>Quick Auto 310</i>							
OM-2	AUTO	OM-2 shoe	G	A-TTL	MF	MR	A
OM-2	AUTO	AuC	G, B	A-TTL	A-TTL	A-TTL	A-TTL
OM-2	AUTO	SyC		MF	MF	MR	A
OM-2	MANUAL	OM-2 shoe	FI	MF(5)	MF	MR	A
OM-2	MANUAL	AuC	NR	MF(5)	MF	MF	MF
OM-2	MANUAL	SyC	FI	MF	MF	MR	A
OM-1	Any	SyC	G, FI	MF	MF	MR	A
OM-1	Any	ExS	B	Mode as set on remote sensor			
OM-1	Any	OM-1 shoe	G, FI	MF	MF	MR	A
OM-1	Any	AuC	NR	MF	MF	MF	MF
<i>Quick Auto 300</i>							
OM-2 or 1	Any	Shoe	G, FI	—	MF	MR	A
OM-2 or 1	Any	AuC	NR	—	MF	MF	MF
OM-2 or 1	Any	SyC	G, FI	—	MF	MR	A
OM-2 or 1	Any	ExS	B	—	Mode as set on remote sensor		

The Quick Auto flash units operate in different ways according to which camera they are linked with and by what means. This table summarises the combinations and results. The numbered notes below indicate special points and abbreviations used:

(1) With the OM-2 at the AUTO or OFF settings the flash does not fire if the prevailing light causes the automatic system to select a shutter speed of 1/125 second or faster. Nor will the OM-2 trigger the flash at manual settings with such shorter shutter speeds.

(2) The different connections, apart from fitting the flash directly into the camera shoe, are: AuC = Auto synchronising cord (flash off camera or on bounce grip); SyC = normal synchronising cord (with coaxial plug to fit camera socket, or synchronising cord built into bounce grip); ExS = external or remote sensor.

(3) G = general flash photography (preferred combination); B = bounce flash (flash on bounce grip); FI = suitable for fill-in lighting with daylight; NR = not recommended combination (shown only to indicate what happens with it).

(4) The modes indicated are: A-TTL = auto flash with through-the-lens flash control; MF = manual with full power flash; MR = manual with reduced power flash; A = automatic, controlled by built-in sensor of flash or external remote sensor.

(5) Spurious reduced power output if shutter speed is set to 1/60 second.

SELECTING QUICK AUTO 310 AND 300 COMBINATIONS

Flash model	Camera		Flash		
	Model	Meter switching	Mounting	Connection	Selector setting
<i>On-camera automatic: simple, straightforward</i>					
310	OM-2	AUTO	Shoe	Shoe	TTL-AUTO*
310/300	OM-1	Any	Shoe	Shoe	AUTO
300	OM-2	MANUAL	Shoe	Shoe	AUTO
<i>Off-camera automatic: more modelling</i>					
310	OM-2	AUTO	Bounce grip	Auto cord	TTL-AUTO**
310	OM-2	AUTO	Separate	Auto cord	TTL-AUTO**
310/300	OM-1	Any	Bounce grip	Synch cord	AUTO
310/300	OM-1	Any	Separate	Synch cord or remote sensor	AUTO
300	OM-2	MANUAL	Bounce grip	Synch cord	AUTO
300	OM-2	MANUAL	Separate	Remote	AUTO
<i>Bounce flash for soft light</i>					
310	OM-2	AUTO	Bounce grip	Auto cord	TTL-AUTO**
310/300	OM-1	Any	Bounce grip	Remote sensor	AUTO
300	OM-2	MANUAL	Bounce grip	Remote sensor	AUTO
<i>Daylight fill-in (select suitable aperture and/or speed)</i>					
310/300	OM-2	MANUAL	Shoe	Shoe	MANUAL HI
310/300	OM-1	Any	Shoe	Shoe	MANUAL HI
<i>Close-up</i>					
310	OM-2	AUTO	Separate	Auto cord	TTL-AUTO**
310	OM-2	AUTO	Bounce grip (angled)	Auto cord	TTL-AUTO**
310/300	OM-1	Any	Separate or bounce grip (angled)	Remote sensor	AUTO
300	OM-2	MANUAL	Separate or bounce grip (angled)	Remote sensor	AUTO

* Automatic control of flash duration by internal cells of camera.

** In fact auto through-the-lens control takes place irrespective of 310 selector setting when Auto Cord is used and OM-2 set to AUTO (or OFF).

Combinations of camera with flash plus the required mounting, synchronising connection and setting on the selector dial of the flash unit. Where the remote sensor is used, the selector setting applied to the dial on the sensor.

CLOSE-UP TELEPHOTOGRAPHY RANGES

Lens	Extension tube	Focusing range*		Magnification range
		m	feet	
135 mm	None	1.36**	4.5**	0.11**
	7 mm	2.7–0.95	9–3.2	0.05–0.16
	14 mm	1.4–0.75	4.7–2.5	0.10–0.21
180 mm	None	1.93**	6.3**	0.10**
	14 mm	2.5–1.2	8.2–3.9	0.08–0.18
200 mm	None	2.3**	7.5**	0.10**
	14 mm	3.05–1.4	10–4.5	0.07–0.17
300 mm	None	3.1**	10**	0.11**
	14 mm	6.7–2.2	22–7.3	0.05–0.16
	25 mm	3.9–1.8	12.7–6	0.08–0.19
400 mm	None	4.6**	15**	0.10**
	25 mm	6.8–2.8	22–9.4	0.06–0.16
	25 + 14 mm	4.5–2.4	14.8–8	0.10–0.20
600 mm	None	10.5**	35**	0.07**
	25 mm	13.8–5.3	45–17.4	0.04–0.1
	25 + 14 mm	8.6–4.2	28–14	0.07–0.13
1000 mm	None	30**	100**	0.04**
	25 mm	39–15.5	128–51	0.03–0.06
	25 + 14 mm	24.6–12.4	81–41	0.04–0.07
85 mm (85–250 zoom)	None	1.8**	6**	0.05**
	7 mm	1.1–0.73	3.6–2.4	0.08–0.13
	14 mm	0.6–0.48	2.0–1.6	0.16–0.22
250 mm (85–250 zoom)	None	2**	6.6**	0.14**
	7 mm	9.2–1.7	30–5.7	0.03–0.17
	14 mm	4.7–1.5	15.5–5	0.06–0.2
	25 mm	2.75–1.3	9–4.2	0.10–0.24

* Approx. lens/subject distances. ** At near focusing limit of lens

Near focusing limits of tele lenses can be extended for close range telephotography, i.e. medium subject scales at comparatively long subject distances. The table lists the distance ranges and magnification ranges available with long focus and tele lenses combined with extension tubes.

CLOSE-UP ZOOM RANGES

Zoom lens	Ext. tube	Focus setting*	Zoom distance range**		Magnification range
			metres	feet	
35–70 mm	7 mm	∞	0.2–0.75	0.7–2.5	0.2–0.1
	14 mm	∞	0.12–0.4	0.4–1.4	0.4–0.2
75–150 mm	7 mm	∞	0.8–3.4	2.6–11	0.09–0.05
		c.	0.46–0.95	1.5–3.1	0.19–0.19
	14 mm	∞	0.4–1.75	1.3–5.75	0.19–0.09
		c.	0.31–0.7	1.0–2.3	0.23–0.22
	25 mm	∞	0.25–0.95	0.8–3.1	0.33–0.17
		c.	0.18–0.58	0.6–1.9	0.36–0.34
85–250 mm	7 mm	∞	1.1–9.2	3.6–30	0.08–0.03
		c.	0.7–1.7	2.4–5.7	0.17–0.13
	14 mm	∞	0.6–4.7	2.0–15.5	0.16–0.06
		c.	0.5–1.5	1.6–5	0.22–0.2
	25 mm	∞	0.4–2.75	1.3–9	0.3–0.1
		c.	0.3–1.3	1–4.2	0.4–0.35

* Infinity (∞) or closest focus (c.)

** Approx. distance range (lens/subject) covered by zooming from longest to shortest focal length.

By combining zoom lenses with extension tubes you not only bring the near focusing limit nearer but also cover a near subject range at reasonably constant magnification by operating the zoom adjustment rather than the focusing ring. The scale remains particularly constant when the zoom lens is set to its near focusing limit.

The table shows the distance ranges (approximate lens/subject distances) covered by the zooming adjustment with different zoom lenses and extension tube combinations, plus other relevant data. In every case the shortest distance (and the highest magnification) is obtained with the zoom lens at its shortest focus setting.

HAND COPY STAND DATA

Camera lens	Close up lens or ext. tube	Leg extens.	Approx. focus scale setting		Subject area covered		Reprod. scale	
			m	ft	cm	in.	1:	x
Large originals (A4, Foolscap): 38 × 50 cm (15 × 20 inch) support area								
50 mm	None	Long	0.65	2	24.2 × 36.3	9.5 × 14.3	10.2	0.10
Macro f3.5								
50 mm f1.8	None	Long	0.65	2	24.2 × 36.3	9.5 × 14.3	10.2	0.10
50 mm f1.4	None	Long	0.65	2	24.7 × 37.2	9.7 × 14.7	10.3	0.10
55 mm f1.2*	None	Long	0.68	2¼	23.3 × 35.0	9.1 × 13.8	9.75	0.10
Medium originals (Trimmed quarto, larger book): 27 × 36 cm (10.5 × 14 inch) support area								
50 mm	None	Med.	0.50	1.7	17.3 × 26.2	6.8 × 10.3	7.5	0.13
Macro f3.5								
50 mm f1.8	None	Med.	0.47	—	17.0 × 25.8	6.7 × 10.2	7.25	0.14
50 mm f1.4	None	Med.	0.47	—	17.5 × 26.6	6.9 × 10.5	7.5	0.13
50 mm f1.2*	None	Med.	0.50	—	16.9 × 25.6	6.6 × 10.1	7.13	0.14
Smaller originals (Octavo, normal book page): 20 × 28 cm (8 × 11 inch) support area								
50 mm	None	Short	0.40	1.3	12.7 × 19.0	5.0 × 7.4	5.4	0.19
Macro f3.5								
50 mm f1.8	49 mm/40 cm	Short	1.15	3¾	12.8 × 19.3	5.1 × 7.6	5.5	0.18
50 mm f1.4	49 mm/40 cm	Short	1.15	3¾	13.1 × 19.7	5.1 × 7.7	5.6	0.18
50 mm f1.2*	55 mm/40 cm	Short	1.25	4	12.3 × 18.5	4.8 × 7.25	5.25	0.19
Very small: 11 × 15 cm (4.5 × 6 inch) support area								
50 mm	None	Shortest	0.24	9¾ in	5.1 × 7.7	2 × 3	2.25	0.44
Macro f3.5								
50 mm f1.8	7 + 14 mm tubes	Shortest	0.9	3	4.8 × 7.3	1.9 × 2.9	2	0.5
50 mm f1.4	7 + 14 mm tubes	Shortest	2.5	8	5.3 × 8.1	2.1 × 3.2	2.25	0.44
55 mm f1.2*	7 + 14 mm	Shortest	1.50	5	5.4 × 8.3	2.15 × 3.3	2.3	0.43

* With 55/49 mm step-down adapter ring. Where close-up lens is used, screw this into 55 mm lens, and adapter ring into close-up lens

Subject areas covered with different 50 and 55 mm lenses at the three leg extensions of the Handy copy stand. The leg extensions determine the lens/copy distance and the focusing scale settings. The latter are approximate; focus accurately by observing the image in the finder. The lenses are listed in order of preference for optimum quality. Subject areas refer to conditions where the copy stand legs actually stand on the surface being copied—the ideal condition for keeping a page etc. flat. Closer focusing (and hence smaller subject areas) may be involved where a book of finite thickness is placed within the field covered by the legs. Subject areas refer to the field covered by the OM camera finder (and by transparency frames); slightly more is included on the film. The support area in each case is the minimum area required to support the legs safely.

RECOMMENDED CLOSE-UP/MACRO COMBINATIONS

Reprod. scale	Suitable combinations of			
	Lens	Extension unit or accessory	Focusing means	Minimum camera support
<i>Preferred combinations</i>				
0–0.5×	50 mm Auto-Macro	None needed	Lens mount, plus possibly focusing rail and stage	Hand held or tripod, copy stand etc.
0.5–2.2×	80 mm Macro	Bellows	Bellows	Copy stand or VST-1 or PMT-35
1.8–6×	38 mm Macro	Bellows	Bellows	VST-1 or PMT-35
4.3–12.4×	20 mm Macro	Bellows	Bellows	VST-1 or PMT-35
<i>Other feasible combinations</i>				
0–0.5×	Any 50 mm	Tubes and/or supp. lens	Lens mount	Hand held, or tripod, copy stand etc.
	Other lenses	Tubes	Lens mount	As above
0.5–1×	50 mm Auto-Macro	25 mm tube	Lens mount, focusing rail and stage	Copy stand, focusing rail and stage
0.7–1.6×	135 mm	Bellows	Bellows	Copy stand
0.7–2×	100 mm	Bellows	Bellows	Copy stand
0.75–4×	50 mm Auto-Macro	Bellows	Bellows	VST-1
1× and over	Other lenses	Bellows	Bellows	Copy stand or VST-1

* Greater maximum magnification possible with PMT-35 system or addition of extension tubes

** Approx. max. magnification with retro-mounted lens

A guide to selecting the appropriate items for different macro set-ups, depending on the scale of reproduction to be covered. The first half of the table (preferred combinations) lists lenses, extension units and focusing means that yield the best results and also indicates the standard of rigidity required in supporting the camera.

The second half of the table shows feasible equipment combinations you can use if for instance you do not have any or all the macro lenses indicated, or if you have to work without a bellows unit.

CLOSE-UP RANGES WITH CLOSE-UP LENS AND EXTENSION TUBES

Lens	Close-up aid (1)	Focusing range (2)		Scale of reprod.	
		mm	inches	Mag. x	Red. 1:
50 mm Macro f3.5	None	∞–114	∞–4.5	0–0.5	∞–2
	CL	395–85	15.5–3.3	0.13–0.67	7.7–1.5
	14	200–75	7.9–3	0.29–0.8	3.4–1.25
	14 + CL	130–60	5.1–2.35	0.42–0.9	2.4–1.1
	25	118–64	4.7–2.5	0.57–1.0	1.75–1.0
	25 + CL	89–51	3.5–2.0	0.67–1.14	1.5–0.9
	25 + 14	80–51	3.2–2.0	0.8–1.33	
	25 + 14 + 7	70–48	2.75–1.9	0.93–1.35	
50 mm Standard (3)	None	∞–362	∞–14.75	0–0.15	∞–6.5
	CL	393–188	15.5–7.4	0.13–0.3	7.5–3.4
	7	390–195	15.4–7.7	0.14–0.31	7–3.25
	7 + CL	195–130	7.7–5.15	0.29–0.44	3.5–2.25
	14	204–140	8.0–5.5	0.29–0.43	3.5–2.3
	14 + CL	133–102	5.25–4.0	0.44–0.57	2.25–1.75
	14 + 7	142–110	5.6–4.4	0.44–0.57	2.25–1.75
	14 + 7 + CL	104–84	4.1–3.3	0.57–0.73	1.75–1.4
	25	124–99	4.9–3.9	0.50–0.67	2–1.5
	25 + CL	91–76	3.5–3.0	0.65–0.8	1.55–1.25
	25 + 7	99–85	3.9–3.35	0.67–0.8	1.5–1.25
	25 + 14	86–76	3.4–3	0.8–1.0	
	25 + 14 + 7	76–68	3–2.7	0.95–1.14	
55 mm f12	None	∞–349	∞–13.7	0–0.167	∞–6
	CL	394–182	15.5–7.2	0.14–0.31	7–3.25
	7	438–191	17.2–7.5	0.13–0.31	7.75–3.25
	7 + CL	205–127	8.0–5.0	0.29–0.44	3.5–2.25
	14	220–134	8.7–5.25	0.25–0.43	4–2.3
	14 + CL	139–97	5.5–3.95	0.4–0.57	2.5–1.75
	25	124–91	4.9–3.6	0.43–0.62	2.33–1.63
	25 + CL	94–70	3.7–2.75	0.61–0.77	1.65–1.3
	25 + 7	95–76	3.8–3.0	0.59–0.75	1.7–1.33
	25 + 7 + CL	76–63	3.0–2.45	0.87–0.95	1.15–1.08
	25 + 14	78–64	3.1–2.5	0.73–0.89	1.38–1.13
	25 + 14 + 7	66–56	2.6–2.25	0.89–0.98	1.13–1.03
100 mm f2.8	CL	390–270	15.3–10.6	0.26–0.43	3.9–2.3
	14	814–470	32–18.5	0.14–0.27	7.1–3.7
	14 + CL	260–212	10.3–8.3	0.43–0.59	2.3–1.7
	25	500–365	19.7–14.4	0.26–0.40	3.9–2.5
	25 + CL	215–187	8.5–7.7	0.61–0.77	1.65–1.3
	25 + 14	355–295	14–11.7	0.42–0.56	2.4–1.8
	25 + 14 + 7	318–274	12.5–0.65	0.49–0.65	2.05–1.55

The close-up lens generally provides a greater focusing range than an extension tube, but the image quality with the latter is better at the higher magnifications. Combinations with the close-up lens at reproduction scales above about 0.3 × require some stopping down to reduce definition loss towards the edge of the field. The same applies also to higher magnifications (above about 0.4 ×) with the extension tubes.

Numbered notes:

(1) CL = close-up lens (40 cm focal length); 7, 14, 25 = length in mm of extension tubes.

(2) Lens-to-subject distances (not lens-to-film plane).

(3) Figures measured for 50 mm f1.8; values very similar for 50 mm f1.4.

EXTENSION TUBES WITH MACRO LENSES

<i>Lens</i>	<i>Close-up aid (1)</i>	<i>Lens/subject distance (from front lens rim)</i>		<i>Scale of reproduction</i>	
		<i>mm</i>	<i>inches</i>	<i>Magnif.</i>	<i>Red. 1:</i>
80 mm Macro	25	640	25.0	0.14×	7.25
	25 + 7	393	15.5	0.23×	4.33
	25 + 14	295	11.6	0.36×	2.75
	25 + 14 + 7	238	9.4	0.41×	2.45
	25 + CL	242	9.5	0.36×	2.75
	25 + 7 + CL	195	7.7	0.44×	2.25
	25 + 14 + CL	167	6.5	0.57×	1.75
	25 + 14 + 7 + CL	148	5.8	0.67×	1.5
38 mm Macro (2)	None	71	2.8	0.87×	1.15
	7	62	2.5	1.18×	
	14	56	2.25	1.35×	
	25	51	2.0	1.6×	

The 80 mm and 38 mm macro lenses have no focusing movement and hence yield sharp images with extension tubes and (in the case of the 80 mm lens) the close-up lens only at single fixed distances. In view of the special close-up correction of these lenses, definition performance is however good. The 38 mm macro lens is mounted via the PM-MTob adapter. Still larger scales are possible with further extension tube combinations; here the tube set-up however becomes inconvenient and the bellows should be used. (They are preferable with the macro lenses, anyway.)

Numbered notes:

(1) CL = close-up lens (40 cm focal length); 7, 14, 25 = length in mm of extension tubes.

(2) Mounted via PM-MTob adapter.

MACRO LENSES WITH BELLOWS

<i>Magnif.</i>	<i>50 mm Macro (N)</i>		<i>50 mm Macro (R)</i>		<i>80 mm Macro</i>		<i>38 mm Macro</i>		<i>20 mm Macro</i>	
	<i>B</i>	<i>L/S</i>	<i>B</i>	<i>L/S</i>	<i>B</i>	<i>L/S</i>	<i>B</i>	<i>L/S</i>	<i>B</i>	<i>L/S</i>
	<i>mm</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>
0.4×	—	—	—	—	79	243	—	—	—	—
0.6×	—	—	—	—	95	176	—	—	—	—
0.8×	74	77	—	—	111	143	—	—	—	—
1.0×	84	64	102	62	127	123	—	—	—	—
1.2×	—	—	112	53	143	110	—	—	—	—
1.4×	—	—	123	47	159	100	—	—	—	—
1.6×	—	—	134	42	175	93	—	—	—	—
1.8×	—	—	144	38	191	88	—	—	—	—
2.0×	—	—	155	35	207	83	75	44	—	—
2.2×	—	—	166	33	223	80	83	43	—	—
2.4×	—	—	177	31	(**)	(**)	90	41	—	—
2.6×	—	—	187	29	(**)	(**)	98	40	—	—
2.8×	—	—	198	28	—	—	106	39	—	—
3.0×	—	—	209	26	—	—	113	38	—	—
3.5×	—	—	—	—	—	—	132	36	—	—
4.0×	—	—	—	—	—	—	151	35	—	—
4.5×	—	—	—	—	—	—	170	34	73	21
5.0×	—	—	—	—	—	—	189	33	83	21
5.5×	—	—	—	—	—	—	208	32	93	20
6.0×	—	—	—	—	—	—	227	32	103	20
6.5×	—	—	—	—	—	—	(**)	(**)	113	20
7.0×	—	—	—	—	—	—	(**)	(**)	123	20
8.0×	—	—	—	—	—	—	—	—	143	19
9.0×	—	—	—	—	—	—	—	—	163	19
10.0×	—	—	—	—	—	—	—	—	183	19
12.0×	—	—	—	—	—	—	—	—	223	18
<i>Subject/film addition</i>	54 mm		50 mm		60 mm		48 mm		39 mm	

* Magnifications obtainable with lens directly on camera—but minimum bellows extension too long

** Can be reached with bellows and ext. tubes but cumbersome—better use next shorter focal length

Magnifications obtainable with macro lenses used in conjunction with the Auto-bellows. The bold values are preferred ranges.

Higher magnifications are possible with the 80 mm and 38 mm lenses by adding extension tubes to the bellows; in these cases it is however more convenient to switch to the 38 mm and 20 mm lenses respectively.

B in all cases is the location of the rear edge of the rear bellows standard on the scale, when the front standard is pushed fully forward against the rail screw.

L/S is the distance in mm from the front lens mount to the subject plane. The distances give an approximate indication of the amount of space available for lighting etc.

N indicates normal mounting and *R* retro mounting of 50 mm macro lens.

Subject/film addition: The table indicates lens/subject distances. To obtain subject/film distances, add together the bellows extension value (*B*) and the lens/subject distance (*L/S*) for the required magnification, and add to this the subject/film addition shown at the bottom of the appropriate lens column. For example, with the 38 mm macro lens at 3× magnification, the subject/film plane distance is 113 + 38 mm (*B* + *L/S*) plus 48 mm (subject/film addition) = 199 mm.

The figures are also valid for the 20, 38 and 80 mm macro lenses used on the PMT-35 bellows. The setting values on the bellows scale are there however higher by 13 mm (e.g. for the 80 mm macro lens at 1.0× magnification, the bellows scale setting would be 140 mm and not 127 mm) because the PMT-35 bellows scale does not start at zero. To calculate total subject/film distance however use the figures for *B* in this table, not those corrected for the PMT-35 scale. (i.e. the total subject/film distance with the 80 mm macro lens at 1.0× would still be 127 + 123 + 60 mm = 310 mm—not 140 + 123 + 60 mm).

OTHER LENSES WITH BELLWS

Magnif.	50 mm f1.8(N)		50 mm f1.8(R)		50 mm f1.4(N)		50 mm f1.4(R)	
	B	L/S	B	L/S	B	L/S	B	L/S
	mm	mm	mm	mm	mm	mm	mm	mm
0.7×	69	92	—	—	69	82	—	—
0.8×	74	83	—	—	74	73	—	—
0.9	79	76	—	—	79	66	—	—
1.0×	85	70	—	—	85	60	—	—
1.2×	—	—	78	78	—	—	74	78
1.4×	—	—	89	72	—	—	84	72
1.6×	—	—	99	67	—	—	95	67
1.8×	—	—	109	63	—	—	105	63
2.0×	—	—	120	61	—	—	115	60
2.2×	—	—	130	58	—	—	126	58
2.4×	—	—	140	56	—	—	136	56
2.6×	—	—	151	55	—	—	146	54
2.8×	—	—	161	53	—	—	157	53
3.0×	—	—	171	52	—	—	167	52
3.5×	—	—	197	49	—	—	193	49
4.0×	—	—	223	48	—	—	219	48
Subject/film addition	45 mm		50 mm		50 mm		50 mm	

* Use 55–49 mm step-down adapter ring on front of reversed lens to couple with bellows

** Data similar with 135 mm f2.8 lens but lens/subject distances 28 mm shorter at all settings (f3.5 lens is more pronounced telephoto type)

*** Higher magnifications possible with extension tubes but with serious loss of image quality

While the macro lenses are specially corrected for a near focusing range, the other standard lenses and short tele lenses are usable in the near range subject to some limitations. In particular, they need more stopping down for reasonable sharpness over the whole image area.

The standard (50 and 55 mm) lenses should be mounted normally (N) at reproduction scales up to 1.0×, or reversed (retro-mounted) for higher magnifications (R). These lenses should be set to infinity. The 100 and 135 mm lenses—given here as examples of longer focal length to obtain greater lens/subject distance—are used with the focusing movement set to its closest distance (C). With the 50 and 55 mm lenses the bellows can be mounted on the VST-1 stand; use the copy stand or other arrangement for the 100 and 135 mm lenses as the minimum lens/subject distance is here too great for the VST-1.

OTHER LENSES WITH BELLWS

Magnif.	55 mm f1.2(N)		55 mm f1.2(R)*		100 mm f2.8(C)		135 mm f3.5(C)	
	B	L/S	B	L/S	B	L/S	B	L/S**
	mm	mm	mm	mm	mm	mm	mm	mm
0.7×	72	80	—	—	88	252	110	362
0.8×	78	70	—	—	98	234	123	338
0.9×	83	62	—	—	108	220	136	319
1.0×	89	56	—	—	118	209	150	304
1.2×	—	—	—	—	138	193	177	282
1.4×	—	—	93	75	158	181	204	265
1.6×	—	—	104	70	178	172	231	253
1.8×	—	—	115	66	198	165	—	(***)
2.0×	—	—	126	63	218	159	—	—
2.2×	—	—	137	60	—	(***)	—	—
2.4×	—	—	149	58	—	(***)	—	—
2.6×	—	—	160	56	—	—	—	—
2.8×	—	—	171	55	—	—	—	—
3.0×	—	—	182	53	—	—	—	—
3.5×	—	—	211	51	—	—	—	—
4.0×	—	—	—	—	—	—	—	—
Subject/film addition	61 mm		50 mm		73 mm		102 mm (f3.5)	109 mm (f2.8)

* Use 55–49 mm step-down adapter ring on front of reversed lens to couple with bellows

** Data similar with 135 mm f2.8 lens but lens/subject distances 28 mm shorter at all settings (f3.5 lens is more pronounced telephoto type)

*** Higher magnification possible with extension tubes but with serious loss of image quality

B is the bellows extension, being the location of the rear standard on the bellows rail scale when the front (lens) standard is moved fully to the front rail end.

L/S is the lens/subject distance (measured from subject plane to front lens mount).

Subject/film addition: The tables indicate lens/subject distances. To obtain subject/film distances, add together the bellows extension value (B) and the lens/subject distance (L/S) for the required magnification, and add to this the subject/film addition shown at the bottom of the appropriate lens column. For example, with the 50 mm f1.8 lens used at 1.0× magnification, add together 85 + 70 (B + L/S) + 45 mm (subject/film addition) = 200 mm total subject/film plane distance.

SLIDE COPIER LENS AND BELLOWS SETTINGS

Lens	Mounting	Focus setting on lens	Alignment of			Magnif.
			Front of bellows rail (mark) on slide copier arm	Lens standard on bellows rail (front)	Camera standard on bellows rail (rear)	
Same-size copying						
80 mm Macro	Normal	—	1 × orange	25 mm (1)	152 mm (2)	1 ×
50 mm Macro f3.5	Normal	0.3 m	1 ×/1.5 × white	25 mm (1)	95 mm (3)	1 ×
50 mm f1.4, f1.8, f2	Normal	∞	1 ×/1.5 × white	25 mm (1)	108 mm (4)	1 ×
Magnified copying						
80 mm Macro	Normal	—	1.5 × orange	25 mm (1)	192 mm (5)	1.5 ×
50 mm Macro f3.5	Reversed (retro)	0.23 m	1 ×/1.5 × white	0 mm (6)	120 mm (7)	1.5 ×
50 mm Macro f3.5	Normal	0.23 m	1 ×/1.5 × white	25 mm (1)	108–110 mm (4)	1.5 ×
50 mm* f1.4, f1.8	Reversed (retro)	∞	1 ×/1.5 × white	0 mm (6)	88 mm	1.5 ×
80 mm Macro	Normal	—	forward of 1.5 × orange	25 mm (1)	230 mm (8)	2 ×
38 mm Macro	Normal (on PM-MTob)	—	1 ×/1.5 × white	0 mm (6)	80 mm	2 ×
50 mm*	Reversed (retro)	0.23 m	1 ×/1.5 × white	0 mm (6)	145 mm	2 ×
80 mm Macro	Normal	—	forward of 1.5 × orange	0 mm (6)	230 mm (8)	2.3 ×
38 mm** Macro	Normal (on PM-MTob)	—	1 ×/1.5 × white	0 mm (6)	115 mm** (7)	3 ×
50 mm Macro	Reversed (retro)	0.3 m	1 ×/1.5 × white	0 mm (6)	230 mm (8)	3.6 ×

* Lens needs stopping down to at least f8

** Still higher magnifications possible with increased bellows extension but unlikely to be needed

Positions of lens standard and camera standard on the bellows rail and the alignment of the latter against appropriate marks on the slide copier panel, as a starting point in setting up the slide copier for same-size or enlarged reproduction. The magnification is determined by the bellows extension (distance from front of lens standard to rear of camera standard) and by the lens. Alignments of front rail are approximate, preparatory to fine focusing. Combinations marked with (*) yield even overall sharpness only with the lens stopped down to at least f8 or even f11; with other combinations stop down to f5.6.

Enlarged reproduction figures here go beyond the combinations described in the text (Chapt. *Small-scale close-up equipment*).

Lenses are listed in each magnification range in descending order of preference and close-up image quality. Intermediate positions yield intermediate magnifications.

Numbered notes refer to locations of standards on *bellows rail*:

(1) Orange/white line mark. (2) Orange 1 × mark. (3) Bellows fully compressed. (4) White 1 × mark. (5) Orange 1.5 × mark. (6) Extreme front of bellows rail. (7) Near white 1.5 × mark. (8) Extreme rear of bellows rail.

PMT-35 SETTINGS

Lens	Magnif.	Coarse adjustment of		
		Object stage (1)	Lens standard (2)	Illuminator lamp (3)
Transillumination				
80 mm	3× to 0.9×	Up	Down	Slightly out
	0.75×	Down	Down (4)	Slightly out
	0.5×	Down	Down (5)	In
	0.37×	Down	Up (5)	In
38 mm	8× to 2.9×	Down	Down	In
	2.9× to 1.9×	Down	Down (5)	In
20 mm	16× to 6.2×	Down	Down	In
	6.2× to 4.8×	Down	Down (5)	In
Shadowless lighting with Lieberkühn reflector (no suppl. condenser)				
38 mm	8× to 2.9×	Down	Down	Slightly out
20 mm	16× to 6.2×	Down	Down	Slightly out

Coarse adjustments as initial settings of the object stage and lens standard plus preliminary lamp socket adjustment on the PMT-35 macrophotography unit. The 'down' position of the object stage is the stage rail on the PM-DL 95 illuminator fully lowered on its dovetail guide. The 'up' position has the stage dovetail rail raised in its dovetail holder as far as it will go without unscrewing the stop pin. In both cases the rack-and-pinion fine focusing adjustment of the stage along the rail covers all object positions within the magnification range indicated.

The lens standard is nearly always located at the bottom end of the bellows rail ('down'); the 'up' position implies that the lens standard is raised to the top of its 70 mm long rack. The magnification scale on the bellows rail for the camera standard is in this case not valid. At the lowest magnifications with each lens a sufficiently short bellows extension is only obtainable by removing the leaf shutter at the rear of the lens standard. To retain leaf shutter use in these ranges preferably switch to a longer-focus macro lens.

The lamp socket is normally fully pushed home in the lamphouse; in the cases indicated, pulling the socket out by about 5 mm improves evenness of illumination.

The data for shadowless lighting with the Lieberkühn reflector apply to the supplementary condenser (for 20 and 38 mm macro lens) *removed* from the main condenser.

Numbered notes:

(1) Refers to position of stage rail in front dovetail holder.

(2) Refers to position of lens standard on lower section of bellows rail.

(3) 'Slightly out' means pulling lamp socket about 5 mm out of lamp housing.

(4) Lowest magnification obtainable with shutter in position.

(5) With shutter removed. (With 20 mm and 38 mm lens in this magnification range switch to 38 or 80 mm respectively.)

MAGNIFICATIONS AND SUBJECT FIELDS

Scale of reproduction	Subject field on 24 × 36 mm film	
	mm	inches
0.1× (1:10)	240 × 360	9.45 × 14.2
0.2× (1:5)	120 × 180	4.7 × 7.1
0.3× (1:3.3)	80 × 120	3.15 × 4.7
0.4× (1:2.5)	60 × 90	2.35 × 3.5
0.5× (1:2)	48 × 72	1.9 × 2.8
0.6× (1:1.67)	40 × 60	1.57 × 2.36
0.7× (1:1.4)	34 × 51	1.35 × 2.02
0.8× (1:1.25)	30 × 45	1.18 × 1.77
0.9× (1:1.1)	26 × 40	1.05 × 1.57
1×	24 × 36	0.94 × 1.42
1.5×	16 × 24	0.63 × 0.94
2×	12 × 18	0.47 × 0.71
2.5×	9.6 × 14.4	0.38 × 0.57
3×	8.0 × 12.0	0.31 × 0.47
3.5×	6.8 × 10.3	0.27 × 0.40
4×	6.0 × 9.0	0.24 × 0.35
4.5×	5.3 × 8.0	0.21 × 0.31
5×	4.8 × 7.2	0.19 × 0.28
6×	4.0 × 6.0	0.16 × 0.24
7×	3.4 × 5.1	0.13 × 0.20
8×	3.0 × 4.5	0.12 × 0.18
10×	2.4 × 3.6	0.09 × 0.14
12×	2.0 × 3.0	0.08 × 0.12
14×	1.7 × 2.5	0.07 × 0.10
16×	1.5 × 2.25	0.06 × 0.09

Size of subject field taken in at different scales of reproduction in close-up macrophotography. The subject fields are based on the full 24 × 36 mm frame recorded on the film; the field on the focusing screen is smaller. Subject fields at intermediate magnifications are proportional. Thus at 0.25× magnification the field would be 96 × 144 mm (or 10 times the field at 2.5×).

CLOSE-UP DEPTH OF FIELD

Magnification	Limiting aperture	Total depth of field (mm) at					
		f3.5-4	f5.6	f8	f11	f16	f22
0.1×	—	27	41	59	81	117	162
0.2×	—	7.5	11.1	16	22	32	44
0.3×	—	3.6	5.3	7.6	10.5	15	21
0.4×	—	2.2	3.2	4.6	6.4	9.2	13
0.5×	f22	1.5	2.2	3.2	4.4	6.3	8.7
0.6×	f22	1.1	1.6	2.3	3.2	4.7	6.5
0.7×	f22	0.87	1.3	1.8	2.5	3.7	5.0
0.8×	f22	0.71	1.0	1.5	2.0	3.0	4.1
0.9×	f16	0.59	0.87	1.2	1.7	2.5	3.4*
1×	f16	0.50	0.74	1.1	1.5	2.1	2.9*
1.5×	f11	0.28	0.41	0.59	0.81	1.2*	1.6*
2×	f11	0.19	0.28	0.40	0.55	0.79*	1.1*
2.5×	f11	0.14	0.21	0.30	0.41	0.59*	—
3×	f8	0.11	0.16	0.23	0.32*	0.47*	—
3.5×	f8	0.092	0.14	0.19	0.27*	0.39*	—
4×	f8	0.078	0.12	0.17	0.23*	—	—
4.5×	f5.6	0.068	0.10	0.14*	0.20*	—	—
5×	f5.6	0.060	0.089	0.13*	—	—	—
6×	f5.6	0.050	0.072	0.10*	—	—	—
7×	f4	0.041	0.060*	0.086*	—	—	—
8×	f4	0.035	0.052*	—	—	—	—
10×	f3.5	0.028	0.040*	—	—	—	—
12×	f3.5	0.023*	0.033*	—	—	—	—
14×	f3.5	0.019*	—	—	—	—	—
16×	f3.5	0.017*	—	—	—	—	—

In the close-up and macro ranges, depth of field rapidly decreases and also becomes dependent only on the scale of reproduction.

In addition to listing the theoretically available depth of field at different magnifications and apertures, the table shows the limiting aperture beyond which the lens should not be stopped down at higher magnifications. Otherwise diffraction effects lead to increased unsharpness that masks any gain in depth of field.

The depth values marked (*) indicate depth that would be available in the absence of diffraction; in practice at these limiting settings depth of field is somewhat greater but the standard of sharpness is also inevitably reduced. Where no depth values are given, the lens should not be stopped down to that aperture at the magnification in question.

The values for the limiting aperture and total depth of field are based on an approximate sharpness standard of a 0.03 mm circle of confusion.

LAMP FILTER TYPES AND DESIGNATIONS

<i>Filter type</i>	<i>45 mm round unmounted (glass)</i>	<i>45 mm round mounted (interference)</i>	<i>45 × 60 mm rectangular unmounted (glass)</i>
Monochromatic			
Yellow	45 Y-48	—	60 × 45 Y-48
Green	45 G-53	—	60 × 45 G-53
Heat filter (cobalt glass)	—	—	60 × 45 B-76
Diffuser	—	—	60 × 45 WF
Colour temperature compensating	45 LB-45 45 LB-100 45 LB-200	— — —	60 × 45 LB-45 60 × 45 LB-100 60 × 45 LB-200
Neutral density	— — —	43 LBD W-45 43 ND-6 43 ND-12 43 ND-50	— — — —

In conjunction with the LSD and PM-DL 95 micro spotlights the lamp filters modify the light quality and intensity. The monochromatic filters are used primarily as contrast filters in photomicrography and macrophotography, the colour temperature compensating and neutral density filters for colour temperature and intensity control in colour photography. The 45 × 60 mm rectangular filters fit the LSD illuminator, the other filters fit the LSD, PM-LSD 2 and PM-DL 95 illuminators. Colour temperature and neutral density filters can be used in combination. The LSD and LSD-2 illuminators can take two filters at the same time, the PM-DL 95 up to 4 filters.

ND FILTERS FOR MACROPHOTOGRAPHY

<i>Transmission %</i>	<i>No. of ND filters used</i>			<i>Effective total density</i>	<i>Exposure factor</i>	
	<i>ND 50</i>	<i>ND 12</i>	<i>ND 6</i>		<i>Arith.</i>	<i>EV</i>
50%	1	—	—	0.30	2×	-1
25%	2	—	—	0.60	4×	-2
12%	—	1	—	0.92	8×	-3
6%	—	—	1	1.22	16×	-4
3%	1	—	1	1.52	33×	-5
1.5%	2	—	1	1.82	66×	-6
0.72%	—	1	1	2.14	138×	-7
0.36%	1	1	1	2.44	275×	-8
0.18%	2	1	1	2.74	550×	-9

The number designation of the ND 50, ND 12 and ND 6 filters indicates their percentage transmission—used here to mark the fact that these are lamp filters to reduce the illumination of the LSD and LSD 2 illuminators or the transilluminator of the PMT-35 macro outfit.

The table indicates the transmission, effective density and exposure factors (in arithmetic values and EV) with different ND filter combinations of the PMT-35 outfit. The latter includes two ND 50 and one each ND 12 and ND 6 filters.

LAMP FILTERS FOR COLOUR TEMPERATURE CONTROL

<i>Colour temperature K</i>	<i>Lamp voltage V</i>	<i>Filters</i>	<i>Use with</i>
3200	4.5 5 6 7	LBD + LB 45 LBD LB 45 None	Tungsten type (3200K balanced) colour reversal film
3400	5 6 7.5	LBD + LB 45 LB 45 None	Type A (3400K balanced) colour reversal film
4000	6 7	2× LB 45 or LB 100 LBD	Acceptable for negative colour films
4500–5000	6 8	LB 100 2× LB 45	Negative colour film or daylight type colour reversal film (warm colours)
5500	6 7–8	LB 100 + LB 45 or LB 200 LBD + LB 45	Daylight type colour reversal film

The colour temperature of lighting in macrophotography depends on the lamp voltage of the LSD illuminator or PM-LD 95—which can be controlled by the transformer setting and may be modified also by colour temperature compensating filters. The preferred way of matching the colour temperature to the colour film type in use is by checking with the CT (colour temperature) probe of the EMM-7 exposure meter. Lacking such a meter, this table shows approximate colour temperatures obtainable by varying degrees of over-running the lamp of the micro spotlight with or without colour temperature compensating filters. The exact colour temperatures obtained may vary somewhat depending on the age of the lamp.

EMM-7 EXPOSURE SCALE FOR BELLOWS READINGS

<i>Index scale</i>	<i>Exposure time (sec)</i>		<i>Index scale</i>	<i>Exposure time (sec)</i>	
	<i>High</i>	<i>Low</i>		<i>High</i>	<i>Low</i>
1			5		
2	1/15	2	6		1/4
3	1/30	1	7	1/250	
4	1/60		8		1/8
5	1/125	1/2	9		
6		1/4	10		1/15

When the EMM-7 exposure meter cell is located in the equivalent film plane (via the PM-EA adapter) exposures are derived by reference to the innermost index scale of the meter. This table shows the actual exposures for different scale readings with the meter switched to its HIGH or LOW range. Note that many of the exposure time settings for the leaf shutter (PMT-35 or PM-PBM housing) or for the camera shutter are between numbered positions on the index scale. As often intermediate exposures are not possible, carry out the final exposure matching with the lens aperture.