

Mamiya TLR System Summary

Compiled by

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Problems?

For a collection of notes about common problems, see Section 16.

Wanted! :

Some evidence is coming to light that C330 cameras (maybe others) were made in Manaus, Brazil. It would be really interesting to know dates, which models, where they were sold, and any local variations.

Examples of the two-letter code stickers found on lenses and inside film chambers are welcome. Especially if the original purchase date is known. The initial few letters or digits of serial numbers would also be useful (1234xxx is fine, for example).

Recent history:

Changes since June 2005: More letter codes.

Changes since January 2005: Mounting hand meters to the flash shoe (Section 9.7), Section 1.14 on Brazilian Mamiyas added. Update on the 80mm'S'. Updated information on the Mamiyaflex-PF in section 1.13.

Old history:

Changes in 2004: Long-roll conversions. (Section 9.6); corrected web link in the on-line references; more letter codes; example serial number tabulation.

Changes since February 2003: Details on Seikosha-MX, -SLV, and -S shutters expanded. More information on letter codes. More information on the C33/C22 220 capability and development. Added link to C2 manual on the Web.

Changes since December 2002: Note on C330/C330f screen adjustment in section 7.1

Changes since October 2002: Revised Paramender details.

Changes since September 2002: Added Section 6.7 on crank adapters for the film advance knob on early models.

Changes since May 2002: Corrected 330s removable back details.

Changes since December 2001: Added a notice about citation and reuse.

Changes since February 2001: Changed to a more up to date version of Rich Text Format and RTFtoHTML conversion. This has changed the core file names. It has also required extensive modification to the embedded URLs. To avoid broken reference links, the old files will be converted to redirections to the new main page. Third party accessories section 9 expanded to include 'one off' modifications. Added section 9.4 on Other finders to note a custom 45 degree prism fitting. Extensive new information on Single Exposure Backs. This site has been referenced (without endorsement) on the Mamiya America web site, and in the current McBroom's Camera Blue Book. Added a note about MACO 820c infra-red film to section 2.10. Added illustration of C330s strap lug. Added link to DIY Paramender project. Included specific notes about citation in active auctions. Added comments on the anti-reflection material in the film box.

Changes since January 21st 2001: Corrected error that miss-rendered the exposure compensation table. Added new letter codes to the dating section, and provided a new tabulation.

Changes since June 2000: Which lenses **were** marked with centimetre focal lengths? More Mamiyaflex information. The sportsfinder mask PostScript program has been converted to Adobe Portable Document Format (PDF).

Changes since February 2000: Added note on lens hood mounting of oversize filters. Commenced adding an index. Another letter code to the date table. More information about the Mamiyaflex and MX series lenses. This document is now four years old!

Changes since 27th September 1999: Added link to online C330 manual (in PDF format) at Mamiya USA in section 13. Updated information on Front Element exchanges in section 11.6. An 80mm f3.7 chrome has been seen, but details are still sketchy - section 3.3. Added more detail to the Mamiyaflex entry. Added some more letter codes. Firmed up dates for the C330 variants, and broad dates for the black lens variants (section 4.0). Revised notes on lens coatings. Included note about Seiko shutter variants.

Changes since 14th August 1999: Link to a Polaroid modification example (Section 8.2). The document history has been split in the interests of legibility.

Changes since 16th April 1999: The Compiler of this document has moved to California, but the home of this document will remain a UK server for the immediate future. Do not adjust your links... Minor changes to C3, C33 and C22 concerning focus scales.

Changes since 25th February 1999: minor alterations to wording of section 7.0 (focusing screens). Added section 11.8 on flash guns. Commenced adding glossary of terms.

Changes since 20th January 1999: Note the change of email address and preferred URL.

Changes since 9th January 1999: The Depth of Field calculator code, calc1.ps, has been revised to suit PostScript document managers such as Ghostview. Note about different infinity focus bellows extension added to lenses section.

Changes since 1st January 1999: Added pictures of basic grip holder (6.2.1), metered chimney finder (6.4.5), and prism finder (6.4.8).

Changes since 11th October 1998: New URL for Jan-Jaap's Mamiya pages.

Changes since 27th September 1998: Addition of Porrofinder photograph;

Changes since 26th July 1998: Inserted missing decimal point in sportfinder aperture table (section 6.4); New web link to a Mamiya TLR review (13); Corrected a few of the mis-spellings(!); More thoughts on the dating question.

Changes since 27th June 1998: Added images of: C330 focusing scale (1.7), C330 WLF (6.4.1), C330S WLF (6.4.2), comparison view of 6 of the 7 black lenses(4), and the lens lock / focal length programming control from a C330 at (5.1).

Changes since 29th May 1998: New sub-section 2.10 on Infra-red. Amended sub-section 2.5 to include flash connection problems. Added sub-section 2.11 on causes of focus discrepancies. Added sub-section 11.7 on film advance problems. Enhanced sub-section 2.8 to include polarising and graduate filters. The distance tables have been revised to show Feet and Inches in place of the twelfths fractions. I hope I haven't missed any.

Changes since 26th April 1998: Note about C3 shutter / transport interlock. Clarification of alignment for sportsfinder masks. Comments on model variations. Comments on self-timers added. Section 1.0.x renumbered.

Changes since 1st March 1998: Updated C330s details. Revised details on 65mm black and 80S lenses. Added YashicaMat to table of comparative weights. More information on the Mirror Finder.

Changes since 6th February 1998: Minor change to CdS magnifier, explicit note on non-Polaroid capability. Various minor changes. Addition of an alternative DOF calculator link.

Changes since 20th January 1998: HTML link correction

Changes since 13th January 1998: Revised details on CdS Magnifying Hood, 80mm 'S', Black lens click-stops. Revised C2 details. 'Mirror finder' note.

Changes since 3rd October 1997: Two more lens sizes added to rear lens caps information. Finder coverage value added. Updated notes on the C330/f focusing screens. New sub-section (11.4) on front-element converters. New sub-section (11.5) on pin-hole adaptation. Updated C2 details. Revised information on exposure compensation (5).

Future plans

This document is currently located at http://www.btinternet.com/~g.a.patterson/mfaq/m_faq.html. Comments concerning this site may be addressed to the author, at G.A.Patterson@removethis.btinternet.com. (this address should be edited to remove the anti-spam component). Please include a relevant subject line, as I am inclined to delete any mail that may be malicious before reading it. I may

be obliged to move this site to a service located in the United States of America but I will endeavour to ensure that it is constantly available. I mirror this document and some additional Mamiya material at <http://webfiles.berkeley.edu/~grahamp/> . Finally, I will endeavour to make these pages locatable via my commercial site at <http://www.gapatterson.com> .

I am considering adding more illustrations, primarily of items and features that can cause confusion between models. If you feel that there is some aspect that would benefit from an illustration, please let me know.

0 Purpose

This summary is intended to provide a single reference concerning the various models of the Mamiya Twin Lens Reflex cameras. It isn't a 'Frequently Asked Questions' (FAQ) in the usual format, but it is hoped that the content will be as useful. In pursuing details of the Mamiya C-series with a view to my own purchases, I found the small variations between models confusing. This document represents my attempt to organise what I've learned to date.

Since its inception, this document has been almost universally well received. I'd like to thank those who have contributed information, however minor, and those who have sent messages of appreciation. A little encouragement helps when I have to do battle with this monster I've spawned! There have also been a number of favourable citations in Web sites and discussion forums. Again, I would like to acknowledge all these kind words.

As more information comes to light, I would expect the content, and possibly the format, to be revised. Please note that some of this information is tabulated, and will require a table-aware browser for correct formatting. The original for this web release is a Microsoft Word document of 54 US letter pages at 10pt; a total of 28217 words. The HTML mark-up is produced using RTFtoHTML, with additional customisation using AWK scripts and HTML Tidy. An Adobe Acrobat PDF file of the text is available via the link page. Currently there are 32 HTML files in the suite.

The first release of this document was in June 1996. Revised releases are normally posted for the 1st of the month, if new information is available. Since much of the system has been covered, I expect future changes to be minor and irregular.

0.1 Caveats

While the information contained in this document is provided in good faith, neither the compiler nor contributors can be responsible for the accuracy of content, nor the use that may be made of this information. If you intend purchasing equipment, you are advised to verify details with the vendor prior to purchase. This document is subject to continuing research and revision. Where possible information has been obtained from examples of the equipment, or from the primary sources cited.

References are made to commercial sources for parts and references within this document. I do not necessarily have personal experience of these organisations, and their inclusion does not constitute an endorsement.

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0.2 Contributions

Additions and corrections are welcomed. Please indicate whether the information comes from a published source, direct examination of the item, or recollection. Contributors will be cited with their express permission only.

1 Models

1.0 General points

The Mamiya Twin Lens Reflex Model C can be considered as two series of cameras spanning a production life of nearly 38 years, based on common ancestors (the fixed lens Mamiyaflex A and B). The '3' series was the 'Professional' model, while the simpler '2' series was the 'amateur' or 'budget' model. However the final models in both series bore the 'Professional' label. The difference was one of features rather than build quality. Models are listed in their order of introduction. From the C220 onwards, the body was redesigned to be slightly smaller, and increasing use was made of plastics.

Serial numbers for the bodies (for the C33 and later models at least) are located on either the front face or upper surface of the 'chin' of the lens mount. It can be hard to see with a lens mounted.

The C330 (and possibly the C330f and C330s) was also produced in an all-black finish to the bellows frame, in place of the more common chrome. It doesn't seem to be very common, but if anyone can throw more light on this topic, it would be appreciated. During the 1970's there was a trend in the 35mm single lens reflex world to produce both chrome and black cameras. The black was supposed to be the low visibility, 'professional' version. Ironically, the chrome finish wore considerably better!

Some cameras (C3s and others) appear to have had mid-grey leatherette instead of the more common black. There was a vogue for grey cameras in the 50's and early 60's, so Mamiya may well have produced some. Which models were involved, and how many were produced is unclear.

The C330 (and probably later models) have a textured surface to the inside of the camera where the film baffle is located. The C220 and earlier models have matt black paint. The actual paint does vary between camera models. In theory the textured surface should result in less internal reflections and better contrast. Since the film baffle has a covering of velvet, the bottom of this chamber is not treated to the same extent.

It is becoming clear from various reports of 'discrepancies' between the cameras detailed here and actual examples in people's possession that these cameras are subject to numerous detail differences within a particular model. While all the details given are based on inspected examples and original documentation, there may well exist still more combinations that *haven't* been included. Where possible, points of difference will be mentioned.

A pictorial guide in the form of a Mamiya system chart for the early production C330s can be found at <https://webfiles.berkeley.edu/~grahamp/mfaq/mamiyaC330systemchart.pdf>. This is a Portable Document File. There are variations between models – notably in terms of screens and single sheet backs – that are not noted in the diagram. Please refer to the text.

1.0.1 Focusing

All models use a rack and pinion focus bellows system providing around 56mm extension. The effective extension depends on the initial amount required for infinity focus with individual lenses. Note that this is a twin bellows; the viewing and taking sections are separated by an internal baffle. The distance scales apparently measure from the film plane. In the case of the C330 this lies approximately 8mm forward of the camera back. There is no reference mark.

1.0.2 Focus scale plates

The original Mamiyaflex focusing scales ([jpg/cscales.jpg](#)) were superseded on other early models up to the C33, and including the C220 and C220f, by engraved plates mounted on the bellows mounting frame. The selection of lens focal lengths on these plates does vary between models, and even between examples of the same model. Some of these plates may be a retro-fit to enable the use of later lenses.

1.0.3 Multi-exposure function

The multi-exposure control on the camera only serves to disengage the multiple exposure prevention facility and not the film advance. This allows the shutter release(s) to operate repeatedly if the shutter is cocked manually on the second and subsequent exposure. This is unlike most other cameras where the wind-on stroke cocks the shutter without moving the film.

The sequence is to expose the first frame, switch to 'Multi', manually re-cock the shutter and use the normal shutter release to make a subsequent exposure. Reset the control to Single, and advance the film in the usual manner.

It is also possible to achieve the same effect by manually tripping the lever on the shutter, but it isn't as convenient to reach as the standard shutter release.

1.0.4 Shutter idiosyncrasies

Some cameras are sensitive to 'first pressure' on the shutter release. This appears to trip the double exposure mechanism without affecting the shutter. This behaviour may reflect the wear that the body has received. There are work-arounds involving the multi-exposure control or manual triggering of the shutter, but it is best to be decisive about making the exposure.

A similar problem can arise with certain lenses that permit the shutter trip lever to move even if the lens is not cocked.

There is a 'feature' of the interlock mechanism that can cause unexpected problems. Early 120 colour film was often sold in 6 exposure lengths. This may have been due to either cost or the physical thickness of the film base and emulsion. In order to wind off the film without going through a further 6 blank frames, the shutter release is held down on the first extra frame while the film is wound off. The most likely use for this 'feature' is to allow an early film change when working with action subjects. It can be a danger, as one or two users have discovered when using a locking cable release or auxiliary timer! Also see section [11.7](#).

1.0.5 Names and Dates

The Mamiya Flex name was used for a series of fixed lens twin-lens reflex cameras built from 1948 to about 1956. These had 'A' and 'B' designations, hence the 'C' in the interchangeable lens models. Refer to the Mamiya web page (Section 13) for details. The dates of manufacture are very difficult to confirm. Some references quote the date of announcement, others the date of first availability in a particular country. Further more, older models would still be available new for a period. The basic C220/C330 design, with minor modifications, lasted some 26 of the 38 year production history.

More detail on dating of the cameras and lenses can be found in Section 2.6.

Summary of model chronology

Model	Initial year of production	Final year of production
Mamiyaflex C	1956	1958?
C2	1958	1962?
C3	1962	1965
C33	1965	1969?
C22	1966	1968?
C220	1968	1982?
C330	1969	1974
C330f	1972	1982
C220f	1982	1995
C330s	1983	1994

For the frivolously minded: the texture on the rubber covered models is a capital 'M'...

1.1 Mamiyaflex

Dates of manufacture	10/1956 or 1/1957 - 1958?
Weight (body)	
Film advance	Knob, automatic frame counting and spacing.
Shutter cocking	Manual
Shutter releases	One, right side
Parallax compensation	Scale
Exposure compensation	Scale.
120/220 capability	120 only
Lens focus scales	80, 105, 135mm
Interchangeable screens	No
WLF type	Sports finder (80mm)
Flash shoe	Yes
Removable back	Yes
Multi-exposure	Manual stop to prevent double exposure
Cable release	Appears to vary with age - some have been seen with, some without. There are reports that modern standard conical releases do not work. The fitting is in the side of the front standard, level with the shutter release arm.
Tripod screw	1/4"
Other idiosyncrasies	Original chrome 80mm, 105mm, 135mm lenses (¹ / ₄₀₀ second). Frame counter must be manually reset. Also known as the Mamiya Flex C Professional. There is a single focus knob on the right side, with a focus lock on the left. The lens retaining wire is hinged from the opposite side when compared to the C3 and later models, and the light baffle control is on the right side. The base of the camera differs from the later models in not having the flat base / tripod socket / 'chin' front. The cameras were equipped with two 'Dracula fang' type support pins, which required a special tripod adapter jpg/tripodb.jpg . (Picture courtesy Ken Kirch). There appears to have been an early paramender design for this camera.

1.2 C2

Dates of manufacture	6/1958 - 1962(?)
Weight (body)	1250
Film advance	Knob. Incorporates frame counter around knob barrel. A red window is fitted as a 'film loaded' indicator only.

Shutter cocking	Manual
Shutter releases	One, side, metal stud
Parallax compensation	Two ruled lines for use with the exposure compensation scale.
Exposure compensation	On focus scale.
120/220 capability	120 only
Lens focus scales	Left side of bellows. Examples are known with various scale combinations.
Interchangeable screens	No
WLF type	Sports finder for 80mm. Type 1?
Flash shoe	Cold, upper left side
Removable back	Yes, sheet film back option
Multi-exposure	Yes (There is a film transport lock only, no shutter interlock)
Cable release	Conical thread socket on lens panel frame, level with the shutter release arm.
Tripod screw	1/4"
Other idiosyncrasies	Introduction of second focus knob (both are chrome), addition of 65mm and 180mm lenses during life of this camera (an example of the manual lists the 80mm, 105mm, 135mm, and the 180mm, but not the 65mm). Some bodies were sold with the Seikosh-MX series lenses. Upper front label reads 'Mamiyaflex'. The lens retaining wire latches on the right side. The 'lock/unlock' control is also located on the right side. The film advance lock without shutter lock requires a consistent exposure / wind-on policy to avoid double exposures and missed frames.

1.3 C3

Dates of manufacture	9/1962 - 1965
Weight (body)	
Film advance	Crank, partial 360 degree stroke, reversed to rest, double exposure prevention (see Idiosyncrasies below)
Shutter cocking	Manual
Shutter releases	One, side, metal stud
Parallax compensation	Scale in finder used in conjunction with exposure compensation scale.
Exposure compensation	Scale on left side of bellows.
120/220 capability	120
Lens focus scales	65mm, 80mm, 105mm (chrome), 135mm, 180mm. A retrofit to accept the 55mm and 250mm lenses was available. This includes the 65mm and 80mm scales not found on the equivalent C33 update.
Interchangeable screens	No
WLF type	Type 1, 80mm aperture only, uses masks for 65mm, 105mm, 135mm, 180mm, and 250mm
Flash shoe	Upper left side, cold.
Removable back	Yes, sheet film option. Same mechanism as C33.
Multi-exposure	Yes
Cable release	Conical thread socket on lens panel frame
Tripod screw	1/4"
Other idiosyncrasies	Lenses upgraded to 1/500 second. Introduction of auto-zeroing frame counter. Textured rubber finish. Two-stage lens release. (See section 2.3). Both black and chrome focus knobs appear to have been used. The film transport interlock appears to require the complete travel of the shutter release to clear. At least one example is known with an aluminium 'chin' below the lens mount in place of the usual black crackle finish.

1.4 C33

Dates of manufacture	4/1965 - 1969?
Weight (body)	1810
Film advance	Crank, partial 360 degree, reverse to rest
Shutter cocking	Automatic
Shutter releases	Single, side mounted
Parallax compensation	Automatic for 80, 105, 135, and 180mm
Exposure compensation	As parallax compensation
120/220 capability	120 only. See 1.12 C33 modifications for 220 conversion.
Lens focus scales	65mm and 80mm in window on right side, 105mm (chrome), 135mm, 180mm on

	plates fitted to the lens rack on the left side. 1968 and later models may have additional scales for the 55mm and 250mm. A retrofit to accept the 55mm and 250mm lenses was available which differs from the C3/C22 version by not having 65mm and 80mm scales. These are handled by a moving scale in the camera body.
Interchangeable screens	No.
WLF type	Type 1
Flash shoe	Cold, upper left side
Removable back	Yes, sheet film option, two sprung pin latches, as C3
Multi-exposure	Yes
Cable release	Conical thread socket on lens panel frame
Tripod screw	1/4"
Other idiosyncrasies	Textured rubber covering, change to black focus knobs. The crank should be reverse wound back to the rest position after each frame advance (Compare with C330 models). Evidence from a Mamiya repair manual for the C33 shows that this camera was under aggressive development during 1965/1966. There are a number of detail differences internally. 120-only versions have the film start mark at the upper left of the film gate (as with the C3 and earlier models). 220 versions have the mark at the lower left side.

1.5 C22

Dates of manufacture	3/1966 - 1968 (?)
Weight (body)	1480
Film advance	Knob with optional accessory crank, double exposure prevention
Shutter cocking	Manual
Shutter releases	Single, side mounted
Parallax compensation	Scale
Exposure compensation	Scale
120/220 capability	Optional 220 back (as C33 1.12) for most cameras without modification
Lens focus scales	Main scale on left side of focus rack. Expanded scale for 65mm and 80mm on right side of focus rack. A retrofit to accept the 55mm and 250mm lenses was available. This includes the 65mm and 80mm scale not seen on the C33 version.
Interchangeable screens	No
WLF type	Type 1, single flap.
Flash shoe	Cold, left side of body
Removable back	Yes
Multi-exposure	Only by direct manipulation of the shutter
Cable release	Yes, top right of lens panel frame
Tripod screw	1/4" ?
Other idiosyncrasies	Textured rubber covering. Accepts the first model of sheet film back. Some of the earliest C22 cameras were not 220-capable – probably items made prior to March 1966. 120-only versions have the film start mark at the upper left of the film gate (as with the C3 and earlier models). 220 versions have the mark at the lower left side.

1.6 C220

Dates of manufacture	4/1968 - ?
Weight (body)	1150
Film advance	Knob, with fold-out crank
Shutter cocking	Manual
Shutter releases	Single, side, plastic tab, not lockable
Parallax compensation	Via focus scale / exposure compensation scale and two reference lines on focusing screen
Exposure compensation	Scale (55-65mm, 80mm, 105-135mm, 180-250mm)
120/220 capability	Yes; rotating pressure plate and manual setting of frame counter range
Lens focus scales	55, 65, 80, 105, 135, 180, 250mm. Some examples have both 105mm scales.
Interchangeable screens	No
WLF type	Type 1 (220 form, with 80mm sportfinder)
Flash shoe	Cold, when present. Not all bodies were so equipped.
Removable back	No

Multi-exposure	Yes
Cable release	Conical thread socket on lens panel frame
Tripod screw	$\frac{1}{4}$ "
Other idiosyncrasies	55mm and 250mm lenses introduced, textured rubber covering, automatic film counter reset. May have been sold with the 80mm f3.7. The pressure plate and the frame counter must be set when changing between 120 and 220 film. Camera interior is smooth matt black. See ./c220/c220.html

1.7 C330

Dates of manufacture	10/1969 - 1974
Weight (body)	1465
Film advance	Crank, single 360 degree clockwise action
Shutter cocking	Automatic
Shutter releases	Two, side (plastic tab) and chin, lockable
Parallax compensation	Automatic, all lenses (if 55/65mm correction plate employed)
Exposure compensation	As parallax compensation
120/220 capability	Both, rotating pressure plate, frame counter configured automatically
Lens focus scales	Hexagonal rod on left side, manually adjustable for focal length, not suitable for 105mm D lenses. Short lenses are read via window in the body, longer lenses read against the front edge of the body. Rod is user interchangeable according to manual. The rod mounting at the front of the camera has a removable (read: frequently lost) black plastic cover. This C330 scale (jpg/330scale.jpg) is missing the plastic cover. It is set for the 105mm lens, with the focus at about 5 feet. See ./c330/c330.html
Interchangeable screens	Yes. Matte, 4 degree split, 6 degree split, microprism, cross hair, grid
WLF type	Type 1
Flash shoe	Cold, upper left side
Removable back	Yes, sheet film option, different fitting from C33
Multi-exposure	Yes
Cable release	Chin release provided with conical thread
Tripod screw	$\frac{3}{8}$ " with insert for $\frac{1}{4}$ ". Note that there is supposed to be a small inner locking screw, but it is often missing.
Other idiosyncrasies	No focus lock. Film speed reminder dial includes tungsten, daylight, and B/W flag. Early versions may have the focus screen screwed in place, as with the C33. Leatherette finish. A few C330 bodies were produced in black anodised finish in place of the chrome on the lens board frame. Camera interior is hexagonal textured finish.

1.8 C330f

Dates of manufacture	1972 - 1982 (Yes, this does overlap with the C330 – information from Mamiya America)
Weight (body)	1390
Film advance	Single 360 degree clockwise stroke
Shutter cocking	Part of film advance stroke
Shutter releases	Two, Side (plastic tab) and chin. The side release incorporates a lock operating on both releases.
Parallax compensation	Automatic, all lenses (if 55/65mm correction plate employed)
Exposure compensation	As parallax compensation
120/220 capability	Yes, rotating pressure plate
Lens focus scales	Hexagonal rod, manually adjusted scales.
Interchangeable screens	Yes
WLF type	Type 2
Flash shoe	Side, cold
Removable back	Yes
Multi-exposure	Yes
Cable release	Yes
Tripod screw	$\frac{3}{8}$ " with insert for $\frac{1}{4}$ ". Note that there is supposed to be a small inner locking screw, but it is often missing.
Other idiosyncrasies	Focus knob lock, textured leatherette finish. Film tab holder introduced, which incorporates the 120/220 setting window. Some models had black side panel rims, and

	black rims on the film spool retainers.
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1.9 C220f

Dates of manufacture	3/1982 - 1995 (Rarely seen new as late as '95 - take this as the official end of manufacture)
Weight (body)	1150
Film advance	Knob without fold-out crank. The knob is larger than that fitted to the C220.
Shutter cocking	Manual
Shutter releases	Single, side (plastic tab)
Parallax compensation	From viewing screen marks via focus scale
Exposure compensation	Scale (separate for each focal length)
120/220 capability	Yes, rotating pressure plate, automatic frame counter adjustment
Lens focus scales	Chart
Interchangeable screens	No
WLF type	Type 2, but without sportfinder (Mamiya code H3)
Flash shoe	Cold, upper left side
Removable back	No
Multi-exposure	Yes, control is concentric with winding knob
Cable release	Conical thread socket on lens panel frame
Tripod screw	Presumed to be 1/4" only.
Other idiosyncrasies	Textured leatherette finish. Back release is by pushing in the take-up spool knob after operating the sliding lock. Lens lock control uses engraved 'Lock' and 'Unlock' positions rather than the window used in earlier models. Strap mounts may be lugs in place of slots. Film reminder holder on back.

1.10 C330s

Dates of manufacture	10/1983 - 1/1994
Weight (body)	1340 (estimated, manual states 1650 including 80mm f2.8)
Film advance	Crank
Shutter cocking	Automatic
Shutter releases	Two, side (plastic tab) and chin. Shutter lock on body.
Parallax compensation	In viewing screen according to focal length set. Applies to all lenses (if 55/65mm correction plate employed).
Exposure compensation	As parallax compensation
120/220 capability	Yes, rotating pressure plate
Lens focus scales	Hexagonal rod, manually adjusted scales. Should have both 105mm scales. Both feet and metre scales were available, and are user-replaceable according to the C330s manual. Side window for viewing scales for 55, 65, 80mm lenses.
Interchangeable screens	Yes, Matte, Matte (wide angle) 4 degree split, 6 degree split, microprism, Cross hair, microprism / split, grid. Not compatible with 330 and 330f screens.
WLF type	2, sports finder with interchangeable masks for 105, 135, 180, 250mm
Flash shoe	Cold, upper left side
Removable back	Yes. No compatible alternatives are known.
Multi-exposure	Yes; control surrounds the crank mounting
Cable release	Conical thread socket on chin release
Tripod screw	1/4" only
Other idiosyncrasies	Textured leatherette finish. The rear door latch is attached to the body, not the back, with separate lock and release catches (the catch is the upper spool retaining knob). Film tab holder. Focus lock. Film transport is reputed to be modified over earlier models. jpg/c330slug.jpg Some, if not all, have a stud strap mount, rather than the slot used with earlier models. This is similar to the strap lugs on Mamiya RB cameras, and aftermarket straps for that camera may be suitable. Different font and use of lower case on 'Mamiya' title. The focusing knobs are larger than previously, and the focus adapter does not fit.

1.11 C220s

Doesn't exist...unless you know different?

1.12 C33 Modifications

A 220 back for the C33/C22 is known. The only example of a C33 with 220 back that the compiler of this document has examined appeared to be a factory modification with a second frame counter pressure tab. This tab was located beneath an extra cut-away on the upper right rear of the camera body, and a stud was provided on the 220 back to operate it. This has been borne out by examination of a separate 220 back, several 120 capable C33's, and a C33 manual. This illustration of C33 with 220 back ([jpg/c33-220.jpg](http://www.mamiya.com/c33-220.jpg)) (courtesy of Seth Kantowitz, New Haven CT. USA) shows the stud and the cut-away at the upper right of the back. The C33 manual states that bodies with serial numbers with an 'H' prefix are 220 capable, but others will require modification. This is not the whole story, since at least one 'H' serial C33 has been seen which cannot physically accept a 220 back without external modification, even if the internal modifications have been made. A C33 repair manual indicates that there was considerable development of the C33, with many variations in the internal parts, including the film advance mechanism. More use was made of rivets in place of screws, and the gears were made heavier. So it is possible to have C33s with the extended film counter, but no method of using it, or C33s with the modified side panel with the cut-away but no enhanced film advance.

120-only versions have the film start mark at the upper left of the film gate (as with the C3 and earlier models). 220 versions have the mark at the lower left side.

Since the C22 was issued contemporaneously with the C33 modification, it is *probable* that most C22s were able to use the longer film. Information from a C33 repair manual suggests that very early C22 cameras did not have 220 capability when manufactured. 220 film became available late 1965 and early 1966. This coincides with the introduction of the C22. It is also probable that C33s with 220 capability were of 1966 and later vintage. However, this was a retro-fit option, and cannot be used as a reliable guide.

1.13 Mamiya Flex PF

The Mamiya America web site lists the Mamiya-PF as a custom model for the Japanese police, and dates it to 1962. It also implies that it was fitted with a 105mm lens which is at odds with the example used to compile the following notes. The nameplate reads 'MAMIYA-PF'. It does not appear to have been made for the export market.

This camera appears to be based on the C2 body (twin chrome focus knobs). At least one example came fitted with an 8cm Mamiya Sekor lens pair in a Seikosha-MX shutter. The body has two focus scales. On the left side is the usual horizontal scale with the exposure compensation/parallax guide. This is marked for the 80mm lens only, in feet, with some Kanji lettering. On the right side below the shutter release on the bellows frame is an angled scale for the 80mm, this time in metres. The design of this scale is possibly unique to this camera. Certainly it does not appear widely used on exported models. The horizontal scale is colour coded at 2' (blue) and 10' (red). This could have been to assist users in standardised picture arrangements, but without details of the exact use made of these cameras ('mug' shots, crime scene, evidence documentation), it is just speculation. The lock/unlock control is labelled with Kanji.

1.14 Brazilian Mamiyas

There were Mamiya twin-lens cameras manufactured in Manaus (northern Brazil) during the 1970's. The C330f was definitely made, but information is very sparse on lenses and variations. The cameras have a modified 'chin' plate that reads "Professional f, Sonora Industrial S/A, Ind. Brasileira". Brazil had strong trade protections at that time, and local assembly or manufacture would have been attractive. There is no information on whether these cameras were distributed outside Brazil.

2 Lenses, General

2.1 Fittings

As a broad generality, all lenses will fit all bodies. But early bodies will not have focus, parallax, and exposure compensation scales for the focal lengths introduced later. The original 1/400th Seikosha-MX shuttered lenses and some Seikosha-S shuttered 180mm lenses will not fit C33 and later auto-cocking bodies. The problem with the MX series is that the lens cocking arm is located higher than on the later lenses, and the auto-cocking lever will not engage. It also fouls the lens lever for manual cocking..

Some lenses are known to fail to cock properly on later bodies. This appears to be due to the auto-cocking lever not moving the lens cocking lever quite far enough. At least one case has been recorded of the body cocking arm needing more travel than the lens shutter arm permits.

Lenses of different focal length have different back focus distances. In practice this means that the bellows extension required for infinity focus is different. This is common with bellows focusing systems, and does have the benefit of giving the optical designer more freedom.

2.2 Lens hoods

The lens hood diameter refers to the square clamp-fit Mamiya hoods. They will only fit over slimline filters. Conventional screw-fit hoods of suitable dimensions may be used in the filter thread. The Mamiya hoods are of two basic designs. The first design, used for the 55mm, 65mm, 180mm, and 250mm were square with the upper flap hinged at the front. This permitted the angle of the top flap to be set so that glare from the top of the hood was invisible in the finder. The hoods for the 80mm, 105mm, and 135mm lenses were of a circular changing to square aperture rigid type. The 80mm and 105mm chrome lenses used 42mm hoods, the 80mm and 105mm black, and both 135mm lenses used the 48mm hood. All the 180mm and the 250mm lenses used the same hood. These hoods are generally metal. There is also a telephoto lens hood for the chrome series that consists of two rigid square shades in a single plastic unit. (*Compiler's Note: This item is huge!*)

2.3 Optical design

There was a change in physical and optical design between the chrome and black series lenses. One known effect is that the 105mm D and DS lenses have a different back focus from the 105mm chrome and the early 105mm black. This means that the scale on the C330 and earlier bodies is incorrect for the later lenses. The C330s (and probably most C330f) have scales for both 105mm lenses. It should also be noted that earlier bodies do not have scales for the focal lengths introduced later. The lenses will function, however. The 180mm (black) and 180mm Super (black) are different optical designs, but appear to share the same back focus.

2.4 Lens coating

This is a contentious issue, probably stemming from a lack of understanding of lens coating in general. Lens coating has been common since the Second World War, initially as general single coating, then as single coating tailored to individual lens performance, and most recently coating of internal elements and multiple coating for optimum corrections. Coating is used to reduce reflection from the surface that contributes to flare and lack of contrast. It also helps compensate for minor variations in glass batches, and in multi-coating the performance over a range of wavelengths is made more consistent.

The chrome lenses were single coated, and the black series had single coatings which may have extended to various lens elements. Some late black series lenses have had multi-coating, but there is a lack of substantive evidence as to when it was introduced, and on which lenses. The 55mm, 80mm S, 105mm DS, and 180mm Super are the most likely candidates, as these were later or more extreme designs.

Even the best of these lenses won't have the class of coatings that appeared in the 1990's.

2.5 Shutters and flash synchronisation

The original chrome lenses were fitted with shutters having a maximum speed of 1/400 second (Seikosha-MX). Later chrome lenses were improved to a 1/500 second top speed, giving a conventional range from 1 second to 1/500, plus B (Seikosha-S). The changeover seems to have occurred during the production life of the C2. The final black series lenses used a Seiko shutter with 1 second to 1/500th second plus B settings. Some shutters exhibit a leaf with a raised tip. This 'anti-crash' feature is intended to reduce the chance of the shutter blades locking when closing. It usually indicates a newer shutter, often with a blue insert in the shutter cocking arm. The 80mm f3.7 black lens had a Copal shutter. At least one Seikosha-MX shuttered 80mm lens was labelled 'f=8cm'.

The lenses all have integral leaf shutters, providing X and M synchronisation at all speeds. Connection is via a standard 3mm co-axial PC cord on each lens. Lenses which have been in professional hands sometimes have the flash synchronisation levers fixed in the 'X' setting. This is usually achieved by cementing a small stop to the lens barrel. Obviously the inadvertent shift to 'M' with electronic flash had happened once too often! There is around 200 milliseconds delay between releasing the shutter (and closing the flash contacts) and the shutter opening on the 'M' setting. This delay was to allow flash bulbs time to reach full illumination. Since the delay is a mechanical process, and the M setting is rarely used, longer delays are quite common and the shutter may stick.

The PC connection on most lenses consists of a hollow stud. The centre hole is one side of the flash contact, and connects to a wire running to the shutter assembly. The outer portion of the stud is the other contact, and connects to the lens mounting through its mounting screws. Intermittent flash problems may be caused by the mounting or wire becoming loose. This can be tested using a resistance (Ohm) meter. [*A resistance meter applies a negligible current and voltage across its probes. Higher voltages or currents may result in damage.*] Set the lens to a slow speed (say 1 second), and cock it. Insert the PC cord, and hold the resistance meter probes to the terminals at the other end of the cord. When the shutter is fired, the meter will register if the flash circuit is made. A slow speed is necessary to be sure the meter has time to react.

Some later lenses, such as the 105mm DS, have a shrouded PC socket that appears less vulnerable to accidental damage or loosening.

At the risk of stating the obvious, these shutters work in fixed steps. Intermediate speeds should not be set. Intermediate apertures can be set.

The most frequent sign of damage with lenses is a dented filter ring. The lens locking wire can scratch the top of the viewing lens barrel.

Weights, where quoted, may include front and rear caps.

2.6 Dating lenses (and bodies and accessories)

Mamiya claim not to have any dating information based on serial numbers.

It has been suggested that lenses can be dated (for black models at least) by the gold two-letter stickers that sometimes survive. These are not the 'JCxxx' series stickers that are found on all new Japanese exported equipment. The two-letter stickers do not appear to have been used on chrome series lenses. New information suggests that letter code series apply to individual items. So code 'AA' would mean a different year/month on a C330 and a C220, for example. Since this equipment isn't new, the amount of wear and tear is probably more important than chronological age so far as practical use is concerned. For the curious:

Example two-letter codes carried by black series lenses, cameras, and accessories

Item	Codes	Body / lens serial prefixes	Production (see note)
C330s	KH	None, or 'I', W	
C330f	BC, GC, GJ, ID, EK, FA	D, none	FA=0107xxx BC=D150xxx D140xxx
C220f	BD, BE, CD	W	
C330	AA, AG, BG, BJ, CC, JK, JB (1982) (sticker inside film chamber), IL, IK	D	JB=Late? 1974/5 serials=D457xx & D267xx, BJ D635xx, AG=?47xxx, CC=0718xx,70's
C220	HK, DG, DI, HF	B	HF=B964xx
C33	EI, EK, FA, FC, GC, GF, GJ	H (some with R suffix)	FA seen in body purchased c. May 1966 FC=261xxx
C22 (220 capable)	DI, DK	None known	Probably 1966 or later
Pentaprism	BL, DI, IJ, CL		
CdS Magnifying Hood	AH, AE		
CdS Porrofinder	GC		
55mm	AA (round), AG, AI, AK, FH, DC, DH, DL, IK, JA, CA, CF, CH, CI, CL, CK, ED, EG, HB, GE, HC, EK, FD, JE, JF, JK (round)	501xx, 519xx	FH=Late, CF=1985, AA=439xx, AK=1974/5? serials 501xx & 519xx, CI=non-blue (early 80's) DH=non-blue 735xx, JA=355xx, CA=non-blue,103xxx CK=66xxx, JK=422xx,425xx JE=377xx,378xx, no insert, no click stops, CH=634xx,631xx FD=803xx,805xx
65mm	AI, BG, BI, CA, CF, CK, EA, EC, JG, HC, HI, ?K, DJ, FF	57892xx	BG=57892xx, FF=not blue, has click-stops, AI=5789xxx
80mm	AC, AD, AI, BC, BD, BF, BJ, BK, JL, EB, EL, FD, HA, HI, ID, IE, JE, FC, DB, DC, DI, CB, CE, CH, CI, CF, IF, II, GI	7524xx, 6613xx 6605xx	AC=943000,late BC=105xx, BD=121xx, BF=Middle, AI=Late, JL Unexamined, AD=1969, EL=Late, CE=7524xx, 80mm 1974/5? serials=6605xx & 6613xx, HI (9200xx), CB=blue

			insert, CI=blue insert, JE=662xxx,663xxx, DB=778xxx,779xxx, BJ=733xxx, CB=7465xx,7445xx FD=827xxx,806xxx, GI=862xxx
80mm 'S'	BE, BF, BH, CH, DA, HI, IA (on C220f), IB		Unexamined
105mm	DA		Unexamined
105mm D	CD,CG, BF, CI, IK		CD=plain insert,Late
105mm DS	AE, CJ, EC, JF, JK		AE=Late
135mm	AL, FC, FF, IJ, CD, CH, CI, BG, IG, JA, JE, DA, ED, EF, EH, HG, JJ, JL (round), BI (or J) round	6253xx	FF= Late, IJ=1982, Late?, BG=1972, AL=1974/5? Serials 6253xx, FC=blue insert, ED 6476xx, EF=Blue insert, IG=661xxx, CD=blue insert, CI=6365xx,6364xx,blue insert, HG=6595xx,6599xx,blue
180mm	IJ		IJ=112xxx
180mm Super	AF, AG, AJ, AL, IA, BF, IB, CB, CG, JJ, EA, EF, FC, CI, GD, HB,HH, DE, DK	267xx	IA=Late, DK – no blue insert on shutter cocking lever, AG=267xx, CG=no blue insert, AJ=299xx, HH=655xx, AL=305xx296xx, HB=620xx, DE=511xx EA=53xxx
250mm	CG, DH, HC, HE, IF, JF		CG=Middle, DH, JF and HC Unexamined, HE no blue shutter insert, IF=218xx & 213xx

The Chrome series lenses do not appear to have carried two letter codes.

The BG C330 and the BF 80mm are believed to be the pairing as originally sold.

The FA in the C33 is known to be no later than May 1966.

The DI C22 is 1966 or later.

Using the barrel focal length marking and aperture click stop as a guide (see section 4) gives the 'Early', 'Middle' (1970's), and 'Late' (1980's) production groupings for the black lenses.

The current known ranges are: First letter A – L, Second letter A – L.

For comparison: An early Mamiya 6 rangefinder has a body tag of 'II'.

Tabulation of example serial numbers

Item	Serial
135mm	6253xx
135mm	6364xx
135mm	6365xx
135mm	6476xx
135mm	6595xx
135mm	6599xx
135mm	661xxx
180mm	112xxx
180mm Super	267xx
180mm Super	296xx
180mm Super	299xx

180mm Super	305xx
180mm Super	511xx
180mm Super	532xx
180mm Super	535xx
180mm Super	564xx
180mm Super	620xx
180mm Super	655xx
105mm D	241xx
250mm	213xx
250mm	218xx
55mm	103xx
55mm	355xx
55mm	377xx
55mm	378xx
55mm	422xx
55mm	425xx
55mm	439xx
55mm	501xx
55mm	519xx
55mm	631xx
55mm	634xx
55mm	66xxx
55mm	735xx
55mm	803xx
55mm	805xx
65mm	57892xx
65mm	5789xxx
80mm	105xx
80mm	121xx
80mm	6605xx
80mm	6613xx
80mm	662xxx
80mm	663xxx
80mm	733xxx
80mm	7445xx
80mm	7465xx
80mm	7524xx
80mm	778xxx
80mm	779xxx
80mm	806xxx
80mm	827xxx
80mm	862xxx
80mm	9200xx
80mm	943xxx
80mm	949xxx
80mm	950xxx
C33	261xxx
C220	B964xx
C330	D267xx
C330	D457xx
C330	D47xxx
C330	D635xx
C330	D718xx
C330f	D140xxx
C330f	D150xxx
C330s	W1124xx

Although there are some exceptions, which may be due to inaccurate or sparse data, it appears that serial number sequences were issued by item type. It is reasonable to expect that numbers were issued sequentially within a block, though there is no evidence to support this supposition. There are 5, 6, and 7 digit numbers, as well as letter prefixes for bodies. Since the letter prefix used on the C33 was 'H', even those are not in chronological sequence.

Tabulation of known letter codes and equipment (all lenses cited are black series)

Code	Bodies						Finders				Black series lenses									
	C330 s	C330 f	C330	C220	C33	C22	Pent. Prism	Porro finder	CdS Porro	CdS Hood	55	65	80	80 S	105	105 D	105 DS	135	180 Supe r	250
AA			*							*										
AC													*							
AD													*							
AE									*							*				
AF																			*	
AG			*							*					*					
AH									*	*										
AI											*		*							
AJ																			*	
AK										*										
AL																	*		*	

Code	Bodies						Finders				Black series lenses									
	C330 s	C330 f	C330	C220	C33	C22	Pent. Prism	Porro finder	CdS Porro	CdS Hood	55	65	80	80 S	105	105 D	105 DS	135	180 Supe r	250
BA																				
BB																				
BC		*											*							
BD													*							
BE													*							
BF													*	*	*				*	
BG			*										*	*	*			*		
BH	*												*	*	*			*		
BI												*						*		
BJ			*										*							
BK													*							
BL							*						*							

Code	Bodies						Finders				Black series lenses									
	C330 s	C330 f	C330	C220	C33	C22	Pent. Prism	Porro finder	CdS Porro	CdS Hood	55	65	80	80 S	105	105 D	105 DS	135	180 Supe r	250
CA										*	*									*
CB													*							*
CC			*															*		
CD															*			*		
CE																				
CF										*	*									
CG															*			*		*
CH										*		*	*					*		
CI										*		*			*			*	*	
CJ																*		*		
CK										*	*									*
CL							*			*										

Code	Bodies						Finders				Black series lenses								
	C330 s	C330 f	C330	C220	C33	C22	Pent. Prism	Porro finder	CdS Porro	CdS Hood	55	65	80	80 S	105	105 D	105 DS	135	180 Supe r

																r				
DA																				*
DB																				*
DC																				*
DD																				
DE																				*
DF																				
DG				*																
DH																				*
DI					*														*	
DJ																				*
DK																				*
DL																				*

Bodies							Finders				Black series lenses									
Code	C330 s	C330 f	C330	C220	C33	C22	Pent. Prism	Porro finder	CdS Porro	CdS Hood	55	65	80	80 S	105	105 D	105 DS	135	180 Super	250
EA												*								*
EB																				
EC												*					*			
ED											*							*		
EE				*															*	*
EF																			*	*
EG											*								*	
EH																			*	
EI					*															
EK		*			*						*									
EL													*							

Bodies							Finders				Black series lenses									
Code	C330 s	C330 f	C330	C220	C33	C22	Pent. Prism	Porro finder	CdS Porro	CdS Hood	55	65	80	80 S	105	105 D	105 DS	135	180 Super	250
FA		*			*															*
FC					*															*
FD											*									*
FF												*								*
FH											*	*								*

Bodies							Finders				Black series lenses									
Code	C330 s	C330 f	C330	C220	C33	C22	Pent. Prism	Porro finder	CdS Porro	CdS Hood	55	65	80	80 S	105	105 D	105 DS	135	180 Super	250
GC		*			*															*
GD																				*
GE											*									
GF					*															
GI													*							
GJ		*			*															

Bodies							Finders				Black series lenses									
Code	C330 s	C330 f	C330	C220	C33	C22	Pent. Prism	Porro finder	CdS Porro	CdS Hood	55	65	80	80 S	105	105 D	105 DS	135	180 Super	250

Utter speculation (!)

So far I have yet to hear of a letter pair with the second letter greater / later than 'L'. So this *could* be a month indicator. That would suggest that the first letter is a year indicator. Given the known chronology (C33 to C330 to C330f, for example) it is obvious that the first letter cannot be a year code, *unless* it represents the year from start of manufacture of *that item*. But that implies, just from the codes cited, there is a two year overlap between the C33 and the C330, and a three year overlap between the C330 and the C330f. I find this hard to believe. Then we have the KH for a C330s body and LD for an 80mm 'S' lens. This makes some sense, as they are late items. But there are a couple of 80 'S' lenses in the Bx group, implying that these were manufactured for 12 years.

Then we have the letter prefix on the body serial number. This cannot be a year designation, since I know of a C33 with an 'H' prefix, several C220s with 'B' prefixes, and a C330 with a 'D' prefix, and C220fs with 'W' prefix. It may indicate production groups (not years, since the C33 was not produced concurrently with the C330 to my knowledge).

This leads me to further speculate that production wasn't annual, but batched. In which case we lose any direct correlation with age. We also have the problem that any lenses that were re-shuttered during repair could have the late click-stop type installed, thus invalidating that as a guide to the age of the code.

At the moment we have insufficient data to draw any firm conclusions. **More letter codes would be useful**, especially if the original purchase year is known.

Interpretation

Some new information has come to light from a service manual for the C33. It appears that the letters are year/month pairs, but for the bodies at least these start counting from the year of development or sale. Prior to public sale there may have been more than one development iteration in a year. So an 'Ax' tag on a C33 would be unusual, though not impossible. Since these cameras are rarely in the hands of original owners it is very difficult to get accurate purchase date information. And the date of purchase could be significantly later than the date of manufacture.

Mapping of letter codes to production years. **This is very preliminary data, and is subject to revision**

First-letter year codes from C33 repair manual data. Italicized values are inferred pre-production codes; bold values are known examples. It is very likely that the less popular items were not in continuous production. '?' indicates known examples but uncertain dates.

Camera	Initial Year	A	B	C	D	E	F	G	H	I	J	K	L
C33		<i>Pre-production period</i>	<i>Pre-production period</i>	<i>Pre-production period</i>	<i>Pre-production period</i>	1965	1966	1967		End of production?			
C22		1965	1966	1967	1968								
C330		1968	1969	1970	1971	1972	1973	1974 End of production?	1975	1976	1977		
C220		1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
C330f		1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	
C220f		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
C330s		1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994

55mm		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
65mm		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976		
80mm		1968	1969	1970	1971	1972	1973	1974	1975	1976	1977		
80mm S													
105mm													
105mm D				?									
105mm DS		?		?		?					?		
135mm				1970?						?	?		
180mm													
180mm Super		?		?	?	?	?	?	?	?	?		
250mm		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978

2.7 Focal length comparison

Table of 35mm format equivalent focal lengths for the lenses in the TLR range (after Scott, with permission)

6x6 cm	Largest Square	Largest 5x4 (10x8)	Largest 11x14	Largest 2x3 (35mm)
55	24	30	30	36
65	28	35	36	42
80	35	43	44	52
105	45	57	58	68
135	58	73	74	88
180	78	97	99	117
250	108	135	138	163

The focal lengths in the body of the table are the 35mm lenses required to produce an identical image in a given final format with minimum cropping. In other words, to get a square print covering the same area as the 55mm Mamiya lens you would need a 24mm on 35mm format, while cropping a 2x3 area from the Mamiya negative would give the same rendition as a 36mm lens on 35mm format. This table is derived from original work by Ed Scott for 'photo.net' (<http://photo.net/>) . Please see this link for a more general table and an explanation of the method used to derive these values.

2.8 Filters

2.8.1 Plain

Standard screw fit filters may be used, but the 49mm threaded lenses are very close together, which may make it impossible to fit filters on both lenses. Mamiya made special slim-mount filters for this purpose, but they do not seem to be readily available short of special order. The local Mamiya distributor may be able to help. Standard filters may also cause problems with the Mamiya clamp-fit lens hoods.

It is possible to file a flat on a UV or haze filter to improve clearance if it is going to be a permanent fitting on the viewing lens. Obviously the filter mount should be marked and then de-mounted from the lens *before* filing it!

An alternative for the viewing lens is to use one of the chrome protective rings to retain a bare UV or skylight filter directly on the lens. This requires dismantling a standard filter unless you can obtain an unmounted glass.

Some users have found that filters can be mounted inside the larger square Mamiya lens hoods. This is done by cementing an old filter mount to the inside (usually after the original mounting thread has been filed flat and the old glass removed) and using it as a threaded mount. Since old or scratched filters can be utilised for the mount this is an economic approach. In use the filter of choice is screwed to the new mount inside the hood. Obviously the maximum filter size that can be used in this manner depends on the hood size and the slimmness of one's fingers!

2.8.2 Polarising

Most of the same restrictions about fitting plain filters applies to polarising filters. Perhaps more so, since these tend to have physically larger mounts. The common method is to preview the effect by eye, or on the viewing lens, and note the position of the mount (You need a mount marked in increments to do this - you can add your own). The filter is then installed on the taking lens and set to the same orientation.

In theory, you could mount two identical polarisers in common alignment and wrap an elastic band around the rotating rims. Rotating one would move the other in synchronisation. *But* the physical proximity of the lenses means you'd have to use 46mm polarisers. And a circular lens hood!

Linear polarisers are perfectly adequate for these cameras. The circular versions are intended for cameras with through the lens metering which use an optical system that is itself polarising.

2.8.3 Graduated

It is difficult to preview the effect on the viewing lens and then transfer it to the taking lens, but possible. Unless you are using a 105mm D/DS lens you cannot preview the effect of stopping down. There was a sliding mount designed for the Cokin 'P' series, but this does not appear to be still available. See section 9.2 for the reference.

2.9 Self-timers

None of the Mamiya TLR cameras have self-timers on the body. Only the 105mm DS lens has a 'V' setting for delayed release. The only other options are to use an air release, or to try and track down a cable release mount accessory timer (usually clockwork).

2.10 Infra-red focusing

These cameras do not include infra-red focusing scales. Just how crucial this is will depend on your application. Infra-red film varies in its degree of sensitivity. Certainly Konica 750 and Ilford SFX have a closer sensitivity to visible light than Kodak's (35mm) offering. False colour infra-red film has to include some visible light, otherwise you do not get a full range of colours.

The focus scales are comparatively crude, so a precise adjustment is not practical, or at least hardly repeatable. Unless working at close distances or at wide apertures the correction can probably be ignored. Should highly infra-red sensitive emulsions become available (see below), then experimentation *with each lens* would be advisable.

The cameras are *probably* infra-red safe with current emulsions. The biggest risk would come from an extended bellows, so it might be wise to retract the bellows (or close the internal baffle) when not actively photographing.

The new MACO 820c infra-red emulsion falls between the Kodak HIE and Konica 750 offerings. This is a true infra-red film (development should be in a metal or foil-shielded tank, for example), and should be treated with caution. The recommended focus adjustment is an increased extension of 1/100th of the focal length of the lens, or about 0.5mm for the 55mm, and 2.5mm for the 250mm lenses. This sort of correction is actually easier to implement on the rack and pinion bellows focusing of the Mamiyas than on helical mount lenses.

Compiler's Note: If any reader has practical experience of infra-red with these cameras, I'd be pleased to include it here.

2.11 Focusing discrepancies

There are reports of lenses that do not provide sharp images on the film, even though carefully focused. This may mean that the lens pair is out of adjustment, but there are several alternative explanations. These are, in approximate order of increasing severity:

2.11.1 Wrong film

Using 220 film in a camera configured for 120 will cause focus errors, as the pressure plate is set for a thicker film and backing paper combination. You will probably have a strange starting position for the first frame, as the leader length on the two types is different.

2.11.2 Back incorrectly latched

The backs on these cameras are quite flexible, and must be closed using even pressure on both top corners. Otherwise the back may not latch correctly on both sides. This prevents the pressure plate from applying even pressure across the whole frame.

2.11.3 Incorrectly mounted focusing screen / wrong magnifier correction

Some screens can be disassembled when removed. If they are reassembled with the 'glass' upside down, the focus is wrong. De-mountable screens should be correctly fitted, though this is a gross error that should be easily spotted. Fixed screens are sometimes shimmed to adjust their height. Remove them only if necessary and with extreme care. The C330, f, and s are designed with replaceable screens.

The flip-up magnifiers and eyepiece correction lenses should be a reasonable match for your eye (with or without correction as applicable).

2.11.4 Incorrectly mounted lens

It is just possible to mount the lens unevenly on the lens panel, but it is unlikely that the auto-cocking feature on later models would work.

2.11.5 Distorted lens panel

If the lens panel isn't parallel to the film plane and at right angles to the focus screen, then an error will occur. These are tough cameras, so you'd probably need to drop it to cause this fault. (Not advised.)

2.11.6 Lens pair maladjusted

It does happen, often because the retaining rings are loosened and spacing shims drop out. This is a pain to adjust, so touch the lens as a last resort.

3 Chrome series lenses

3.0 Introduction

3.0.1 Seikosha-MX shutter

The first series of lenses had Seikosha-MX shutters with a speed range of 1 – 1/400th second. This was the usual 1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/200, 1/400 step series. In common with a number of early leaf shutter designs the fastest speed can only be set with the shutter uncocked. The lens range was 65mm, 80mm (f2.8 only), 105mm, and 135mm. The optical construction is believed to be that same as the second chrome series, but this is unverified. Spares for these lenses are not easy to obtain due to their age and small production run. The shutter release is short and curved compared to later lenses, and the shutter cocking lever is smaller than that on the Seikosha-S shutters. The shutter cocking stroke is 67 degrees 30 minutes which is much less than the 112 degree 30 minute stroke of the later bodies. The M and X synchronisation lever looks like a miniature shutter cocking lever rather than the small projection used on the later lenses. It usually has a red insert in the end of the lever. The 80mm f2.8 is marked 'f=8cm'. At least one example has a 7 digit number on the shutter body in addition to the normal lens numbers. Some (if not all) 135mm lenses were marked as '13.5cm'. On one example the bottom of the lens mounting flange bears the text 'Made in Japan' in white. Sales period December 1956 to March 1959.

3.0.2 Seikosha-S shutter

The second chrome series is by far the more common, with a wider shutter speed range in a modern one stop sequence. It was in production for models up to and including the C33/C22. The shutter is labelled Seikosha-S, and is identified by the chrome shutter/aperture bezel. Portions of the lens barrels may be black. The shutter speed scale is on the left (when holding the camera for photography), and the aperture scale is on the right. Shutter adjustment is via a thin knurled ring, aperture by moving a small pointer. Speeds 1 - 1/500 + B. Most lenses have double exposure prevention, in that the shutter release lever will only move when the shutter is cocked. However with some the release lever will move on the uncocked shutter, giving the impression that the shutter has fired. Parts for these lenses are also limited. Sales period uncertain – ought to have been the mid-1960's until superseded.

3.03 Seikosha-SLV shutter

This shutter is not thought to have been used widely. It will not auto-cock on the C33/330 bodies, but it will not foul the auto-cocking mechanism. The shutter cocking stroke is 124 degrees (the cocking arm only moves 112 degrees 30 minutes.). Sales period April 1958 to July 1962.

The chrome lenses are cited as late as the C330 manual, but were probably no longer in production by that time.

3.1 65mm f3.5

Composition	6 elements 5 groups
Picture angle	63 degrees
Minimum aperture	f32
Filter diameter (mm)	49
Lens hood diameter (mm)	50
Closest focus (cm)	27 cm
Subject coverage and reproduction ratio at closest focus (cm)	7.03 x 7.03 cm x0.93
Weight (grams)	365
Flash synchronisation	X,M
Other characteristics	Retrofocus design, originally had filter thread guard rings. Late versions (c.C33) may have been supplied with a finder mask for correct exposure and parallax compensation. There was a wide-angle lens made to fit the sports finder in early WLFs to give the 65mm field of view.

3.2 80mm f2.8

Composition	5 elements 3 groups
Picture angle	50 degrees 40 minutes
Minimum aperture	f32
Filter diameter (mm)	40.5
Lens hood diameter (mm)	42
Closest focus (cm)	34.2 cm
Subject coverage and reproduction	8.9 x 8.9 cm x0.71

ratio at closest focus (cm)	
Weight (grams)	
Flash synchronisation	X,M
Other characteristics	

3.3 80mm f3.7

Composition	4 elements 3 groups?
Picture angle	50 degrees 40 minutes?
Minimum aperture	f32?
Filter diameter (mm)	40.5?
Lens hood diameter (mm)	42?
Closest focus (cm)	34.2 cm
Subject coverage and reproduction ratio at closest focus (cm)	8.9 x 8.9 cm x0.71
Weight (grams)	?
Flash synchronisation	M,X?
Other characteristics	Rare 'Budget' lens. Referenced in a C3 manual, and a couple of examples observed for sale. It is unknown if this lens would auto-cock on a later body. Mamiya-Kominar lens in Seikosha-SLV shutter.

3.4 105mm f3.5

Composition	4 elements 3 groups
Picture angle	41 degrees
Minimum aperture	f32
Filter diameter (mm)	40.5
Lens hood diameter (mm)	42
Closest focus (cm)	57.9 cm
Subject coverage and reproduction ratio at closest focus (cm)	17.9 x 17.9 cm x0.31
Weight (grams)	
Flash synchronisation	X,M
Other characteristics	Long focus design

3.5 135mm f4.5

Composition	4 elements 3 groups
Picture angle	33 degrees
Minimum aperture	f45?
Filter diameter (mm)	46
Lens hood diameter (mm)	48
Closest focus (cm)	82.3 cm
Subject coverage and reproduction ratio at closest focus (cm)	22.8 x 22.8 cm x0.25
Weight (grams)	
Flash synchronisation	X,M
Other characteristics	Long focus design. Some early Seikosha-S shutter lenses have the focal length in centimetres.

3.6 180mm f4.5

Composition	4 elements 3 groups
Picture angle	24 degrees 30 minutes
Minimum aperture	f45?
Filter diameter (mm)	49
Lens hood diameter (mm)	50
Shortest film to subject distance (cm)	118.9 cm
Subject coverage and reproduction ratio at closest focus (cm)	23.5 x 23.5 cm x0.24

Weight (grams)	
Flash synchronisation	X,M
Other characteristics	Early versions may require modification for auto-cocking on later bodies. Originally had chrome filter thread guard rings. Telephoto design.

4 Black series lenses

4.0 Introduction

The black series lenses were introduced with the C220 and C330, c.1969, though there is a reference to the 55mm and 250mm alongside the C22/C33 as early as March 1967. The shutter is labelled Seiko (except for the 80mm f3.7, which is a Copal), and is all black. There are two designs of Seiko shutter which are only externally distinguished by the aperture click-stops on the later versions. Mamiya (America) announced in 1999 that some new parts for early Seiko shutters were exhausted and that they would not be able to undertake repairs.

Some lenses are labelled 'Seiko' and some 'Seiko – SLV' (examples of 180mm Super and 55mm are known).

Some, but certainly not all, black lenses have optical multi-coatings. Exactly what coatings were applied and to which lenses is a matter of debate. Given the number of years of production this isn't too surprising.

Both the shutter speed scale and aperture scales read against a common index mark on the left of the lens. Shutter adjustment is via a wide knurled ring, and apertures are set using a large knob on the right side of the lens opposite the scale. Speeds 1 - 1/500 + B.

There is some variation in specification within this group. The earliest versions (1960's) have the focal length given in centimetres (cm), and the last versions (from around 1980) had click-stops for the full aperture values. Mid-production lenses (1970's) were without aperture click-stops, and had the focal length engraved in millimetres. There are also some variations in the style of script used for lens markings, but it hasn't been possible to assign a date to these differences.

It seems that all lenses with 49mm filter threads were originally supplied with chrome 'keeper' rings to stiffen and protect the thin alloy mountings. Not surprisingly these are often absent now. These have concentric ribs inside that are often mistaken for a (strange) filter thread. Some lenses, such as the early 80mm, have a chrome cosmetic ring around the outside of the filter thread, which should not be mistaken for a keeper ring.

This collection of lenses ([jpg/lenses.jpg](#)) shows the relative size of the various focal lengths in the black series. The 65mm is missing, as I was unable to locate one when the photograph was made. Front row, left to right: 105mm DS, 80mm (with dented viewing lens thread), and 55mm. Rear row, left to right: 250mm, 180mm Super (with keeper rings mounted), and 135mm. Note that some lenses have haze/UV filters fitted.

4.1 55mm f4.5

Composition	9 elements, 7 groups
Picture angle	70 degrees 30 minutes
Minimum aperture	f22
Filter diameter (mm)	46
Lens hood diameter (mm)	48
Closest focus (cm)	24
Subject coverage and reproduction ratio at closest focus (cm)	6.4 x 6.4 1 to 1.14
Weight (grams)	360
Flash synchronisation	X,M
Other characteristics	Retrofocus design. Cited in an American distributor's catalogue as early as 30th March 1967, but actual availability is unknown. An insert for the finder bases was produced to provide corrected parallax and exposure indices. See section 6.4

4.2 65mm f3.5

Composition	6 elements, 5 groups
Picture angle	63 degrees
Minimum aperture	f32
Filter diameter (mm)	49
Lens hood diameter (mm)	50

Closest focus (cm)	27
Subject coverage and reproduction ratio at closest focus (cm)	6.7 x 6.7 1 to 1.2
Weight (grams)	340
Flash synchronisation	X,M
Other characteristics	Originally supplied with chrome reinforcing rings in the filter threads. An insert for the finder bases was produced to provide corrected parallax and exposure indices. See section 6.4

4.3.1 80mm f2.8

Composition	5 elements, 3 groups
Picture angle	50 degrees 40 minutes
Minimum aperture	f32
Filter diameter (mm)	46
Lens hood diameter (mm)	48
Closest focus (cm)	35.5
Subject coverage and reproduction ratio at closest focus (cm)	8.6 x 8.6 1 to 1.5
Weight (grams)	310
Flash synchronisation	X,M
Other characteristics	Updated to become the 'S' version. See section 4.3.2.

4.3.2 80mm f2.8 'S'

Composition	5 elements, 3 groups
Picture angle	50 degrees 40 minutes
Minimum aperture	f32
Filter diameter (mm)	46
Lens hood diameter (mm)	48
Closest focus (cm)	35.5
Subject coverage and reproduction ratio at closest focus (cm)	8.6 x 8.6 1 to 1.5
Weight (grams)	310
Flash synchronisation	X,M
Other characteristics	'S' version does not have markings surrounding the lens front elements. Lens details and serial on top of viewing lens. The viewing lens is of different design from the taking lens, and elements are definitely <u>not</u> interchangeable with the taking lens.

4.4 80mm f3.7

Composition	Believed to be 4 elements in 3 groups (Tessar type)
Picture angle	As 80mm f2.8?
Minimum aperture	f32
Filter diameter (mm)	40.5
Lens hood diameter (mm)	42
Closest focus (cm)	As 80mm f2.8?
Subject coverage and reproduction ratio at closest focus (cm)	As 80mm f2.8?
Weight (grams)	
Flash synchronisation	M,X
Other characteristics	Rare 'Budget' lens. From notes in C330 and C330s manuals, this lens was manually cocked. The shutter and aperture index and the cocking lever are on the right, adjacent to the shutter release lever. This is completely at odds with all the other lenses in the range. The shutter release lever will move even if the lens is not cocked – which can fool the double exposure prevention mechanism. Appears to have been discontinued during the life of the C330 as it is not cited in the system chart, though several chrome lenses are included. A Copal shutter was used, and the aperture ring has no click-stops.

4.5 105mm f3.5

Composition	4 elements, 3 groups
Picture angle	41 degrees 20 minutes
Minimum aperture	f32
Filter diameter (mm)	46
Lens hood diameter (mm)	48
Closest focus (cm)	64.5
Subject coverage and reproduction ratio at closest focus (cm)	21.8 x 21.8
Weight (grams)	
Flash synchronisation	X,M
Other characteristics	Long focus

4.6 105mm f3.5 D & DS

Composition	5 elements, 3 groups
Picture angle	41 degrees 20 minutes
Minimum aperture	f32
Filter diameter (mm)	46
Lens hood diameter (mm)	48
Closest focus (cm)	57.5
Subject coverage and reproduction ratio at closest focus (cm)	17 x 17 1 to 3
Weight (grams)	365
Flash synchronisation	X,M,V (self-timer on DS model)
Other characteristics	The 105mm D appears to be an optical re-design from the earlier 105mm black, with a consequent change in back-focus. At the moment the best evidence suggests that only the last DS variant had a viewing lens diaphragm and depth of field calculator ring. Most users agree that the DOF preview is of limited utility, but the DOF calculator is useful if treated conservatively. Long focus. Focus scales may not match on pre C330s cameras. The D or DS engraving is in red.

4.7 135mm f4.5

Composition	4 elements, 3 groups
Picture angle	33 degrees
Minimum aperture	f45
Filter diameter (mm)	46
Lens hood diameter (mm)	48
Closest focus (cm)	90.2
Subject coverage and reproduction ratio at closest focus (cm)	25.2 x 25.2 1 to 5.5
Weight (grams)	370
Flash synchronisation	X,M
Other characteristics	The lens diaphragm and shutter is located behind the lens elements, and is exposed when the rear cap is removed. Long focus design.

4.8 180mm f4.5

Composition	4 elements, 3 groups
Picture angle	24 degrees 30 minutes
Minimum aperture	f45
Filter diameter (mm)	49
Lens hood diameter (mm)	50
Closest focus (cm)	129
Subject coverage and reproduction ratio at closest focus (cm)	27.5 x 27.5 1 to 5
Weight (grams)	? Probably about 600
Flash synchronisation	X,M

Other characteristics	Telephoto design
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4.9 180mm f4.5 Super

Composition	5 elements, 4 groups
Picture angle	24 degrees 30 minutes
Minimum aperture	f45
Filter diameter (mm)	49
Lens hood diameter (mm)	50
Closest focus (cm)	129
Subject coverage and reproduction ratio at closest focus (cm)	27.5 x 27.5 1 to 5
Weight (grams)	640
Flash synchronisation	X,M
Other characteristics	Optical redesign from the earlier version. The filter ring is very thin and exposed, and is easily dented. Some lenses come with alloy rings which stiffen the threads when filters are not attached. Telephoto design, which is more complex than the earlier model. The word 'Super' is engraved on the bezel around the front element in red, and the '180' engraving on top of the viewing lens is also red. One example has been reported that does not have the '180' engraving and the shutter is marked 'Seiko – SLV'.

4.10 250mm f6.3

Composition	6 elements, 4 groups
Picture angle	18 degrees
Minimum aperture	f64
Filter diameter (mm)	49
Lens hood diameter (mm)	50
Closest focus (cm)	205
Subject coverage and reproduction ratio at closest focus (cm)	31.1 x 31.1 1 to 6.6
Weight (grams)	645
Flash synchronisation	X,M
Other characteristics	Manual cocking on all bodies. Telephoto design. Cited in an American distributor's catalogue as early as 30 th March 1967, but actual availability is unknown.

5 *Lens handling, exposure compensation, parallax, and performance*

5.1 Lens changing

These notes are based on the C3, C33 and C330 models. The principle is the same in all models, but the appearance of the controls does vary.

The lens assembly is retained in place by a stiff wire clamp. The wire is locked in place by a small metal cam on the lens board. This is brass on early models, black on later ones. This cam pivots out of the way of the wire when the bellows are fully closed and the control on the left body side set to 'Unlock'. This cam is moved by a small plunger that projects from the camera body when the film change baffle is raised. Since this plunger does not project far, the bellows must be retracted. On the C3 and similar bodies, there is a chrome sliding knob (the 'catch lock') on the upper left side which must be slid towards the lens. Setting the control to 'Unlock' also raises the internal baffle that protects the film while the lens is removed. It is suggested that the lens is changed with the camera lying on its back. When mounting a new lens, take care that the body cocking lever ('33' and later series bodies) meshes with the shutter cocking lever on the lens. Lenses may be changed in the cocked or uncocked condition, but remember to set the replacement to the same state! It is inadvisable to change lenses on auto cocking bodies with the film part-wound, as this can mean that the shutter lever ends up on the wrong side of the cocking lever. Damage is very probable.

On the C33 and C330 models you should also change the focal length setting on the side dial so that the exposure compensation / parallax compensation indicator is correctly programmed. This image of a C330 side dial ([jpg/330dial.jpg](http://www.mamiya.com/330dial.jpg)) shows the lens lock control in the 'lock' position, the film speed reminder at ISO 200, and the film type reminder as 'black and white'. The inner of the two, ridged, sliders at the 5 o'clock position programs the focal length. It's currently at 180/250mm. Note that the 65mm and 55mm use the 80mm setting and the extra finder scale.

5.2 Exposure compensation

The large extension allowed by the bellows construction of these cameras permits magnifications of nearly life size with short focal lengths. At this degree of extension the effective aperture of the lens is reduced, and more exposure is required. The C33, C330, C330f, and C330s are all fitted with a mechanical guide which can be read in the viewfinder. The focal length in use is set using a dial on the left side of the body (see 5.1). As the bellows is extended a marker descends from the top of the frame. This is read against an engraved scale on the focusing screen which gives the factor for the extra exposure. The 55mm and 65mm lenses need further correction, as the closest setting on the camera is 80mm. This is usually achieved using a supplementary scale attached to the finder. See 6.4 Finders.

Tests suggest that the indicator should be read *beneath* the engraved factor, and not above or below.

The other cameras rely on a scale which is found on the left side of the bellows rack. This is marked in compensation factors for each focal length, and is read against an index mark on the camera body. Again, not all bodies have scales for all lenses. However exposure compensation for lens extension is calculable. Tests suggest that this scale can err on the conservative side by indicating up to +0.5 stops over the correct exposure. This exposure scale (jpg/cside2.jpg) from a Mamiyaflex (courtesy Ken Kirch) has two scales. One for the 80mm, and one for the 105mm and 135mm.

Table of Exposure Corrections, Magnification, Image width, and Parallax (J.Hein, personal communication)

+ F stop	Factor	Magnification	Viewfinder field	Negative field	Parallax
0.25	1.19	1:11.05	56.3cm	61.9cm	0.5cm
0.50	1.41	1:5.29	27.0cm	29.6cm	0.9cm
0.75	1.68	1:3.37	17.2cm	18.9cm	1.5cm
1.00	2.00	1:2.41	12.3cm	13.5cm	2.1cm
1.25	2.38	1:1.84	9.4cm	10.3cm	2.7cm
1.50	2.83	1:1.47	7.5cm	8.2cm	3.4cm
1.75	3.36	1:1.20	6.1cm	6.7cm	4.2cm
2.00	4.00	1:1.00	5.1cm	5.6cm	5.0cm

First column: correction in f-stops

Second column: time correction factor (note the difference $\frac{1}{2}$ stop and factor 1.5)

Third column: Magnification

Fourth column: Object field shown in view finder, starting from screen width of 51mm

Fifth column: Object field shown on negative, starting from negative width of 56mm

Sixth column: Shift of view image due to parallax

This table neglects the contribution of varying entry and exit pupil sizes. Users are advised to verify these figures with their own systems before using them for critical work.

5.3 Parallax compensation

A distinction must be drawn between parallax compensation, and parallax correction. The Mamiya lenses have the viewing and taking lenses displaced by 50mm. This means that they see slightly different views. In practice this means that the top of the frame of the viewing lens is also 50mm higher than the top of the taking frame. At distances over a metre or so, this has negligible effect. At closer distances, where the field of view may be as little as 65mm across, a 50mm discrepancy is over half a frame.

Parallax compensation demands that the image is framed, and then the alignment of the camera is adjusted by tilting the camera upwards. In the case of the cameras with viewfinder scales, the scale line determined by the exposure compensation should be aligned with that portion of the image which lay at the top of the screen during framing. With the C33 etc. this is the moving bar, on other models it is the line representing the 1.5x and 2x exposure compensation.

Because the taking lens was not on the same axis as the viewing lens, the spatial relationship of elements in a three dimensional subject will change. If precise control over this alignment within the subject is required, parallax correction is required.

5.4 Parallax correction

The aim of parallax correction is simple. Move the camera until the taking lens is in the position occupied by the viewing lens without changing the angle of the camera. This can be done using a tripod with an adjustable centre column, though you are limited to keeping the camera back parallel to the column axis. Failing to do this means that the taking lens does not obtain the same angle and distance from the subject. Tripods with an angled column (such as the Benbo) will eliminate this problem.

The Paramender (See 6.1) provides the precise 50mm displacement required.

5.5 Lens performance

The most recent comprehensive lens tests available were done by Tim Brown, and can be found at the http://www.photo.net/bboard/q-and-a-fetch-msg.tcl?msg_id=000513&topic_id=35&topic=Medium%20Format%20Digest Mamiya TLR lens' tests .

6 Accessories - Mamiya

6.0 Introduction

This isn't an exhaustive list. Various flash brackets have been ignored, for example. See Section 9 for third party (commercial) accessories and personal modifications.

6.1 Paramender

Basically this just a device to shift the lens axes by 50mm to correct for parallax error. Similar to a cranked tripod column, but effective with tripod heads at any angle. A probable prototype for the Paramender that would fit the Mamiyaflex has been seen. The difference is in the smaller camera platform and what appears to be a removable/convertible tripod bush. At least one home built paramender project has been done. See <http://www.btinternet.com/~jrbham/paramender/index.html> .

6.1.1 Paramender, type 1

Knob-driven rack and pinion mechanism, with locking screw. There is no provision for damped return of the camera to the lower position. The Paramender Type 1 ([jpg/paramender1.jpg](#)) is illustrated in the C3 manual. The knob rotates 225 degrees. There are two variants of this model. The earlier version just has the rack knob and the locking screw, while the later version also has a latch to secure the device in the raised position.

6.1.2 Paramender, type 2

A lever replaces the knob of the Paramender Type 1. A 225 degree action raises the camera, which latches at the top of the travel. A friction knob provides for intermediate positioning. Lowering the camera is not damped. There are variants with both black and grey levers.

6.1.3 Paramender, type 3

Two-axis pan / tilt head with adjustable platform height and damped camera return. This is listed in a C330 and C330f manual, but has disappeared in the later C330s manual which only refers to the Model 2. Although rare, it does exist.

6.2 Grips

Some Mamiya RB series grips will fit 330 bodies as they share the same base locating holes and shutter release position. At least one grip intended for an M645 Super will fit, though the electronic shutter release will not operate! It is recommended that such non-standard combinations be verified by experiment.

6.2.1 Grip holder

Basic left-hand grip fastening to the base of camera, with duplicate (1/4") tripod socket. It has an angled cold flash shoe and strap for the back of the hand. Most have plastic grips and strap, though wooden ones (with leather strap) are known to have been available with the original Mamiyaflex C. This grip holder ([jpg/grip1.jpg](#)) has a plastic handle, and shows some wear on the bracket. The angled shoe seems to be simply to move the flash gun away from ones head when using a waistlevel finder!

6.2.2 Grip holder with trigger

Variant of the Grip Holder with a mechanical linkage allowing the trigger to operate the chin shutter release on the C330 models. A cold flash shoe is fitted. It will fit non-330 bodies, but the shutter release has nothing to operate, and there is no provision for a cable release.

6.2.3 Multi-angle grip

A more elaborate version of the Grip Holder with Trigger which may be adjusted for grip angle and includes a pan/tilt cold flash shoe and shutter lock. Multi-angle Grip ([jpg/lgrip.jpg](#)).

6.3 Pistol grips

Some Mamiya RB series grips will fit 330 bodies as they share the same base locating holes and shutter release position. It is recommended that this be verified by experiment with specific equipment.

6.3.1 *Pistol grip with cable release*

Generic pistol grip with trigger action via cable. This is the only type usable by models up to and including the C33, and for the C220 and C220f.

6.3.2 *Pistol grip, mechanical linkage, type 1*

For C330, C330f, and C330s only. Trigger has a mechanical linkage to the chin shutter release.

6.3.3 *Pistol grip, mechanical linkage, type 2*

Similar to the type 1, this is a compatible grip from the RB67 system. The base plate can be configured to accept brackets for Mamiya, Heiland, or Graflex flashguns, or a sub-grip.

6.4 Finders

Coverage Measurements of the screen apertures on a C330 and C220 give a value of 51mm (to the nearest millimetre), while the image area is 56mm. 51/56 gives a finder coverage of 91%. This is partly to allow for the fractional variations in the positioning of the lenses when they are changed.

Since the finders are interchangeable amongst the bodies, it is not unknown for older bodies to have the (better) later fittings. There are indications that there are more than two models of finder - possibly two each for the '2' and '3' series cameras. The '2' series finders do not appear to have had the second push down frame for the 65mm lens, just the 80mm aperture, and the C220F model does not have any aperture at all. More information is required about this topic.

The finders fit by sliding the slots at the front of the finder over the lugs on the camera body, and lowering into place. The finder is secured by tightening the screw at the rear of the focusing screen.

All the finders examined by the compiler of this document (C33, C330, and C330s WLF, CdS Magnifier, and a prism finder) have a recess in the base with a set of spring clips. These are intended to take an auxiliary scale with exposure and parallax correction settings for use with the 80mm setting on the C33 and later models. It consists of an exposure compensation scale on the left, and a new set of parallax marks on the right. This facility may also offer an opportunity for adding a grid overlay to models without interchangeable screens, or for adding format framing guides with all models.

Here is a scan of a correction plate 55/65mm finder insert ([gif/corscale.gif](#)). The proportions should be correct (printer permitting), and dimensions may be obtained by reference to the recess in the finder. An example examined by the compiler is made of clear plastic with red engraving. It is 55mm square, by slightly over 1mm thick. The bottom edge is chamfered. This short PostScript program, plate2.ps ([plate2.ps](#)), (also available as an Adobe PDF plate2.pdf ([plate2.pdf](#))) can be used to draw an actual size example if a suitable printer is available. It produces two copies each of the correction plate, a simple grid, a combined correction plate and grid, and the standard correction scale for C330+ screens without this feature. The grid leaves the central 10mm focusing spot unobscured, and is approximately correct for horizontal and vertical 10x8" format framing. Good results can be obtained by printing straight to *laser grade* transparency film.

A sportsfinder mask fitted with a slight wide-angle lens was available to convert the 80mm aperture of early WLFs to use the 65mm lens. It fits to the sportsfinder mask attachment pins and projects outward by 9mm. It can be left attached, but is vulnerable to scratching, and the raising of focus magnifier and the dropping of the sportsfinder flap is impaired. It is doubtful that a similar fixture was provided for the 55mm, and no reference to such an item has been found. These finder masks ([jpg/masks.jpg](#)) show the relative sizes of the apertures.

The file mask.ps ([mask.ps](#)) contains a PostScript program that draws sportsfinder mask templates for the 105mm, 135mm, 180mm, and 250mm lenses, and a combined version. The 'wings' on each side of the template curve forward away from the WLF as an aid to fitting. The keyhole-shaped mounting holes are indicated by the groups of three circles that should be opened to form a circle and slot. The originals use a brass 'U' shaped spring to hold the mask in place. A rubber wedge might make an alternative. Masks can be fabricated from aluminium or brass sheet, or plastic sheet of about 0.030". Transparent acetate is an option, especially for the combined mask. This mask.pdf ([mask.pdf](#)) file is a Portable Document Format version that may be easier to print.

If you choose to try and fabricate masks using the dimensions given below, the centres of all the masks are the same. The locating lugs on the finder are offset. Sports finder masks ([masks.jpg](#)).

Sportsfinder mask apertures, to the nearest half-millimetre by measurement

105mm lens	135mm lens	180mm lens	250mm lens
37mm	29.5mm	21.5 mm	15.5mm

The paint finish on the original masks varies from a coarse crinkle finish to a fine matt flock texture. All are black with the focal length engraved on the front.

6.4.1 WLF, Type 1

A four independent flap type, with simple fixed 3.4x flip up magnifier. The Mamiyaflex pattern was without a sportfinder and the flip-up magnifier was hinged at the rear. Sports finder included openings for the 80mm and 65mm on '3' series cameras, 80mm only for the C220 and none for the C220f. Later versions appear to have had chrome support struts for the front and back flaps. An example of a C330 WLF ([jpg/330wlf.jpg](#)) shows these side struts and the gap between the sides and the magnifier.

6.4.2 WLF, Type 2

Single action linked flap type, with magnifier in full-size light shield. Sports finder; 65mm and 80mm masking as standard, longer lengths by additional masks on the C330f and C330s models only. Prior to the C330s version, the 65mm finder flap could be released by pressing in the left flap of the waist level finder. The C220F version does not have a sportfinder aperture of any size. 5 alternative strengths for the magnifier are available, and are user fitted. It will not accept the WLF magnifier. An example of a C330S WLF ([jpg/330swlf.jpg](#)) shows the better light shielding of this design.

6.4.3 WLF Magnifier

6.5x magnifier that clips over the sides of the Type 1 WLF. Has adjustment for eyesight. Cited as late as the C330 manual, but withdrawn with the introduction of the C330f/s (Type 2) WLF, which it will not fit.

6.4.4 Magnifying Hood

This is a 'Chimney' type 3.5x magnification finder, with an optional 6x central area magnification. The eyepiece is large and is visible using spectacles. The main benefit is from the excellent light shielding compared with the WLF, but it cannot be used at a distance. It is physically large, and does not collapse. However it is no heavier than the WLF. Not listed in the C3 manual, and has apparently been superseded by the CdS Magnifying Hood with the introduction of the C330s. The C330 and C330f manuals list both the metered and non-metered versions. Variations with both black and chrome top surfaces have been seen.

6.4.5 CdS Magnifying Hood

A version of the magnifying hood that incorporates a CdS meter. There seems to have been two variants. The first version had the second-stage magnifier and the meter, while the later version has a meter but does not have the two-stage magnification. The meter must be programmed with the film speed and the viewing lens maximum aperture. The on/off control swings the meter cell into the centre of the field of view. There is a secondary power switch that is depressed when the finder is mounted. Presumably this is to avoid battery drain when the finder is unmounted. Operation is by the match needle principle, and the exposure must be manually transferred to the lens.

The meter can be confused by the second diaphragm in the 105mm DS lens, which must be set to match the meter lens aperture setting (normally f3.5). The split-image rangefinder screens can also inflate the reading. The meter cell may be moved slightly with the on/off control to avoid this effect. The meter area is semi-spot, the actual angle of view depending on the lens in use.

A mercury cell battery is believed to have been used in some models. (Mercury batteries have been discontinued in the USA for some time, and production in Europe will cease shortly. I have no information about the availability of replacements.) Late versions use two silver oxide cells (SG13 or equivalent). This item is not listed in a C330 manual, although the CdS Porrofinder is mentioned. The overall height, with the rubber eye-cup collapsed, is 85mm. This is the same height as the top of the lid of the C330f or C330s WLF when opened. This metered chimney finder ([jpg/chim1.jpg](#)) is mounted on a C220. The composite dial controls the film speed setting, the lens maximum aperture, and the match needle operation. The meter on/off arm control can be seen at the base of the finder. This example has the rubber eyecup extended and a cap in place.

6.4.6 Porrofinder (also known as 'Porroflex')

Mirror equivalent of pentaprism. The eyepiece is offset to the left, and the finder overhangs the left side of the camera considerably. Due to the overhang the camera does not hang well from the standard strap lugs.. Apparent magnification with 80mm lens is 0.5x. This item is first listed in the C3 manual, and is joined by the metered version in the C330 manual. It appears to have been superseded by the metered version by the time of the C330s release. This rear view of a porrofinder ([jpg/porro.jpg](#)), courtesy of HAN, shows the bulk and offset eyepiece of this item.

The Porroflex version is illustrated in some C33 promotional material as having the name 'Porroflex' on the lower front. Early versions were manufactured by Nippon Kogaku (Nikon), though whether this was a sub-contract or third-party product is unclear. Porrofinders in the C330 manual have the usual S-M symbol on the upper front.

6.4.7 CdS Porrofinder

Version of the standard Porrofinder incorporating a CdS meter. The meter operates in a similar manner as that in the CdS finder (6.4.5). Versions are known to take Type 76 (1.5v) silver oxide cells, but do verify that batteries are available if contemplating a purchase.

6.4.8 Prism finder

A true pentaprism, with rubber eyecup and dioptic correction provision. Apparent image size with 80mm lens is 0.7x. This item is heavy, but brighter than the Porrofinders, if not as bright as the WLF. The full screen area is difficult to see for anyone wearing glasses, and a dioptic correction lens is recommended. This fits under a retaining ring inside the eyepiece. This example prism finder ([jpg/prism1.jpg](http://www.btinternet.com/~g.a.patterson/c220/prism1.jpg)) is fitted to a C220.

6.4.9 Mirror Finder

There is a reference in a C2 manual to 'mirror finder', though it disappears from the accessory list for later models. It resembles the pentaprism in size, with a central eyepiece, unlike the porrofinders. It has a **single mirror** that provides eye-level, laterally reversed and inverted viewing. The mirror is exposed at the base, and needs careful cleaning. It may have been the prototype for the Porrofinder. Mirror finder image ([jpg/mirrfind.jpg](http://www.btinternet.com/~g.a.patterson/c220/mirrfind.jpg)).

The rationale for a finder that completely inverts the image eludes me, unless it is to make view camera users feel at home?

6.5 Focus knob adapter

An enlarged focus knob to provide finer control. There are two sizes. The Type one will fit earlier cameras, while the Type 2 fits later models (definitely the C220f and C330s). The Type 2, at least, appears to be a scale focusing device for 65, 80, and 105mm lenses, and came in both feet (code DSF-2) and metre (code DSM-2) forms.

6.6 Clip-on Distance Scale

This is mentioned but not illustrated in the C3 and C33 manuals, but is illustrated in a C22 / C33 publicity brochure. It is an accessory that slips into the flash shoe with a bracket that attaches to the side of the lens panel. Racking the bellows moves a rod connecting the two portions of the device. The movement of the rod is converted into the motion of a top-reading dial for the 80mm and 65mm lenses. See also the Focus Knob Adapter.

6.7 Film advance knob crank adapter

This is a rarely seen item that fits over the film advance knob on the early Mamiyaflex models. It clamps in place and provides an advance crank. Alloy or chrome finish.

7 Focusing screens

7.0 Introduction

Only the 330 series bodies have interchangeable screens. The standard screen resembles the Type 1 below. Some other bodies are known to have non-standard screens, either as a special order or a retro-fit. The fixed screen models usually have washers or shims fitted under the screen to obtain the correct focus. If you need to clean these screens it is strongly recommended that you attempt it from the lens mount, or have it done by a competent mechanic.

The C330s uses different screens and a different mounting method from the C330 and C330f. The difference in the two split-image types is the sensitivity of focus. The 6 degree version is most sensitive. According to a C330s manual, there was a checker screen that fitted into the finder (like the 55/65mm compensation plate). Note that not all screens have the exposure compensation scale. It appears that screens of C330 vintage do not have the scale. A PostScript program in section 6.4 can be used to create a finder insert.

At least one C220 is known to have had a C330-type screen fitted. The only advantage of this would have been to use the different split image screens to match different focal lengths. The exposure/parallax correction scale would have been of little value. This appears to have been done professionally, as the screen is correctly shimmed to match the film plane.

A number of cameras have been reported with screens refitted upside down, causing a focus problem. Generally this only occurs with fixed screen cameras, but the screens on the C330 can be removed from the mounting frame.

7.1 C330

The C330 has three adjustable studs inside the mirror box that bear on three tabs on the screen itself. These are used to adjust the screen height for focus calibration. Since the screen is mounted into the screen frame with a foam separator, mounting the frame and screen assembly onto the camera applies sufficient pressure to ensure that the screen sits on the adjustment points. The mounting points can be seen in the top and bottom right and 1/3rd up on the left in the mirror box picture at <http://www.btinternet.com/~g.a.patterson/c330/c330.html>.

A range of seven screens was produced:

1. Matte	Matted entire surface backed by Fresnel lens except centre spot. Exposure
----------	---

	compensation scale. This is the standard screen.
2. Rangefinder (split image), 4 degree spot	Matted entire surface except centre horizontal split image and surrounding annulus. Without exposure compensation scale according to some sources, but includes it according to a C330f Focusing Screen insert.
3. Rangefinder (split image), 6 degree spot	As 2, but incorporates exposure compensation scale. Split image rangefinder is more sensitive. May not work well with longer (180mm plus) lenses.
4. Microprism	As 2, but with microprism in place of split image.
5. Cross hair (ground glass with cross in central circular spot)	Matted entire surface with clear centre spot and cross-hair. Suggested for close-up, dim views and astrophotography. To focus using this screen, use a strong (x8-x10) magnifier and adjust the focus until the image remains steady with respect to the cross-hair when the eye is moved from side to side.
6. Checker / grid	Matted entire surface with Fresnel lens except clear centre spot. Incorporates exposure compensation scale.
7. Microprism / split image	Introduced with the C330f. Apparently the same as the C330s Screen E.

7.1.1 Changing screens

Remove the finder, and rack the bellows out a short distance. At the front of the focusing screen mount is a small catch. Pull this forward, towards the lens. The screen will lift off upwards and backwards. The screens are replaced by reversing the process. Screens can be taken out of the metal frame, but it must be done with care. These screens are plastic underneath a clear glass, unlike the glass fittings of older models.

7.2 C330f

These are the same as the C330 screens, but would have the exposure compensation scale as indicated in the previous section. Late C330f's also had the option of a microprism / split image screen similar to the C330s Type E. This is designated as No.7, and combines a microprism with a diagonal split-image. These screens are acrylic resin, and are comparatively soft. Avoid contact with solvents.

7.3 C330s

A range of seven screens was produced. Technically similar to the C330 equivalents.:

A. Matte.	Matted entire surface backed by Fresnel lens except centre spot. Exposure compensation scale.
A2. Matte for wide-angle lenses.	Incorporates the 55/65mm parallax plate.
B. Rangefinder (split image), 4 degree spot.	
B2. Rangefinder (split image), 6 degree spot.	
C. Microprism.	
D. Cross hair.	
E. Microprism / split image.	

Also available was a checked overlay screen for mounting between the focusing screen and the finder.

7.3.1 Changing screens

The screen release catch is to the rear of the screen, and the screen frame hinges up at the front. The screen is positioned into the revealed recess, the frame lowered, and secured.

8 Sheet film back

8.1 Single Exposure Backs

There appears to have been at least three models. The original C2/C3 version (Model 1) and a later design that was used with the C22/C33 (Model 2 for C22/C33, rubber 'M' covering) and the C330/C330f (Model 2 for C330, leatherette covering). This last design came in two versions differing in the attachment to the camera body (the C33 and C330 backs have different hinging mechanisms). The C220, and C220f have fixed backs, and do not take a sheet film attachment. The C330s back is removable, but no alternatives to the standard back are known at this time.

It appears that the holders for the Model 2 variants are not compatible. The C330 version has two registration pins that match recesses in the film holders. So you can use late film holders in early Model 2 backs, but not vice versa, unless you are prepared to remove the

registration pins by filing to allow the holder to seat and the back to be closed. This may reduce the precision with which a holder can be replaced for multiple exposures. Mamiya instructions for the late variant of the Model 2 mentions that new holders are backwardly compatible, but not that the older holders will not fit.

The Model 1 accepted holders that slid in from the bottom. It has the advantage that the camera will sit level on a flat surface, as the back does not project below the base of these cameras.

The later version (both camera types) used a hinged back.

Both Models require some clearance at the back of the camera when used on a tripod or copy stand. The Model 1 needs at least the length of the holder, while the Model 2 is less demanding in this respect.

Two film sheath sizes are quoted: Type J for one-quarter of 4.75" x 6.25" sheet film, Type D for 2.5" x 3.5" (6 x 9cm) sheet film. These days this usually means cutting down 9x12 cm or similar sheet film. The Type D was the normal size. Holders with factory inscribed numbers from 1-3 have been seen.

Back	Cameras	Film holders
Model 1	C, C2, C3, C22, C33	Model 1
Model 2 (C22/C33)	C, C2, C3, C22, C33	Model 2 (both early and late (C330) types)
Model 2 (C330, C330f)	C330, C330f	Model 2 (late C330 type)

8.2 Polaroid film

The film backs are for cut sheet film, and do *not* accept Polaroid film. Given the location of the film plane relative to the camera back, it might be possible to manufacture a fibre-optic type back, but the cost would be more than an entire camera outfit. Because the cameras do not have mid-roll film exchange (a function of magazine backs), it would still be necessary to have two bodies.

There are two known examples of user modifications to accept a fixed Polaroid back, at the expense of infinity focus with shorter focal lengths. See the C330f Polaroid description (<http://CameraQuest.com/m330pol.htm>).

A project to develop a removable back for a C33 body is being pursued using a spare back. This version works with longer focal lengths if a manual focus plane adjustment is used. Details will be added as they come available.

9 Accessories and Conversions - Third-party and adaptations

9.1 Beattie focusing screens

Known to have been manufactured for the C220, C330, C330f, and C330s models. It is understood that they do not have the exposure compensation scale (see section 6.4 for a finder insert), though potential purchasers are advised to confirm this with the manufacturer.

9.2 Cokin filter mount

A mounting for Cokin P series filters has been designed. For further information see Photon magazine (<http://www.photonpub.co.uk/photon/>), August 1996 issue (This site may be defunct or under re-construction (June '98) ? Icon Publications do not appear to be publishing Photon at this time.). At the time of writing the compiler of this summary has no personal knowledge of this item, or current availability. June 1998: The designer / manufacturer does not appear to be reachable.

9.3 Brightscreens

Screens are listed for the C330, C330f, and C330s. See <http://www.brightscreen.com/> (<http://www.brightscreen.com/>) for details.

9.4 Other finders

At least one example is known of a C330 with a 45 degree prism (a Kiev 88 part?) fitted. It appears to have been a permanent fixture to the focusing screen. 45 degree prism finder ([jpg/45pfind.jpg](http://www.brightscreen.com/)).

A commercial implementation of this idea can be seen at the Kiev prism conversion at Baierfoto (<http://www.baierfoto.de/mameng.html>). This company offers custom adapted 45 degree prisms in both metered and non-metered versions. It is also removable. The 45 degree angle of the eyepiece makes these finders something between a chimney and a conventional pentaprism in use. Keeping the camera at chest height should improve stability and handling compared to the pentaprism for most people.

9.5 Maxwell screens

Alternative screens can be obtained from Maxwell Precision Optics, (404) 244-0095 (United States of America).

9.6 Long roll Mamiyaflexes

At least two of these are known to exist. They consist of a large film magazine to hold 70mm (?) film mated to a Mamiya TLR body. The lens in both examples was a 135mm, and one had a self-cocking shutter installed. The film is motor-driven through the camera. These appear to be non-commercial conversions. The nearest similar equipment would be the Hulcher cameras and some of the military bomb-bay cameras. These could take 100 feet of film and expose at around 8-10 frames per second. About 480 frames in under one minute. The Mamiya conversions would appear to be similar. The TLR design would be a good choice – most of the advantages of a single lens reflex, but no mirror to move.

9.7 Sekonic L-208 light meter mounting

This is a nice item about mounting the basic Sekonic L-208 lightmeter to a Mamiya TLR using the meter's supplied flash shoe foot. The article at <http://silvergrain.org/Photo-Tech/TLR-meter.html> also discusses the Gossen Digisix and Cosina VC meters.

10 Data Tables

10.0 Introduction

Note that you will require a browser with **table-handling capabilities** to make much sense of this section. The general Depth of Field tables have been calculated with a circle of confusion of 0.04578mm. This is the 1/1730 of the format diagonal as used by Sinar, amongst others. It is slightly smaller than the common 0.06 or 0.075 mm value. The close-up tables have been calculated to the finer tolerance of 0.0254mm.

In the Depth of Field Tables, 'Infinity' was calculated at 2,200 feet. This somewhat arbitrary figure was dictated by the 250mm lens. The total depth of field section of each table reports infinity where the further limit is undefined. No correction for nodal position has been attempted, so these tables should be verified by experiment before undertaking critical work.

$$\text{Depth forward of plane of focus} = \frac{c \times A \times s \times (s - f)}{f \times f + c \times A \times (s - f)}$$

$$\text{Depth behind plane of focus} = \frac{c \times A \times s \times (s - f)}{f \times f - c \times A \times (s - f)}$$

where c is the circle of confusion, A is the aperture stop, f is the focal length, s is the subject distance.

For a complete description of this formula, see the page on <http://oh114.wpi.edu/~nsushkin/dof.html> "Depth of Field Calculation by Nicholas Sushkin. There are alternative formulae available, however at present these tables seem sufficiently accurate for practical work, given the limited precision of the camera focus scales. These formulae do not appear to take diffraction into account. Diffraction has the effect of increasing the Circle of Confusion at small physical apertures, and reducing effective depth of field. Note that the Close-up Tables are taken from the reference cited, and are (probably) not obtained using these formulae.

[*Compiler's Note*: The tables are in Feet and Inches for purely selfish reasons - that's how my camera is calibrated!

For those who prefer something less cumbersome than tables, I have produced a program that draws a Depth of Field Calculator ([calc1.ps](#)) using the formulae given above. The prototype looks promising. It takes the form of a double-sided dial calculator with the three widest lenses on one side, and the four longer lenses on the other. It is produced using a PostScript program with either a PostScript printer or a suitable interpreter and printer combination, and the images stuck to card or plastic discs. It is 12cm in diameter (Compact Disc size), which is a compromise between resolution and compactness. And yes, it can be modified for any focal length and circle of confusion, within reason. An alternative version of the [calc1.pdf](#) in PDF is also available.

For an alternative depth of field calculator that uses **0.06mm circle of confusion** for 6x6, see the <http://people.smu.edu/rmonagha/mf/brondof.html> Javascript DOF calculator on the Bronica pages.

10.1 Close-up Depth of Field Tables

At close distances, depth of field is a function of magnification, rather than focal length. These tables are applicable to all lenses capable of these reproduction ratios. 0.001in. is approximately 0.0254mm.

Depth of Field in Inches and decimal fractions for scale of reproduction (after Reynolds)

Aperture	0.1 (1:10)	0.17 (1:6)	0.25 (1:4)	0.5 (1:2)	1 (1:1)
f2.8	0.31	0.12	0.056	0.017	0.0056
f4	0.44	0.17	0.08	0.024	0.008
f5.6	0.62	0.23	0.11	0.034	0.011
f8	0.88	0.34	0.16	0.048	0.016
f11	1.21	0.46	0.22	0.066	0.022
f16	1.76	0.67	0.32	0.096	0.032
f22	2.42	0.92	0.44	0.13	0.044
f32	3.5	1.34	0.64	0.19	0.064
f45	4.9	1.90	0.90	0.27	0.090

Circle of Confusion 0.001 in. Values given are the field in front or behind the plane of focus. Double them for total field.

Depth of Field in Millimetres for scale of reproduction (after Reynolds)

Aperture	0.1 (1:10)	0.17 (1:6)	0.25 (1:4)	0.5 (1:2)	1 (1:1)
f2.8	7.75	3	1.4	0.425	0.14
f4	11	4.25	2	0.6	0.2
f5.6	15.5	5.75	2.75	0.85	0.275
f8	22	8.5	4	1.2	0.4
f11	30.25	11.5	5.5	1.65	0.55
f16	44	16.75	8	2.4	0.8
f22	60.5	23	11	3.25	1.1
f32	87.5	33.5	16	4.75	1.6
f45	122.5	47.5	22.5	6.75	2.25

Circle of Confusion 0.001 in. Values given are the field in front or behind the plane of focus. Double them for total field.

10.2 Depth of Field Table, 55mm

First Section: Near limit of acceptable focus, Second Section: Far limit of acceptable focus, Third Section: Total Depth of Field Values are in *Feet and Inches*.

Near limit															
Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
4.5	47' 3"	18' 7"	11' 6"	8' 4"	6' 2"	5' 4"	4' 7"	3' 8"	3' 3"	2' 10"	1' 11"	1' 8"	1' 6"	1' 3"	1
5.6	38' 2"	17	10' 10"	8	5' 11"	5' 3"	4' 5"	3' 8"	3' 3"	2' 10"	1' 11"	1' 8"	1' 5"	1' 3"	1
8	26' 10"	14' 4"	9' 8"	7' 4"	5' 7"	4' 11"	4' 3"	3' 6"	3' 1"	2' 9"	1' 10"	1' 8"	1' 5"	1' 2"	1
11	19' 7"	11' 11"	8' 7"	6' 8"	5' 2"	4' 8"	4	3' 4"	3	2' 8"	1' 10"	1' 7"	1' 5"	1' 2"	1
16	13' 6"	9' 5"	7' 2"	5' 10"	4' 8"	4' 2"	3' 8"	3' 1"	2' 10"	2' 6"	1' 9"	1' 7"	1' 4"	1' 2"	' 11"
22	9' 10"	7' 6"	6	5	4' 2"	3' 9"	3' 4"	2' 11"	2' 7"	2' 4"	1' 8"	1' 6"	1' 4"	1' 2"	' 11"
Far limit															
Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
4.5	Inf.	78' 5"	21' 8"	12' 7"	8' 2"	6' 10"	5' 7"	4' 4"	3' 9"	3' 2"	2' 1"	1' 10"	1' 7"	1' 3"	1
5.6	Inf.	129' 5"	24' 3"	13' 5"	8' 6"	7' 1"	5' 9"	4' 5"	3' 10"	3' 3"	2' 1"	1' 10"	1' 7"	1' 3"	1
8	Inf.	Inf.	33	15' 8"	9' 4"	7' 8"	6' 1"	4' 8"	4	3' 4"	2' 2"	1' 10"	1' 7"	1' 4"	1
11	Inf.	Inf.	60	19' 11"	10' 8"	8' 6"	6' 7"	4' 11"	4' 2"	3' 6"	2' 2"	1' 11"	1' 7"	1' 4"	1' 1"
16	Inf.	Inf.	Inf.	36' 1"	14' 1"	10' 6"	7' 9"	5' 7"	4' 8"	3' 9"	2' 4"	2	1' 8"	1' 4"	1' 1"
22	Inf.	Inf.	Inf.	1623' 11"	22' 7"	14' 7"	9' 9"	6' 6"	5' 3"	4' 2"	2' 5"	2' 1"	1' 9"	1' 5"	1' 1"
Total Depth of field															
Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
4.5	Inf.	59' 10"	10' 2"	4' 3"	2	1' 6"	1	' 8"	' 6"	' 4"	' 2"	' 1"	' 1"	' 1"	0
5.6	Inf.	112' 6"	13' 5"	5' 5"	2' 6"	1' 10"	1' 3"	' 10"	' 7"	' 5"	' 2"	' 2"	' 1"	' 1"	' 1"
8	Inf.	Inf.	23' 4"	8' 4"	3' 9"	2' 8"	1' 10"	1' 2"	' 10"	' 8"	' 3"	' 2"	' 2"	' 1"	' 1"
11	Inf.	Inf.	51' 5"	13' 2"	5' 6"	3' 10"	2' 7"	1' 7"	1' 3"	' 10"	' 4"	' 3"	' 2"	' 2"	' 1"
16	Inf.	Inf.	Inf.	30' 3"	9' 5"	6' 4"	4' 1"	2' 5"	1' 10"	1' 4"	' 7"	' 5"	' 4"	' 2"	' 1"
22	Inf.	Inf.	Inf.	1618' 11"	18' 5"	10' 10"	6' 5"	3' 8"	2' 8"	1' 10"	' 9"	' 7"	' 5"	' 3"	' 2"

10.3 Depth of Field Table, 65mm

First Section: Near limit of acceptable focus, Second Section: Far limit of acceptable focus, Third Section: Total Depth of Field Values are in *Feet and Inches*.

Near Limit Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
3.5	83' 5"	22' 4"	12' 10"	9	6' 6"	5' 7"	4' 9"	3' 10"	3' 4"	2' 11"	2	1' 9"	1' 6"	1' 3"	1
4	73' 4"	21' 7"	12' 7"	8' 10"	6' 5"	5' 7"	4' 8"	3' 10"	3' 4"	2' 11"	1' 11"	1' 9"	1' 6"	1' 3"	1
4.5	65' 6"	20' 10"	12' 4"	8' 9"	6' 4"	5' 6"	4' 8"	3' 9"	3' 4"	2' 11"	1' 11"	1' 9"	1' 6"	1' 3"	1
5.6	52' 11"	19' 4"	11' 9"	8' 6"	6' 3"	5' 5"	4' 7"	3' 9"	3' 4"	2' 10"	1' 11"	1' 8"	1' 6"	1' 3"	1
8	37' 4"	16' 10"	10' 10"	7' 11"	5' 11"	5' 2"	4' 5"	3' 8"	3' 3"	2' 10"	1' 11"	1' 8"	1' 5"	1' 3"	1
11	27' 3"	14' 5"	9' 9"	7' 5"	5' 7"	5	4' 3"	3' 6"	3' 2"	2' 9"	1' 11"	1' 8"	1' 5"	1' 2"	1
16	18' 10"	11' 8"	8' 5"	6' 7"	5' 2"	4' 7"	4	3' 4"	3	2' 7"	1' 10"	1' 7"	1' 5"	1' 2"	1
22	13' 9"	9' 6"	7' 3"	5' 10"	4' 8"	4' 3"	3' 9"	3' 2"	2' 10"	2' 6"	1' 9"	1' 7"	1' 4"	1' 2"	1' 1"
32	9' 5"	7' 3"	5' 10"	4' 11"	4' 1"	3' 9"	3' 4"	2' 10"	2' 7"	2' 4"	1' 8"	1' 6"	1' 4"	1' 2"	1' 1"
Far Limit Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
3.5	Inf.	45' 8"	18' 1"	11' 3"	7' 7"	6' 5"	5' 4"	4' 2"	3' 8"	3' 1"	2' 1"	1' 9"	1' 6"	1' 3"	1
4	Inf.	49' 5"	18' 8"	11' 6"	7' 8"	6' 6"	5' 4"	4' 3"	3' 8"	3' 1"	2' 1"	1' 9"	1' 6"	1' 3"	1
4.5	Inf.	53' 9"	19' 3"	11' 8"	7' 9"	6' 7"	5' 5"	4' 3"	3' 8"	3' 2"	2' 1"	1' 9"	1' 6"	1' 3"	1
5.6	Inf.	66' 7"	20' 8"	12' 2"	8	6' 9"	5' 6"	4' 4"	3' 9"	3' 2"	2' 1"	1' 10"	1' 6"	1' 3"	1
8	Inf.	139' 6"	24' 7"	13' 6"	8' 6"	7' 1"	5' 9"	4' 5"	3' 10"	3' 3"	2' 1"	1' 10"	1' 7"	1' 3"	1
11	Inf.	Inf.	32' 4"	15' 6"	9' 3"	7' 7"	6' 1"	4' 8"	4	3' 4"	2' 2"	1' 10"	1' 7"	1' 4"	1
16	Inf.	Inf.	68	20' 8"	10' 11"	8' 8"	6' 8"	5	4' 3"	3' 6"	2' 2"	1' 11"	1' 7"	1' 4"	1' 1"
22	Inf.	Inf.	Inf.	34' 5"	13' 9"	10' 4"	7' 8"	5' 6"	4' 7"	3' 9"	2' 4"	2	1' 8"	1' 4"	1' 1"
32	Inf.	Inf.	Inf.	Inf.	24' 7"	15' 5"	10' 1"	6' 8"	5' 4"	4' 3"	2' 6"	2' 1"	1' 9"	1' 5"	1' 1"
Total Depth of Field Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
3.5	Inf.	23' 4"	5' 3"	2' 3"	1' 1"	1' 10"	7"	4"	3"	2"	1"	1"	1"	0	0
4	Inf.	27' 10"	6' 1"	2' 7"	1' 3"	1' 11"	8"	5"	4"	3"	1"	1"	1"	0	0
4.5	Inf.	32' 11"	6' 11"	3	1' 5"	1	9"	5"	4"	3"	1"	1"	1"	0	0
5.6	Inf.	47' 3"	8' 10"	3' 9"	1' 9"	1' 4"	1' 11"	7"	5"	4"	2"	1"	1"	1"	0
8	Inf.	122' 8"	13' 9"	5' 6"	2' 7"	1' 10"	1' 3"	1' 10"	7"	5"	2"	2"	1"	1"	0
11	Inf.	Inf.	22' 7"	8' 1"	3' 8"	2' 8"	1' 9"	1' 1"	1' 10"	7"	3"	2"	2"	1"	1"
16	Inf.	Inf.	59' 6"	14' 1"	5' 9"	4	2' 8"	1' 8"	1' 3"	11"	5"	3"	2"	2"	1"
22	Inf.	Inf.	Inf.	28' 6"	9' 1"	6' 1"	3' 11"	2' 4"	1' 9"	1' 3"	6"	5"	3"	2"	1"
32	Inf.	Inf.	Inf.	Inf.	20' 6"	11' 8"	6' 9"	3' 10"	2' 9"	1' 11"	9"	7"	5"	3"	2"

10.4 Depth of Field Table, 80mm

First Section: Near limit of acceptable focus, Second Section: Far limit of acceptable focus, Third Section: Total Depth of Field Values are in *Feet and Inches*.

Near Limit Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
2.8	152' 10"	25' 5"	13' 9"	9' 5"	6' 9"	5' 10"	4' 10"	3' 11"	3' 5"	2' 11"	2	1' 9"	1' 6"	1' 3"	1
3.5	124	24' 6"	13' 6"	9' 4"	6' 8"	5' 9"	4' 10"	3' 11"	3' 5"	2' 11"	2	1' 9"	1' 6"	1' 3"	1
4	109' 3"	23' 10"	13' 4"	9' 3"	6' 7"	5' 9"	4' 10"	3' 10"	3' 5"	2' 11"	2	1' 9"	1' 6"	1' 3"	1
4.5	97' 8"	23' 3"	13' 1"	9' 2"	6' 7"	5' 8"	4' 9"	3' 10"	3' 5"	2' 11"	2	1' 9"	1' 6"	1' 3"	1
5.6	79' 2"	22	12' 9"	8' 11"	6' 6"	5' 7"	4' 9"	3' 10"	3' 4"	2' 11"	2	1' 9"	1' 6"	1' 3"	1
8	56	19' 9"	11' 11"	8' 7"	6' 3"	5' 5"	4' 7"	3' 9"	3' 4"	2' 10"	1' 11"	1' 8"	1' 6"	1' 3"	1
11	41	17' 6"	11' 1"	8' 1"	6	5' 3"	4' 6"	3' 8"	3' 3"	2' 10"	1' 11"	1' 8"	1' 5"	1' 3"	1
16	28' 4"	14' 9"	9' 11"	7' 6"	5' 8"	5	4' 4"	3' 6"	3' 2"	2' 9"	1' 11"	1' 8"	1' 5"	1' 3"	1
22	20' 9"	12' 5"	8' 10"	6' 10"	5' 4"	4' 8"	4' 1"	3' 5"	3	2' 8"	1' 10"	1' 8"	1' 5"	1' 2"	1
Far Limit Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
2.8	Inf.	36' 8"	16' 6"	10' 8"	7' 4"	6' 3"	5' 2"	4' 1"	3' 7"	3' 1"	2	1' 9"	1' 6"	1' 3"	1
3.5	Inf.	38' 9"	16' 11"	10' 10"	7' 5"	6' 3"	5' 2"	4' 1"	3' 7"	3' 1"	2	1' 9"	1' 6"	1' 3"	1
4	Inf.	40' 6"	17' 2"	10' 11"	7' 5"	6' 4"	5' 3"	4' 2"	3' 7"	3' 1"	2	1' 9"	1' 6"	1' 3"	1
4.5	Inf.	42' 4"	17' 6"	11' 1"	7' 6"	6' 4"	5' 3"	4' 2"	3' 7"	3' 1"	2	1' 9"	1' 6"	1' 3"	1
5.6	Inf.	47	18' 3"	11' 4"	7' 8"	6' 5"	5' 4"	4' 2"	3' 8"	3' 1"	2' 1"	1' 9"	1' 6"	1' 3"	1
8	Inf.	62' 2"	20' 2"	12	7' 11"	6' 8"	5' 5"	4' 3"	3' 9"	3' 2"	2' 1"	1' 10"	1' 6"	1' 3"	1
11	Inf.	103' 11"	23' 2"	13	8' 4"	6' 11"	5' 8"	4' 5"	3' 10"	3' 3"	2' 1"	1' 10"	1' 7"	1' 3"	1
16	Inf.	Inf.	30' 9"	15' 1"	9' 2"	7' 6"	6	4' 7"	3' 11"	3' 4"	2' 2"	1' 10"	1' 7"	1' 4"	1
22	Inf.	Inf.	50' 10"	18' 9"	10' 4"	8' 3"	6' 6"	4' 10"	4' 2"	3' 5"	2' 2"	1' 11"	1' 7"	1' 4"	1
Total Depth of Field Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
2.8	Inf.	11' 3"	2' 9"	1' 2"	' 7"	' 5"	' 3"	' 2"	' 2"	' 1"	' 1"	0	0	0	0
3.5	Inf.	14' 4"	3' 5"	1' 6"	' 9"	' 6"	' 4"	' 3"	' 2"	' 2"	' 1"	0	0	0	0
4	Inf.	16' 8"	3' 11"	1' 8"	' 10"	' 7"	' 5"	' 3"	' 2"	' 2"	' 1"	' 1"	0	0	0
4.5	Inf.	19' 1"	4' 5"	1' 11"	' 11"	' 8"	' 6"	' 4"	' 3"	' 2"	' 1"	' 1"	0	0	0
5.6	Inf.	25	5' 7"	2' 5"	1' 2"	' 10"	' 7"	' 4"	' 3"	' 2"	' 1"	' 1"	' 1"	0	0
8	Inf.	42' 5"	8' 3"	3' 6"	1' 8"	1' 3"	' 10"	' 6"	' 5"	' 3"	' 1"	' 1"	' 1"	' 1"	0
11	Inf.	86' 5"	12' 1"	4' 11"	2' 4"	1' 8"	1' 2"	' 9"	' 7"	' 5"	' 2"	' 1"	' 1"	' 1"	0
16	Inf.	Inf.	20' 10"	7' 8"	3' 6"	2' 6"	1' 8"	1' 1"	' 10"	' 7"	' 3"	' 2"	' 2"	' 1"	' 1"
22	Inf.	Inf.	42' 1"	11' 11"	5	3' 7"	2' 5"	1' 6"	1' 1"	' 10"	' 4"	' 3"	' 2"	' 1"	' 1"

10.5 Depth of Field Table, 105mm

First Section: Near limit of acceptable focus, Second Section: Far limit of acceptable focus, Third Section: Total Depth of Field Values are in *Feet and Inches*.

Near Limit Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
3.5	205' 3"	26' 6"	14' 1"	9' 7"	6' 10"	5' 10"	4' 11"	3' 11"	3' 5"	3	2	1' 9"	1' 6"	1' 3"	1
4	181' 9"	26' 1"	14	9' 6"	6' 9"	5' 10"	4' 11"	3' 11"	3' 5"	3	2	1' 9"	1' 6"	1' 3"	1
4.5	163	25' 8"	13' 10"	9' 6"	6' 9"	5' 10"	4' 10"	3' 11"	3' 5"	2' 11"	2	1' 9"	1' 6"	1' 3"	1
5.6	132' 11"	24' 10"	13' 7"	9' 4"	6' 8"	5' 9"	4' 10"	3' 11"	3' 5"	2' 11"	2	1' 9"	1' 6"	1' 3"	1
8	94' 9"	23' 1"	13' 1"	9' 1"	6' 7"	5' 8"	4' 9"	3' 10"	3' 5"	2' 11"	2	1' 9"	1' 6"	1' 3"	1
11	69' 9"	21' 3"	12' 6"	8' 10"	6' 5"	5' 7"	4' 8"	3' 10"	3' 4"	2' 11"	1' 11"	1' 9"	1' 6"	1' 3"	1
16	48' 5"	18' 9"	11' 7"	8' 4"	6' 2"	5' 5"	4' 7"	3' 9"	3' 3"	2' 10"	1' 11"	1' 8"	1' 6"	1' 3"	1
22	35' 5"	16' 5"	10' 8"	7' 11"	5' 11"	5' 2"	4' 5"	3' 8"	3' 3"	2' 10"	1' 11"	1' 8"	1' 5"	1' 3"	1
32	24' 6"	13' 8"	9' 5"	7' 2"	5' 6"	4' 11"	4' 3"	3' 6"	3' 1"	2' 9"	1' 10"	1' 8"	1' 5"	1' 2"	1
Far Limit Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
3.5	Inf.	34' 6"	16	10' 5"	7' 3"	6' 2"	5' 1"	4' 1"	3' 7"	3	2	1' 9"	1' 6"	1' 3"	1
4	Inf.	35' 3"	16' 2"	10' 6"	7' 3"	6' 2"	5' 1"	4' 1"	3' 7"	3	2	1' 9"	1' 6"	1' 3"	1
4.5	Inf.	36' 1"	16' 4"	10' 7"	7' 3"	6' 2"	5' 2"	4' 1"	3' 7"	3' 1"	2	1' 9"	1' 6"	1' 3"	1
5.6	Inf.	37' 11"	16' 9"	10' 9"	7' 4"	6' 3"	5' 2"	4' 1"	3' 7"	3' 1"	2	1' 9"	1' 6"	1' 3"	1
8	Inf.	42' 10"	17' 7"	11' 1"	7' 6"	6' 4"	5' 3"	4' 2"	3' 7"	3' 1"	2	1' 9"	1' 6"	1' 3"	1
11	Inf.	51	18' 10"	11' 7"	7' 9"	6' 6"	5' 4"	4' 3"	3' 8"	3' 1"	2' 1"	1' 9"	1' 6"	1' 3"	1
16	Inf.	74' 10"	21' 4"	12' 5"	8' 1"	6' 9"	5' 6"	4' 4"	3' 9"	3' 2"	2' 1"	1' 10"	1' 6"	1' 3"	1
22	Inf.	170	25' 4"	13' 8"	8' 7"	7' 1"	5' 9"	4' 5"	3' 10"	3' 3"	2' 1"	1' 10"	1' 7"	1' 3"	1
32	Inf.	Inf.	36' 9"	16' 5"	9' 7"	7' 9"	6' 2"	4' 8"	4	3' 4"	2' 2"	1' 10"	1' 7"	1' 4"	1
Total Depth of Field Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
3.5	Inf.	8	1' 11"	' 10"	' 5"	' 4"	' 2"	' 2"	' 1"	' 1"	0	0	0	0	0
4	Inf.	9' 2"	2' 3"	1	' 6"	' 4"	' 3"	' 2"	' 1"	' 1"	0	0	0	0	0
4.5	Inf.	10' 5"	2' 6"	1' 1"	' 6"	' 5"	' 3"	' 2"	' 2"	' 1"	0	0	0	0	0
5.6	Inf.	13' 2"	3' 2"	1' 4"	' 8"	' 6"	' 4"	' 2"	' 2"	' 1"	' 1"	0	0	0	0
8	Inf.	19' 9"	4' 6"	2	' 11"	' 8"	' 6"	' 4"	' 3"	' 2"	' 1"	' 1"	0	0	0
11	Inf.	29' 9"	6' 4"	2' 9"	1' 4"	' 11"	' 8"	' 5"	' 4"	' 3"	' 1"	' 1"	' 1"	0	0
16	Inf.	56	9' 9"	4' 1"	1' 11"	1' 5"	' 11"	' 7"	' 5"	' 4"	' 2"	' 1"	' 1"	' 1"	0
22	Inf.	153' 7"	14' 8"	5' 9"	2' 8"	1' 11"	1' 4"	' 10"	' 7"	' 5"	' 2"	' 2"	' 1"	' 1"	0
32	Inf.	Inf.	27' 4"	9' 2"	4' 1"	2' 11"	1' 11"	1' 2"	' 11"	' 8"	' 3"	' 2"	' 2"	' 1"	' 1"

10.6 Depth of Field Table, 135mm

First Section: Near limit of acceptable focus, Second Section: Far limit of acceptable focus, Third Section: Total Depth of Field Values are in *Feet and Inches*.

Near Limit															
Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
4.5	257' 1"	27' 3"	14' 3"	9' 8"	6' 10"	5' 11"	4' 11"	3' 11"	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
5.6	211' 5"	26' 8"	14' 1"	9' 7"	6' 10"	5' 10"	4' 11"	3' 11"	3' 5"	3	2	1' 9"	1' 6"	1' 3"	1
8	152' 5"	25' 5"	13' 9"	9' 5"	6' 9"	5' 10"	4' 10"	3' 11"	3' 5"	2' 11"	2	1' 9"	1' 6"	1' 3"	1
11	113	24	13' 4"	9' 3"	6' 8"	5' 9"	4' 10"	3' 11"	3' 5"	2' 11"	2	1' 9"	1' 6"	1' 3"	1
16	78' 11"	22	12' 9"	8' 11"	6' 6"	5' 7"	4' 9"	3' 10"	3' 4"	2' 11"	2	1' 9"	1' 6"	1' 3"	1
22	58	20' 1"	12' 1"	8' 7"	6' 4"	5' 6"	4' 8"	3' 9"	3' 4"	2' 11"	1' 11"	1' 9"	1' 6"	1' 3"	1
32	40' 2"	17' 5"	11' 1"	8' 1"	6	5' 3"	4' 6"	3' 8"	3' 3"	2' 10"	1' 11"	1' 8"	1' 6"	1' 3"	1
45	28' 9"	14' 11"	10	7' 6"	5' 9"	5	4' 4"	3' 7"	3' 2"	2' 9"	1' 11"	1' 8"	1' 5"	1' 3"	1
Far limit															
Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
4.5	Inf.	33' 5"	15' 9"	10' 4"	7' 2"	6' 1"	5' 1"	4' 1"	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
5.6	Inf.	34' 4"	16	10' 5"	7' 2"	6' 2"	5' 1"	4' 1"	3' 7"	3	2	1' 9"	1' 6"	1' 3"	1
8	Inf.	36' 7"	16' 6"	10' 7"	7' 4"	6' 3"	5' 2"	4' 1"	3' 7"	3' 1"	2	1' 9"	1' 6"	1' 3"	1
11	Inf.	39' 11"	17' 1"	10' 10"	7' 5"	6' 4"	5' 2"	4' 1"	3' 7"	3' 1"	2	1' 9"	1' 6"	1' 3"	1
16	Inf.	46' 11"	18' 3"	11' 4"	7' 7"	6' 5"	5' 4"	4' 2"	3' 8"	3' 1"	2	1' 9"	1' 6"	1' 3"	1
22	Inf.	59' 7"	19' 10"	11' 11"	7' 10"	6' 7"	5' 5"	4' 3"	3' 8"	3' 2"	2' 1"	1' 9"	1' 6"	1' 3"	1
32	Inf.	108	23' 3"	13' 1"	8' 4"	6' 11"	5' 8"	4' 5"	3' 9"	3' 2"	2' 1"	1' 10"	1' 6"	1' 3"	1
45	Inf.	Inf.	30	14' 11"	9	7' 5"	5' 11"	4' 7"	3' 11"	3' 3"	2' 1"	1' 10"	1' 7"	1' 3"	1
Total Depth of Field															
Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
4.5	Inf.	6' 2"	1' 6"	' 8"	' 4"	' 3"	' 2"	' 1"	' 1"	' 1"	0	0	0	0	0
5.6	Inf.	7' 8"	1' 10"	' 10"	' 5"	' 3"	' 2"	' 1"	' 1"	' 1"	0	0	0	0	0
8	Inf.	11' 2"	2' 8"	1' 2"	' 7"	' 5"	' 3"	' 2"	' 2"	' 1"	0	0	0	0	0
11	Inf.	15' 10"	3' 9"	1' 7"	' 9"	' 7"	' 5"	' 3"	' 2"	' 2"	' 1"	0	0	0	0
16	Inf.	24' 11"	5' 6"	2' 4"	1' 2"	' 10"	' 7"	' 4"	' 3"	' 2"	' 1"	' 1"	0	0	0
22	Inf.	39' 6"	7' 10"	3' 4"	1' 7"	1' 2"	' 9"	' 6"	' 4"	' 3"	' 1"	' 1"	' 1"	0	0
32	Inf.	90' 7"	12' 3"	4' 11"	2' 4"	1' 8"	1' 2"	' 8"	' 6"	' 5"	' 2"	' 1"	' 1"	' 1"	0
45	Inf.	Inf.	20	7' 4"	3' 4"	2' 5"	1' 7"	1	' 9"	' 6"	' 3"	' 2"	' 1"	' 1"	0

10.7 Depth of Field Table, 180mm

First Section: Near limit of acceptable focus, Second Section: Far limit of acceptable focus, Third Section: Total Depth of Field Values are in *Feet and Inches*.

Near Limit															
Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
4.5	418' 11"	28' 5"	14' 7"	9' 10"	6' 11"	5' 11"	4' 11"	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
5.6	349' 9"	28	14' 6"	9' 9"	6' 11"	5' 11"	4' 11"	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
8	257' 1"	27' 3"	14' 4"	9' 8"	6' 10"	5' 11"	4' 11"	3' 11"	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
11	193' 1"	26' 4"	14' 1"	9' 7"	6' 10"	5' 10"	4' 11"	3' 11"	3' 5"	3	2	1' 9"	1' 6"	1' 3"	1
16	136' 6"	24' 11"	13' 8"	9' 5"	6' 8"	5' 9"	4' 10"	3' 11"	3' 5"	2' 11"	2	1' 9"	1' 6"	1' 3"	1
22	101	23' 6"	13' 2"	9' 2"	6' 7"	5' 8"	4' 10"	3' 11"	3' 5"	2' 11"	2	1' 9"	1' 6"	1' 3"	1
32	70' 5"	21' 4"	12' 6"	8' 10"	6' 5"	5' 7"	4' 9"	3' 10"	3' 4"	2' 11"	2	1' 9"	1' 6"	1' 3"	1
45	50' 7"	19' 2"	11' 9"	8' 6"	6' 3"	5' 5"	4' 7"	3' 9"	3' 4"	2' 10"	1' 11"	1' 9"	1' 6"	1' 3"	1
Far Limit															
Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
4.5	Inf.	31' 10"	15' 5"	10' 2"	7' 1"	6' 1"	5' 1"	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
5.6	Inf.	32' 3"	15' 6"	10' 3"	7' 1"	6' 1"	5' 1"	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
8	Inf.	33' 4"	15' 9"	10' 4"	7' 2"	6' 1"	5' 1"	4' 1"	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
11	Inf.	34' 10"	16' 1"	10' 6"	7' 3"	6' 2"	5' 1"	4' 1"	3' 7"	3	2	1' 9"	1' 6"	1' 3"	1
16	Inf.	37' 7"	16' 8"	10' 8"	7' 4"	6' 3"	5' 2"	4' 1"	3' 7"	3' 1"	2	1' 9"	1' 6"	1' 3"	1
22	Inf.	41' 7"	17' 4"	11	7' 5"	6' 4"	5' 3"	4' 2"	3' 7"	3' 1"	2	1' 9"	1' 6"	1' 3"	1
32	Inf.	50' 4"	18' 8"	11' 6"	7' 8"	6' 6"	5' 4"	4' 2"	3' 8"	3' 1"	2	1' 9"	1' 6"	1' 3"	1
45	Inf.	69' 6"	20' 9"	12' 3"	8	6' 8"	5' 6"	4' 3"	3' 9"	3' 2"	2' 1"	1' 9"	1' 6"	1' 3"	1
Total Depth of Field															
Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
4.5	Inf.	3' 5"	' 10"	' 4"	' 2"	' 2"	' 1"	' 1"	0	0	0	0	0	0	0
5.6	Inf.	4' 3"	1	' 5"	' 3"	' 2"	' 1"	' 1"	' 1"	0	0	0	0	0	0
8	Inf.	6' 2"	1' 6"	' 8"	' 4"	' 3"	' 2"	' 1"	' 1"	' 1"	0	0	0	0	0
11	Inf.	8' 6"	2' 1"	' 11"	' 5"	' 4"	' 3"	' 2"	' 1"	' 1"	0	0	0	0	0
16	Inf.	12' 8"	3	1' 4"	' 7"	' 5"	' 4"	' 2"	' 2"	' 1"	0	0	0	0	0
22	Inf.	18' 1"	4' 2"	1' 10"	' 10"	' 7"	' 5"	' 3"	' 2"	' 2"	' 1"	0	0	0	0
32	Inf.	29	6' 2"	2' 8"	1' 3"	' 11"	' 7"	' 5"	' 3"	' 2"	' 1"	' 1"	0	0	0
45	Inf.	50' 5"	9' 1"	3' 9"	1' 9"	1' 3"	' 10"	' 6"	' 5"	' 3"	' 1"	' 1"	' 1"	0	0

10.8 Depth of Field Table, 250mm

First Section: Near limit of acceptable focus, Second Section: Far limit of acceptable focus, Third Section: Total Depth of Field Values are in *Feet and Inches*.

Near Limit															
Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
6.3	538' 6"	28' 10"	14' 8"	9' 10"	6' 11"	5' 11"	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
8	447' 4"	28' 6"	14' 8"	9' 10"	6' 11"	5' 11"	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
11	344' 6"	28	14' 6"	9' 9"	6' 11"	5' 11"	4' 11"	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
16	249	27' 2"	14' 3"	9' 8"	6' 10"	5' 11"	4' 11"	3' 11"	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
22	186' 10"	26' 3"	14	9' 7"	6' 10"	5' 10"	4' 11"	3' 11"	3' 5"	3	2	1' 9"	1' 6"	1' 3"	1
32	132	24' 10"	13' 7"	9' 5"	6' 8"	5' 9"	4' 10"	3' 11"	3' 5"	2' 11"	2	1' 9"	1' 6"	1' 3"	1
45	95' 6"	23' 3"	13' 2"	9' 2"	6' 7"	5' 8"	4' 10"	3' 11"	3' 5"	2' 11"	2	1' 9"	1' 6"	1' 3"	1
64	68	21' 2"	12' 6"	8' 10"	6' 5"	5' 7"	4' 9"	3' 10"	3' 4"	2' 11"	2	1' 9"	1' 6"	1' 3"	1
Far Limit															
Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
6.3	Inf.	31' 3"	15' 4"	10' 2"	7' 1"	6' 1"	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
8	Inf.	31' 8"	15' 5"	10' 2"	7' 1"	6' 1"	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
11	Inf.	32' 4"	15' 6"	10' 3"	7' 1"	6' 1"	5' 1"	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
16	Inf.	33' 6"	15' 10"	10' 4"	7' 2"	6' 1"	5' 1"	4' 1"	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
22	Inf.	35	16' 1"	10' 6"	7' 3"	6' 2"	5' 1"	4' 1"	3' 7"	3	2	1' 9"	1' 6"	1' 3"	1
32	Inf.	37' 10"	16' 8"	10' 8"	7' 4"	6' 3"	5' 2"	4' 1"	3' 7"	3' 1"	2	1' 9"	1' 6"	1' 3"	1
45	Inf.	42' 5"	17' 6"	11	7' 6"	6' 4"	5' 3"	4' 2"	3' 7"	3' 1"	2	1' 9"	1' 6"	1' 3"	1
64	Inf.	51' 4"	18' 10"	11' 6"	7' 8"	6' 6"	5' 4"	4' 2"	3' 8"	3' 1"	2	1' 9"	1' 6"	1' 3"	1
Total Depth of Field															
Ft	2200	30	15	10	7	6	5	4	3' 6"	3	2	1' 9"	1' 6"	1' 3"	1
6.3	Inf.	2' 6"	' 7"	' 3"	' 1"	' 1"	' 1"	0	0	0	0	0	0	0	0
8	Inf.	3' 2"	' 9"	' 4"	' 2"	' 1"	' 1"	' 1"	0	0	0	0	0	0	0
11	Inf.	4' 4"	1' 1"	' 5"	' 3"	' 2"	' 1"	' 1"	' 1"	0	0	0	0	0	0
16	Inf.	6' 4"	1' 6"	' 8"	' 4"	' 3"	' 2"	' 1"	' 1"	' 1"	0	0	0	0	0
22	Inf.	8' 9"	2' 1"	' 11"	' 5"	' 4"	' 2"	' 1"	' 1"	' 1"	0	0	0	0	0
32	Inf.	13	3' 1"	1' 4"	' 7"	' 5"	' 4"	' 2"	' 2"	' 1"	0	0	0	0	0
45	Inf.	19' 2"	4' 4"	1' 10"	' 10"	' 7"	' 5"	' 3"	' 2"	' 2"	' 1"	0	0	0	0
64	Inf.	30' 2"	6' 4"	2' 8"	1' 3"	' 11"	' 7"	' 4"	' 3"	' 2"	' 1"	' 1"	0	0	0

10.9 Hyperfocal Distance Table

Hyperfocal Distance Table, for a Circle of Confusion of 0.04578mm. Values given in Feet and Inches. Note that not all combinations of apertures and focal lengths are possible with the lenses available. The zone of acceptable sharpness commences at approximately half the Hyperfocal Distance. So for the 250mm at f64 focused at 70' 2", the zone starts at about 35'. As with depth of field, what constitutes 'sharp' varies between individuals. As was noted in the introduction to the Depth of Field tables, diffraction may be significant at the smallest apertures. The camera cannot be set to this precision!

Ft	55	65	80	105	135	180	250
2.8	-	-	164' 3"	-	-	-	-
3.5	-	86' 9"	131' 5"	226' 4"	-	-	-
4	-	75' 11"	115'	198' 1"	-	-	-
4.5	48' 4"	67' 6"	102' 2"	176' 1"	291'	517' 4"	-
5.6	38' 10"	54' 3"	82' 1"	141' 6"	233' 10"	415' 9"	801' 11"
6.3	34' 6"	48' 2"	73'	125' 9"	207' 10"	369' 6"	712' 10"
8	27' 2"	37' 11"	57' 6"	99'	163' 8"	291'	561' 4"
11	19' 9"	27' 7"	41' 10"	72'	119' 1"	211' 8"	408' 3"
16	13' 7"	19'	28' 9"	49' 6"	81' 10"	145' 6"	280' 8"
22	9' 11"	13' 10"	20' 11"	36'	59' 6"	105' 10"	204' 2"
32	-	-	-	24' 9"	40' 11"	72' 9"	140' 4"
45	-	-	-	-	29' 1"	51' 9"	99' 10"
64	-	-	-	-	-	-	70' 2"

11 User hints

11.0 Introduction

This section is for personal experiences, and any miscellaneous items not noted elsewhere.

11.1 Weight

The earlier models are heavy when compared to other 6x6 cm interchangeable lens cameras. However, comparing a typical 3-lens system shows a slightly different story:

Table of system weights, typical 3 lens system

Lens	YashicaMat (non-metered)	Bronica SQA	Hass.CF	Mamiya 6	C33	C220	C330	C330s
50-60	-	*590	*680	+335	360	360	360	360
75-90	(fixed)	*490	*510	+250	365	365	365	365
150-180	-	*865	*1075	+480	640	640	640	640
Body	1105	*1010	*990	+890	1810	1150	1465	*1340
Total	1105	*2955	*3255	+1955	3175	2515	2830	2705

Weights are in grams. This is only a rough comparison. There are differences in maximum apertures, and the focal lengths are not exact matches. However, it suggests that there is little practical difference between the reflex models for a similar kit. The Mamiya 6 is a rangefinder model, the Bronica SQA and Hasselblad CF are single lens reflexes, and the YashicaMat is a fixed 80mm TLR. All are 6x6 cm format. * Estimated weight from published data. + Manufacturer's published data.

11.2 Lens caps

Rear lens caps are particularly hard to find, and substitutes even rarer. It may be worth contacting your national Mamiya representative directly, as there are some still available. The rear caps for the black series lenses are oblong with radiused ends. The inside of one end has a full circular rim that fits around a rear lens element. Two sizes are known:-

38.4mm diameter, 6mm deep (Long)

Fits 250mm, 180mm, and 135mm black series.

31mm diameter, 6mm deep (Standard)

Fits 105mm DS, 105mm non-DS, 80mm, 65mm, and 55mm black series. It will also fit the 65mm chrome and *probably* the other short chrome lenses.

It appears that the 35mm film cans used for Agfaortho 25 around 1992-94 will fit the 65mm and 105mm chrome lenses when cut down to around 15mm depth. Unfortunately this isn't true of current Kodak and Ilford cans.

The 'figure eight' front caps don't always fit well with filters in place. The older caps - pre-C33 - were metal, later ones were made of soft plastic. Standard clip fit-caps can be substituted, but they may need a flat sanded at a point on the circumference to provide clearance for the cap on the other lens. Pairs of caps can always be joined by a rigid bar or a cord.

Using stepping rings to standardise on 49mm filters usually means fitting new caps.

There are such things as body caps, though they are rare. This image of a "[gif/bodycap.gif](#)" body cap shows the general shape. This picture of the actual item is courtesy of Stefan Geyson. To get a normal sized template, make a pencil rubbing of the lens mount. The original caps have rims to locate the plate, but the clamp wire will suffice to hold a simple plate in place. The main thing to avoid when making a cap is fouling the shutter linkages.

11.3 Light traps

Most of the camera backs incorporate foam light proofing and film pressure pads. The pressure pad rests against the unexposed film spool, and acts as a friction mechanism to keep the film taut. The light trapping lies along the edges of the back.

This material does age, becoming less resilient, and eventually powdery. Local Mamiya parts suppliers may have suitable light trap material available.

Alternative materials:

Large areas can be replaced by a strip of hook and loop fastener (usually known by the trade name, Velcro (R)). The loop side is usually denser.

The thin light trapping strips are hard to replace. Moral: don't damage them! A suggestion made to me recently was to use twisted or plaited black cotton.

The fine black foam used for computer mouse mats can also be used when suitable strips can be cut.

Foam intended for camera use can be obtained from Micro Tools (<http://www.micro-tools.com/>), though you may have to search for it. They have a big inventory.

11.4 Front Element Converters

Since this can be done, it seems worth a few words. But don't expect miracles!

11.4.1 Video camera lens converters

There are a number of wide angle and telephoto front element converters available for use with video cameras. Typically these range from x0.42 and x0.5 at the wide end, to x1.5 or x2 at the long end. At least one company manufactures a reversible x0.5/x1.5 model. Those that are fitted with a 46mm thread are suitable for mounting on the later Mamiya lenses, either directly or via a 46-49mm stepping ring. It is possible to fit two of these devices simultaneously, but this may vary from lens model to model. If you go this route, expect to file a flat on one stepping ring to permit the other to screw down. It's important that the stepping rings used are the same thickness.

Optical performance isn't great. Not surprising, since they are intended for the more tolerant video optical train. The correction for aberrations is often poor, usually manifesting as barrel distortion with wide angle converters, and pin-cushion on the telephoto converters. But they are comparatively inexpensive, especially if you can locate a used pair.

However, if you would like a pseudo-super-wide lens then mounting a x0.5 on a 55mm will produce some dramatic effects. It isn't quite the 27.5mm you might expect, but it does give a cropped circular image (corner vignetting). But don't expect sharp results. You will need to experiment to determine the light loss. Typical values seem to be around half a stop for 0.5x or 1.5x attachments.

At the other end of the scale the aberrations seem better corrected. Adding a x1.5 to a 135, 180, or 250mm gives a nominal 200, 270, or 375mm lens. The trade off is whether the extra length gives better quality than enlarging the image from the prime lens.

11.4.2 35mm and digital format front element converters

These are made for fixed lens cameras, either fixed focal length or zooms. It seems that converters produced for 35mm cameras by the camera manufacturers are definitely better than the video converters. However these are generally too large to be mounted in pairs, which limits their usefulness.

11.4.3 General points on front element converters

Lens hoods and filter mounts are down to you. Though if you have a reversible 46mm converter you could mount 46mm filters reversed. And a 46mm filter ring can be glued to a suitable hood to make a 'gender reversed' version.

Note that the focus scales are completely wrong when using front element converters.

11.5 Other 'Optics'

The TLR bodies make useful mounts for pinhole work. Cut a plate for the front of the camera, using a lens mount as a guide. Be sure to avoid fouling the moving linkages. Stout card will do, as will plastic, aluminium, or brass sheet. Drill a large hole in the centre of the taking lens mount, and paint the internal surfaces matt black. Your prepared pin-hole (there's a lot of information on the web about this - try a search. You can also buy laser cut pinholes.), is taped over this aperture. An opaque flap over the pinhole is also useful as a lens cap. Black electrical tape will suffice.

The lens 'Lock' mechanism provides the equivalent of a darkslide and shutter. Since exposures are going to be at least 1 second, this poses no trouble in practice. You will also have to provide a 'lens cap' for the pinhole, because the shutter release is interlocked to the lock mechanism, and the film advance is interlocked to the shutter release.

For viewing, use the sports finder. With the bellows collapsed the standard 80mm finder is a good match. Racking the bellows out will give you a correspondingly smaller field of view, and a longer exposure. At maximum extension you get the pinhole approximately 135mm from the film; making the 135mm sportsfinder mask suitable. A slightly larger pinhole would be useful to give a constant pseudo f-number.

11.6 Front element exchanges

A number of people have reported success in exchanging the front element of the viewing and taking lenses of a pair when the taking lens has been damaged. However, each lens has matched elements and a simple exchange may not yield a decent result. A complete exchange of the optical components of the lens pair has a better chance of success provided the pair can be brought to common focus, which isn't always possible.

The compiler of this document accepts no responsibility for the results should you attempt such an exchange.

11.7 Film advance slippage

There have been reports of uneven film advance. There are several possible causes; not all of which are serious.

Check that the camera back is fully closed and latched on both sides. Failing to do this can put uneven pressure on the take-up spool and cause the gears to slip.

Check that the camera is correctly set for 120/220. This usually manifests itself as a wrongly placed first frame.

Make sure that the shutter release is not depressed during film advance. This is especially insidious if a cable release is being used. Some cable releases do not always retract fully, and this can trigger the 'short wind off' feature (see sub-section [1.0.4](#)). The effect can manifest itself as an extra rotation of the film advance crank, with very large frame spacing. Typically this could result in only 8 frames exposed with 120 film, while the remaining 4 are on the trailing backing paper.

Mixing spools from different manufacturers can cause difficulties. Some spools are fractionally narrower in film width than others and can cause extra friction when winding the film, particularly with 120. If you suspect this of happening, try using a take-up spool from the same film type.

If none of the above cure the problem, then you may have a fault with the film transport mechanism.

11.8 Flash Equipment

The flash connection (a standard PC synchronisation socket) is on the lens. This is discussed in Section [2.5](#).

The equipment mentioned in the Mamiya TLR manuals is too old (and rare) to be worth discussing here.

The main requirement for using flash with these cameras is to ensure that you use a manual flash, or a system where the flash sensor does not rely on in-camera circuitry. This probably rules out flash guns dedicated to the latest auto-focus 35mm equipment, but check the manual if you have such an item - it may also function on manual. There are a lot of older designs around that fit these criteria, and the vast majority of studio lighting is also suitable.

Small flash guns can be mounted on the camera, or on a 'L' bracket, depending on the model, but these are quite close to the taking lens axis. This makes them useful for fill, but limited as the dominant light source. Tall, 'hammerhead' type gun, or a compact one mounted on a tall bracket will give better modelling. Don't forget to allow for the size and shape of the finder you are using. You do not want to bang your head into it when using a WLF or chimney finder.

The shoe fitted to the C series always seems to come with the stop at the rear of the shoe. This is contrary to modern practice, and some guns may not fit without modification.

A small, low power compact gun, possibly in conjunction with an adjustable shoe adapter makes a good trigger for studio equipment and without the trip hazard of a synch lead. You can always tape a neutral density filter over the window to minimise any influence on the subject while retaining the trigger threshold.

Do remember to re-connect the flash lead when changing lenses...

12 Published Sources

12.0 Sources referenced in preparing this document

- A Facsimile of Mamiya C330 manual provided by Oldtimer Cameras Ltd., London (See below).
- B Facsimile of Mamiya C220 manual. See On-line Sources, Section 13.
- C The Mamiya Book (All models to C330f), Reynolds, C. Focal Press Book 1977, ISBN 0-240-50974-9 facsimile provided by Oldtimer Cameras Ltd., London (See below).
- D Mamiya C220f/C330s entry in The Medium Format Manual, Freeman M., Mitchell Beazley Int. Ltd. 1988
- E Facsimile of Mamiya C3 manual
- F Partial facsimile of C330s manual. See On-line Sources, Section 13.
- G Facsimile of Mamiya C33 manual.
- H Facsimile of Mamiya C2 manual.
- I Partial facsimile of C330f manual.

12.1 Sources of manuals

Operating and repair manuals for Mamiya cameras can be obtained from:

Oldtimer Cameras,
P.O. Box 28A,
Elstree,
Hertfordshire,
WD6 4SY,
UK

Tel. (+44) (0)181 953 5479 or (+44)(0)181 953 2263 Fax (+44)(0)181 905 1705 (Use either the International prefix, or 0 if you are in the UK).

For another source see On-line Sources, Section 13.

The local Mamiya distributor may also be able to help.

13 On-line Sources

13.0 World-Wide Web Sites

As is the nature of the Web, sites come and go, and contain varying amounts of information. These are the ones I find worth keeping an eye on.

1 Mamiya America Inc. (<http://www.mamiya.com>) has a web page with a User Forum for older cameras which includes considerable discussion on the TLRs. They can supply manuals for some models (C3*, C33*, C330F*, C330S, C220F (*photocopies)) within the USA only. There is an entry in the Forum about obtaining manuals. An online version of the **C330** manual in Portable Document Format format is available. A similar facility is provided by Mamiya UK (<http://www.mamiya.co.uk>). The various Mamiya agents have been posting revised history documents in the past year or so that under-play or ignore the Mamiya C series.

2 The Medium Format Digest (<http://www.exeter.ac.uk/mfd/>) archives an the University of Exeter have finally been removed. The new database-supported Medium Format Digest is at Photo Net (<http://photo.net/>).

3 Further Mamiya TLR information can be found on Jan-jaap Aue's home page (<http://www.lighthunter.com/>). This includes scanned manuals for the **C220** and the **C330s**.

4 Another source of repair information is Ed Romney's page (<http://www.edromney.com>). Self-repair is something you try at your own risk.

5 An informal review of Mamiya TLRs can be found at PhotoNet. (<http://photo.net/photo/medium-format/mamiya-tilr.html>).

6 A Mamiya C2 manual can be found at http://www.elusivefoto.com/technical/manuals/mf/mamiyaflex_C2/mamiyaflex_C2.htm

14 Contributors

14.0 Who and What

The compilation of this document has been greatly assisted by other users who have contributed missing details or clarified points of uncertainty. Their time and trouble is greatly valued. The following people have declined their chance to remain anonymous. The compiler gratefully acknowledges all assistance, whether named explicitly or not.

R. Alford Rear lens cap information, wind-off feature

L. Blauner C220F details

S. Geyson Body cap image

T. Griffin Seikosha-MX lens information

J. Hanlon C3 details

J. Hein Various details for C330f and black lenses, finder scaling, exposure compensation.

S.Kantrowitz Illustration of C33 with 220 back.

K. Kirch Mamiyaflex and MX lens information.

R. Kirk C3 and C33 information.

R.Rosenberg C33 details, 55/65 compensation screen

Han Verhulst Porrofinder illustration and various obscure details and measurements; Single Exposure Back information; C33/C22 variations and dating; letter codes; chrome shutter variations; extensive research.

Greg Mamiya-PF pictures.

15 Glossary

15.0 General medium format terms and acronyms

I will add to this list as I come across terms that may not be self-explanatory. It isn't intended to be definitive.

Coating	A layer applied to lens glass surfaces to alter their refractive characteristics. Multi-coating uses more than one coating to correct for different behaviour by different wavelengths (colours) of light.
Parallax	The different image content that results from slightly different viewpoints. What you see isn't exactly what you get.
Pentaprism	A five-sided prism (obviously!) that provides an eye-level, right-way up, left to right correct view of the subject.
Taking lens	In a twin lens reflex camera, the lower lens used to expose the film.
Viewing lens	In a twin lens reflex camera, the upper lens that is used for composition and focusing..
WLF	Waist-level finder. The basic 'flip-up and look down' finder type. Consists of a folding light shield around the camera focussing screen. Image is right-way up, but left to right reversed.

15.1 Mamiya TLR specific terms

Paramender	Mamiya device to move the camera at right angles to the lens axis and parallel to the lens board by 50mm (2"). This moves the taking lens to the viewing lens position to correct parallax at close distance.
Porrofinder	A finder that uses mirrors to achieve a right-way up, left to right correct eye level image. Similar in effect to a pentaprism.
Rack and pinion	A gearing mechanism that uses a toothed bar or track in conjunction with a toothed roller at right angles to the bar.

16 Common Problems

16.0 Introduction

Most of the content of this section can be found spread throughout the rest of this document. This section is intended to be a combination of quick reference and pointer to more details.

16.1 Shutter release problems

The shutter will not release unless the bellows is fully in (or out).

This may mean that the internal light baffle is raised (the camera control is in the 'unlock' position). This is a camera interlock feature that is not normally by-passed.

The shutter will not release.

There are several possible causes. On some cameras the multi-exposure interlock trips before the shutter. So if you start to press the release and change your mind the camera body can be fooled into thinking that you have released the shutter. This behaviour varies between bodies. Use the Multi exposure setting to use the release, then reset to Single exposure

mode.

There are a few instances of older bodies not operating the cocking lever or the release lever correctly on some lenses.

The 80mm f3.7 has a quirk where the shutter release arm on the lens moves even if the lens is not cocked.

16.2 Film advance problems

The camera advances all the film.

This is usually caused by the shutter release being slightly depressed, often by a long cable release. It is caused by the multi-exposure interlock being over-ridden. This was a feature to allow film to be wound off quickly if less than 12 frames were used.

Rarely an improperly latched back can also cause this, as the frame counter does not register the film passing through the camera.

The frame spacing is uneven.

Uneven spacing, but not overlap, between frames is not uncommon on mechanical cameras. Check that the camera is correctly set to 120 or 220 where applicable, and that the film is tightly wound on the take-up spool when exposed.

This may also indicate an improperly latched back.

16.3 Focus problems

If you have routine problems focusing the camera, check:

Your eyesight must be matched by the dioptic correction in the finder that you are using. If you cannot see the boundary of the focus spot sharply, you cannot reliably focus the image. The clear spot/cross hair screen for the C330 cameras is not intended for general photography.

If it happens with just one lens, it could be that the lens needs adjustment.

If it happens with all lenses, you need to check the finder focus against the body focus.

Other focus problems

See Section 2.11

16.4 Sheet film backs

See Section 8.1. There are several versions of the backs and the dark slides are not completely compatible.

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