



## MERLIN STATIC AND DYNAMIC BALANCE

Interactive Spreadsheets (lb/in or gm/mm) for Beta Testing.

### PRELIMINARY INSTRUCTIONS:

*For the Mathematically inclined, here's a surprisingly accurate spreadsheet that will help put your Merlin in near-perfect static and dynamic balance (so it both hangs level and behaves during rapid pans). If your data is accurate -- if you carefully measure weights, vertical c.g. location and distances for the setup -- I think you'll be amazed at how close this gets..*

Garrett Brown

*Note: as in the manual and video, all settings assume -4 (counterclockwise) pre-set turns of the guide, or 'Z' ring. This will allow subsequent adjustment either up or down, to slightly increase or decrease bottom-heaviness.*

#### A. Data Entry – SELECT English or Metric Version.

1. Weigh camera accurately, enter **camera weight** (in the appropriate units) in yellow box in the first column

2. Enter **vertical c.g.** (center of gravity) distance in the yellow box in the second column as follows:

Measure **vert. c.g. distance** from plane of camera base to point on side of camera where camera could balance lying sideways on the tip of your finger. If there are no flat surfaces on either side of your camera, this plane may also be discovered by pointing the camera straight up and balancing the rear surface of the battery (if flat) on your fingertip at the point where the camera can almost be balanced. Likewise if your lens shade is hard, this plane can be discovered with the camera standing vertically on its lens, and balanced on a round pen lying between the lens and your table. Then measure the perpendicular distance to the plane of the camera's base. This is the **camera vertical c.g. distance**.

B. As shown in the manual and video, mark location of fore/aft and side/to/side camera center-of-balance on the camera base.

Determined this by balancing the camera on a fingertip and marking the spot on the base with a grease pencil. Ideally this will co-incide with the camera's mounting hole.)

C. Move the Merlin dovetail around on the camera base as per manual and video so your grease-pencil 'mark' is located under Hole "H". Insert mounting screw in whatever hole most closely lines up with the actual camera mounting hole. Add the locating pin.

D. Select from the three choices of '**nose weights**' in the fourth column

**0 lbs** = none,

**.134 lb** (or 60.8 gm) = one 'finish'

(Note that the nose weights increase pan inertia. With light cameras use at least one 'finish' weight if a dynamic solution exists on the spreadsheet.

**.41 lb** (or 186 gm) = one 'finish' and one 'mid'

Check if a solution exists for your camera if you add a mid weight at the nose. Extra-inert performance is obtained if you can endure the extra 1/4 lb.

E. For the selected **nose-weight**, note the following graphical representation in the third column of the 14 possible **lower weight** combinations that may put your Merlin in balance.

For example:

)= one finish weight

()= one start + one finish

l)= one mid + one finish

(l)= one start + one mid + one finish

etc. etc. until:

(llllll)=1 Start, 6 Mid, 1 Finish

Select the lightest set that yields a "YES" in the seventh column (*'is this solution dynamically balanced?'*) and mount the suggested weight set on the lower spar.

(we suggest you thread on the first weight in the set by itself and then add the others. This reduces the chance of damaging the threads on the lower spar.)

F. Loosen locking knobs and adjust **Stage-to-Setscrew Distance** (aka 'Arc Distance) as shown in the fifth column, by laying the Merlin on its side (to reduce the load on the caliper-hinge adjusting knob.

Measure the **Stage-to-Setscrew distance** with a tape measure held square with the plane of the top of stage, and sighted to the plane of the setscrew. (be sure to re-lock the knobs!)

See the **Merlin Balance Sheet** diagram. (Pressing the end of your tape measure square against the underside of the stage and reading directly to the level of the setscrew position provides a rough check on this measurement without the need to 'sight' from the level tape measure down to the setscrew)

G. Set **Gimbal Position** by adjusting the blue fore/aft trim roller until the length of threaded-rod showing under the stage just ahead of the gimbal carrier agrees with the suggested length as specified in the seventh column.

The range of Gimbal adjustment is from .25" (6.35 mm) -- all the way left -- to 2.1" (53.3mm) of threaded rod showing. It's awkward to use the Merlin when you are out of adjustment in either direction (at the high end it makes the side/side trim roller hard to access). In that case back off the Gimbal position a small amount and arbitrarily alter the **stage mark** (see below) a bit in the same direction to compensate. This will not noticeably affect the Merlin's operating characteristics.

- H. Mount the dovetail plate with camera so the leading edge lines up with the correct **Stage Mark'** scale marking, as specified in the sixth column – *numbers in parentheses indicate negative stage marks (note the minus sign on stage marks to the rear of 0).*

Note that stage marks may be inaccurate by plus or minus one mark or so, due to the incremental nature of mounting holes. The actual camera c.g. may fall in-between holes on the dovetail. Not to worry – trimming, as below, will adjust for any inaccuracies.

- I. Test fore-aft and side-side balance and adjust with the respective blue trim rollers. Test drop time and adjust if needed with clockwise or counterclockwise turns of 'Z' axis guide ring. (remember to depress the button and turn one full rotation until the ring locks again)
- J. Test **dynamic balance** by panning the camera back and forth (using thumb and fingers on guide ring)... let it rotate until the spars almost hit your arm, then back the other way. Observe if the camera pans 'flat' – that is without a tendency to dive to either side. Dynamic balance helps keep your operating precise when making more-rapid expert moves.

Now take note of the 'dynamic moment' (in lb-in-in or kg-cm-cm) predicted in the ninth column on the far right. If you selected an alternate **lower weight set** that does not yield a '**YES**' in the eighth column (a ZERO dynamic moment, you will see the dynamic consequences in the ninth column. Note that there are often lower-weight-set combinations that are in static balance, both top/bottom and fore/aft, but if the resulting dynamic moment is much more than 10 lb-in-in (or 30 kg-cm-cm) you will find the Merlin uncontrollable at high panning rates. *DYNAMIC MOMENT quantifies the force that will push the Merlin off level when panning – which will get worse at higher angular rates of change.*

*If possible, always select a solution that is dynamically balanced (a YES), or yields less than 10 lb-in-in (or 30 kg-cm-cm) of dynamic moment.*

For posterity, or for entry in '**User-Supplied Settings**' on [www.merlincookbook.com](http://www.merlincookbook.com). write down your results and make note of the battery model number you were using when you measured camera weight and vertical c.g.

To help other new Merlin owners, via **User-Supplied Settings**, enter the following (select English or Metric entry):

1. Camera (battery)  
(name manufacturer and model number of both)
2. Similar weight/size cameras  
(if known, is your generic to any other cameras on the market)?
3. Weight  
(if known)
4. Vertical c.g. distance  
(measure. from base of camera to point on side of camera where it might balance on a finger)
5. Front Weights  
(three possible cases)
  - none
  - 1 Finish
  - 1 Finish, 1 Mid
6. Lower Weights  
(fourteen possible cases, lowest weight to highest)
  - ) 1 Finish
  - () 1 Start, 1 Finish
  - I) 1 Mid, 1 Finish
  - (I) 1 Start, 1 Mid, 1 Finish
  - II) 2 Mid, 1 Finish
  - (II) 1 Start, 2 Mid, 1 Finish
  - III) 3 Mid, 1 Finish
  - (III) 1 Start, 3 Mid, 1 Finish
  - IIII) 4 Mid, 1 Finish
  - etc., until:
  - (IIIIII) 1 Start, 6 Mid, 1 Finish
7. Arc Size -- metric or English  
(the spreadsheet refers to this more precisely as Top-of-Stage-to-Setscrew Distance – the perpendicular distance from the plane of the top stage to the plane of the setscrew in the lower tube adjacent to the lower weights.
  - Minimum: 8.25 inches (20.9 cm)
  - Maximum: 13.25 inches (30.3 cm)
8. Mounting Hole  
(fifteen lettered choices: letters A-O)

9. Stage Mark

(scale of arbitrary units, readable at either side of dovetail plate)

Furthest to rear: -4.7

Furthest forward: +4.7

10. 'Z' Turns

(number of counterclockwise turns of threaded Guide ring from 'tight' position)

Expressed with a minus sign:

minimum = -1

maximum = -11

(SPREADSHEET ALWAYS USES -4 'Z' TURNS so users can increase or decrease bottom-heaviness as needed for desirable 'drop time')

11. G-PLATZ

were you able to use the 'Gezornenplatz' screw to stiffen the camera mount? Two choices:

Yes?

No?